UNIVERSITY OF MICHIGAN

Dear Colleagues:

We are pleased to share with you the initial report from the U-M Generative Artificial Intelligence Advisory (GAIA) Committee.

This group was tasked with assessing the opportunities and challenges posed by generative artificial intelligence (GenAI), particularly as it relates to U-M and our ongoing mission. We want to thank every member of the committee who spent countless hours crafting this report.

GenAI is shifting paradigms in higher education, business, the arts, and every aspect of our society. This report represents an important first step in U-M serving as a global leader in fostering the responsible, ethical, and equitable use of GenAI in our community and beyond.

As you review this document, we ask that you consider the context of how it was created. This is meant to be a catalyst for crystalizing our thinking about how U-M should navigate the shifting landscape of GenAI. Some of you will appreciate the proposed directions laid out by this report. Others might only see this report as a discussion starter. More than anything, we are looking to ignite much-needed conversations.

Please note that this report is by no means comprehensive. We understand that there are some areas that are heavily represented and others that are underdeveloped. Our approach to GenAI needs to continue to evolve and iterate as new information comes our way and more campus experts engage.

This report, admirably created by faculty, staff and students on our campus, lays a proposed foundation for how U-M might live and work with GenAI. We look forward to all the discussions the report will inspire and to working together to create an action plan for the future.

Please feel free to contact either of us to share your thoughts and feedback.

Thank you,

Laurie K. McCauley
Provost and Executive Vice President for Academic Affairs

Ravi Pendse
Vice President for Information Technology and Chief Information Officer

UNIVERSITY OF MICHIGAN

Generative Artificial Intelligence Advisory Committee Report

Prepared by

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June 30, 2023

Disclaimers

The extensive capabilities and rapid evolution of Generative AI tools necessitate the development of best practices for their effective use, development, and management. Although we have taken great care through more than two months of research, deliberation, reflection, and discussion to capture key stakeholder perspectives, the complexity and comprehensiveness of the task has no doubt yielded some gaps, and many constituencies of our great institution may not have been adequately represented or had sufficient opportunity to review the material. We acknowledge this shortcoming along with the fact that this topic is a (fast) moving target, and our understanding, policies and guidelines will also constantly evolve.

Efforts put forward by the Faculty Committee to address the impact of AI on research integrity are highly informative. Importantly, the University has an established process for addressing issues related to research integrity including plagiarism and research misconduct across all three U-M campuses, as detailed in the University's Policy Statement on the Integrity of Scholarship (SPG 303.03) and associated Procedures. Additional information and resources can also be found on the OVPR Research Integrity website.

Background & Summary of Recommendations

Generative AI (GenAI) is beginning to disrupt all aspects of society, from teaching and learning to art and design to engineering innovation. While GenAI holds immense potential to augment productivity and minimize redundant tasks, its use also carries significant risks. U-M has the intellectual depth, resources, and international and national connections and networks to be the leader in the development and appropriate use of GenAI. To help navigate the unprecedented scale and speed of this societal change, U-M established the *Generative Artificial Intelligence Advisory (GAIA) Committee.* This body was tasked with assessing the opportunities and challenges posed by GenAI, as well as advising campus leadership and the wider community on how U-M can navigate responsible technological development and integration. The GAIA Committee has developed an initial vision and recommendations towards the goal of ensuring that U-M is at the forefront in the responsible, ethical, legal, secure, equitable, accessible, and transparent development and use of GenAI in all aspects of our missions. Below is a summary of recommendations and action items:

R1: Dissemination of Guidance and Launch of Campus Discussion We recommend that the Office of the Provost and the VPIT-CIO establish a *GenAI committee* to advise on matters related to generative artificial intelligence for the 2023-2024 academic calendar year and beyond. We encourage leadership to disseminate all relevant information and recommendations to the entire U-M community.

R2: Teaching, Learning, and Academic Innovation We recommend that the Office of the Provost and VPIT establish a U-M-wide initiative to leverage GenAI to develop tools and methodologies for AI-augmented education.

R3: GenAI and Research Practice With assistance from the GenAI committee (see R1, R4, R6), we recommend that the U-M Office of Research (UMOR) assess the use of GenAI in research and set best practice standards for privacy protections, data use controls, and updating research integrity related SPGs, PEERS modules, and RCR training.

R4: Creation of GenAI Research Initiative and Integration with U-M's 2034 Vision We recommend that the Office of the Provost, VPR, and the VPIT consider establishing a U-M wide research initiative in the area of Generative AI. This will have multiple benefits, including aligning GenAI and AI more generally as major components of U-M's 2034 vision.

R5: Create, Accommodate & Deliver Secure and Equitable Access to GenAI Platforms, Tools & Services We recommend that U-M expand existing IT infrastructure to accommodate secure and equitable access to GenAI platforms and tools for the entire U-M community, and launch appropriate AI services as soon as feasible to provide equitable access to GenAI tools ranging from basic consumer use to advanced research and experimentation.

R6: Transition Team & AI Commons for University Community We recommend that the Office of the VPIT work with the GenAI committee to coordinate and establish an AI digital commons where our community can share best practices and emerging ideas in GenAI.

R7: GenAI Website & Communications Plan for Strategy, Policies, & Resources We recommend that U-M launch a GenAI website providing strategy, policies, resources, and links that can be a go-to informational resource for students, faculty, staff, and administrators.

Any suggestions related to Michigan Medicine can be found in Appendix A.7

Contents

Note: Text that appears in blue font is a clickable link to different parts of this document, or a hyperlink to a website.

I Executive Summary

Recent advancements in Generative Artificial Intelligence (GenAI) are impacting many aspects of personal and professional life on campus and beyond. While the immense capabilities of GenAI to amplify productivity cannot be understated, the adoption of this technology also introduces substantial risk. For instance, Large Language Models such as ChatGPT can produce syntactically accurate sequences of words that can be compelling, but the output frequently suffers from factual inaccuracies (referred to as hallucinations), logical inconsistencies, or pronounced bias. Additionally, references and substantiating claims made are often absent or falsified. These risks and benefits raise important practical and ethical questions around technological development, deployment, fairness, ownership, equity and accessibility that do not have simple answers.

The emergence of GenAI has been greeted by our community - and the society at large - with a wide variety of perspectives which should be given consideration. Additionally the above shortcomings require that the entire U-M community exercises utmost prudence with the technology. **It is also important to recognize that regardless of one's opinion on the potential, benefits and risks of GenAI, this technology cannot be ignored,** as it is being rapidly integrated across various digital data modalities, including text, images, sound, video, and beyond on an exploding and exponentially growing variety of IT platforms. In a survey of over 6,000 responses across the Ann Arbor, Dearborn and Flint campuses, we found that roughly 60% of faculty and students and 40% of staff members reported already having used GenAI systems. Almost uniformly, all groups expressed a desire for policies, guidelines and training to help them make informed decisions while navigating GenAI in their various roles across campus.

U-M has the opportunity to leverage lessons from prior disruptions to adapt to GenAI. This will involve responsibly leveraging GenAI to further our mission and support our entire community, in some cases with urgency, and in others, with expeditious adaptation. Being resilient also necessitates mitigating threats that we can, and cannot, foresee. When used irresponsibly, GenAI can serve as a tool for plagiarism, fabrication, and falsification. **On an immediate note, AI augmentation may significantly impact instruction in Fall 2023, and U-M will need to re-evaluate policies and teaching strategies to manage opportunities and mitigate risks.** Attention to continued evolution of our values of excellence, transparency, diversity, equity, inclusion, accessibility, and wellness will be critical in GenAI environments.

Though we anticipate that future iterations of GenAI may resolve many of the current technological and social deficiencies, perhaps by incorporating formal logic, mathematical reasoning, and appropriate attribution, the realization of true Artificial General Intelligence (AGI)—or machines with human-level cognitive abilities—may still be a few decades away. There is an active commu-nity of researchers (including, for instance cognitive scientists; AI researchers; linguists) attempting to understand the capacities and limits of GenAI models. **Given its unique combination of depth and breadth, U-M has all the ingredients required to be the leader in the development, management and deployment of this technology as well as advancement of associated policies, and discussions around ethical and social issues.** With such developments there is potential for GenAI technologies to evolve in a beneficial manner, thus meriting alignment with the emerging U-M Vision 2034 plan.

This report aims to set the stage for the U-M community and society at large to harness the transformative benefits of GenAI, while simultaneously mitigating its inherent risks. The figure below illustrates our key findings.

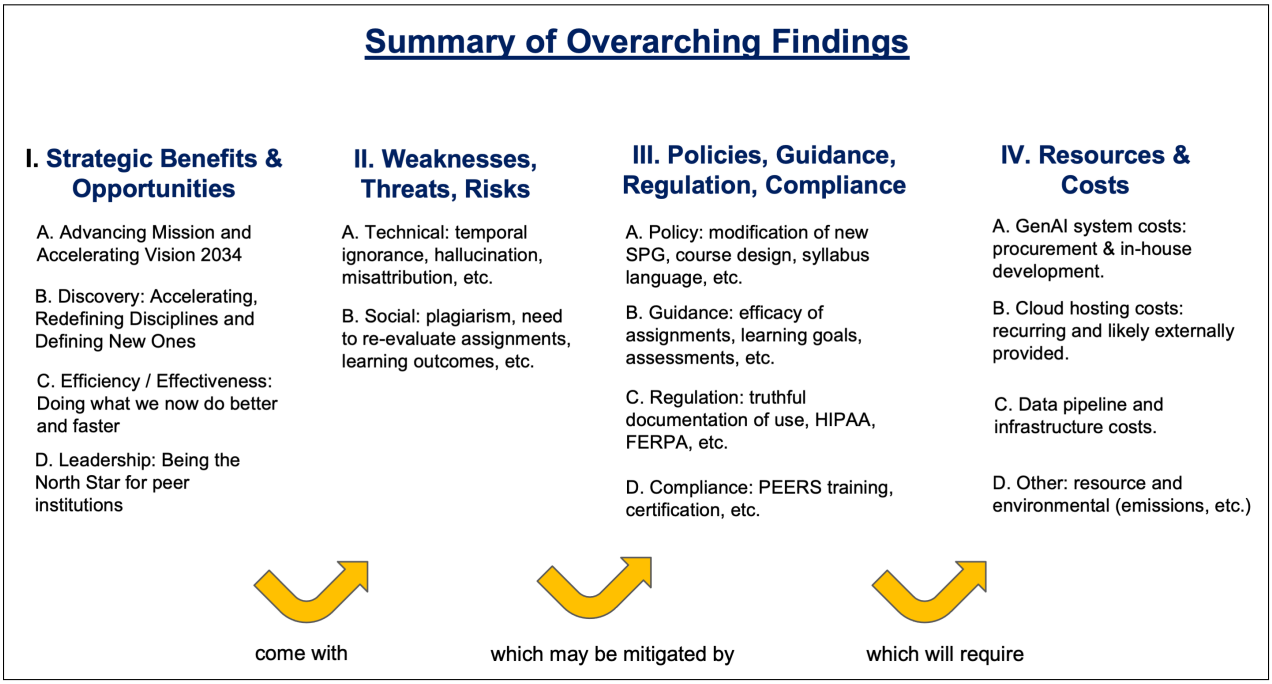


Figure 1

A study guide for the rest of the document is as follows:

- **Key findings, guiding principles and recommendations:** Broad overview of key findings, guiding principles that support major recommendations, followed by a set of recommendations *(recommended for all readers)*.
- **Main report:** In-depth sections comprising an overview of the science and characteristics of GenAI, implications of GenAI in five core areas of U-M, an overview of required supporting facilities and resources, and an overview of GenAI-focused research and innovation *(specific sections recommended for stakeholder groups as appropriate)*.
- **Supporting appendices:** Additional supporting material *(may be useful to some readers desiring additional background information)*.

II Key Findings, Principles & Recommendations

This section summarizes our key findings and presents overarching guiding principles and recommendations.

II.1 Key Findings

Aligning with our charge to ensure strong coverage of teaching and learning issues, each brief paragraph includes specific examples from teaching and learning.

Strategic Benefits & Opportunities

Generative Artificial Intelligence (abbreviated as GenAI or GAI) use will create new opportunities across the entire spectrum of teaching, research, and practice spanning all scholarly disciplines.

- GenAI will enable U-M to advance its mission and accelerate and support Vision 2034, an example being new collaborative structures for GenAI application knowledge development and learning that leverage existing resources (ITS, CRLT, Michigan AI Laboratory, Sweetland Center for Writing, MIDAS, MICDE, Academic Innovation, and others) in new ways.

- GenAI has the potential to transform teaching outcomes by creating customizable learning pathways, aligning instructor objectives with individualized student needs. As an example, U-M researchers are already developing adaptive chatbots as intelligent reading partners that ask students questions, interpret their responses and provide feedback during study[1].

- GenAI will accelerate knowledge development, including rethinking of disciplinary bound-aries and domains, and possibly, defining new ones. An example of the former is the potential of GenAI to drive scientific discoveries and engineering innovations. One high-potential application is the use of foundation material models to generate novel material structures and compositions that can potentially lead to breakthroughs in areas such as en-ergy storage, electronics, and pharmaceuticals. An example of the latter is rethinking how students can best learn the mental models, capabilities, and skills to clearly and concisely express their ideas in writing and other media (audio, visual, video).

- From an efficiency perspective, GenAI has the potential to support enhanced administrative productivity and service quality throughout the University. For example, career planning and support services may leverage various GenAI functions for career development interactions, while enabling expert staff to focus on higher-order skills and capabilities to ensure our students are equipped for the current and future workplace.

- **U-M has the intellectual depth, resources, and international and national connections and networks to be the leader in the development and appropriate use of GenAI.** Recent evidence[2] suggests that even Generative language models - if carefully constructed - need not be of an enormous scale to be useful, and thus useful discipline-specific models could be developed using university-scale resources. Units across campus have already begun this important journey, developing a firm foundation upon which to build: e.g. the cross-campus initiative on GenAI as a part of the Bold Challenges program, the Michigan AI

[1] https://soe.umich.edu/grants-awards/building-teacher-ai-collaborative-system-personalized-instruction-and-assessment

[2] Gunasekar, S., et al "Textbooks are all you need," arXiv:2306.11644, 2023.

Laboratory, ITS, MICDE, MIDAS, Michigan News coverage of U-M experts researching AI danger mitigation, GenAI workshops and town halls across campus).

Weaknesses, Threats, and Risks

The benefits and opportunities outlined above are accompanied by weaknesses, threats and risks, which we overview below. This is followed by policies and guidance suggested to achieve the gains.

- Several technical weaknesses currently exist, including temporal ignorance (for example, GPT-4 has a training data end date of September 2021), hallucination and fabrication (creating fiction and representing it as truth), misattribution (citing sources that are incorrect or do not exist), overriding safety protocols (via clever prompting, users can create unsafe outputs intended to be impossible by system designers), inadvertent inclusion breaches or ethical problems (outputs containing inappropriate language regarding vulnerable populations), and bias in training data (which unnecessarily constrains output quality and richness, and can lead to racist or prejudicial writing).

- Social weaknesses refer to those that arise from the interaction between the system and user, which may yield unanticipated actions and outcomes. While myriad and evolving, a few examples of social weaknesses include rapid escalation of deep fakes in video and audio, user attribution of output generated by GenAI to themselves or others (plagiarism that is difficult to detect), GenAI companion giving dangerous advice to children, use of GenAI to perform research without appropriate disclosure, inappropriate use of prompt data by AI provider, reduced demand for human labor in many professions (perhaps without associated increase in demand in new professions), inequitable access to state-of-the-art GenAI systems, and unauthorized generation or replication of copyrighted or otherwise protected material.

Policies, Guidance, Regulations & Compliance

While the weaknesses above pose a range of risks of varying significance, appropriate policies, guidance, regulation, and compliance may mitigate some risks.

- Regarding policy, in some cases existing policies may apply, while in others, such policies may need modification and new policies may be required. One example is that appropriate GenAI use should be codified in modifications of relevant U-M Standard Practice Guide (SPG) elements across various domains. Another example is that instructors should be given complete flexibility to allow or disallow the use of GenAI tools. If GenAI tools are allowed, the instructor should be clear which tools are allowed and in what capacity. Syllabus language should ask students to reference and validate sources. If GenAI tools are disallowed, this policy may be impossible to enforce perfectly in the short term, partly because detecting tools are (at present) technically untrustworthy, and partly because GenAI can be used undetectably at any stage in composing processes to generate ideas or outlines or drafts. Regarding course design, GenAI offers an opportunity to rethink learning objectives as well as assessment methods. The course design should include some parts that cannot be completed satisfactorily (solely) by GenAI tools, unless GenAI skills and values are the primary learning objectives. **Finally, we recommend that - to the best possible extent - honor codes, pertinent academic policies, and the definition of plagiarism be reviewed and potentially modified before Fall 2023.** Reported national polling about

GenAI policies indicates that many institutions have not yet formulated AI policies, and that instructors generally want guidance for new policies[3]. UC Berkeley's AI Policy Hub is an excellent model of how to do this work.

- U-M instructors should be encouraged to reevaluate and reassess the efficacy of assignments, assessments, learning objectives, and course design in light of GenAI capacities and limitations. In this regard, instructors will need immediate and long-term support and guidance to gain the necessary skills and knowledge. This will require both top-down (guidance from central administrative leadership) and bottom-up initiatives (disciplinary working groups and other forms of local knowledge development), perhaps in a hub-and-spoke organizational model. All existing teaching, writing, and learning centers should be leveraged to support instructors.

- We recommend that all GenAI use be truthfully documented to the best possible extent, foremost in teaching/learning and research domains. As GenAI applications grow, we expect that disclosure best practices will emerge and we will lead/evolve with them. Regarding responsible use, all outputs from GenAI should be independently verified in order to be used for teaching, learning, writing, research, communication, and administrative application. Technically, new GenAI tools and platforms should be evaluated carefully before adoption and use. Researchers must not input personal, private, or HIPAA, FERPA, Common Rule, and Export Control protected information into an unsecure GenAI system. Researchers will need to follow U-M Guidelines and Policies such as those found in the ITS sensitive data guide, which should be updated to address changes brought on by GenAI. Finally, major mistakes and unforeseen behaviors can happen at IT systems level and the U-M will need to have a way to disable AI system(s), as needed, if they exhibit undesirable behaviors or malicious outputs.

- To support compliance, a significant shift will be necessary from all instructors, staff, and students to commit to engaging in learning and using GenAI responsibly and with full transparency. Our committee encourages various vehicles such as PEERS training, training videos, and so forth to be created to support this recommendation. In particular, all researchers may need training and certification in order to use these systems effectively, safely, and within compliance with U-M and Federal regulations, including data sharing re-quirements. Moreover, research sponsors, journal editors, and professional societies have many rules about GenAI that are in flux, are likely to change, and need to be tracked carefully by U-M research administration, researchers, and trainees. To support the varied requirements above, communication and dissemination of relevant knowledge is required. GenAI is changing exponentially, demanding up-to-date and constant communication, information dissemination, adaptive policy change and implementation. This will necessitate a permanent team of diverse stakeholders and leaders to continue to guide U-M on this transformation.

Resources & Costs

Achieving the immense potential benefits overviewed above while mitigating risks via policies, regulations, and guidelines will require investment in various resources as well as new budgetary outlays.

[3] D'Agostino, Susan. "GPT-4 Is Here. But Most Faculty Lack AI Policies."Inside Higher Education (March 21, 2023).

- To ensure equitable access, a certain baseline level of access to GenAI systems and training courses should be available to all instructors, students, and staff to avoid a GenAI-access digital divide. This investment model may involve licensing of existing GenAI systems that align with our policies (specification requirement, vendor vetting, product assessment, etc.), investment in research and development to support U-M-developed GenAI systems, investment in existing training and learning units such as CRLT, recurring operational costs for cloud services, and so forth. Regarding alignment, procured or developed GenAI systems must ensure security and privacy of personal data, HIPAA, FERPA, proprietary, and compliance for other sensitive data types.
- GenAI models require considerable computational resources and large data pipelines. A sustained investment in large-scale computing will be required to keep U-M at the forefront of education, science and technology.
- The resource and environmental costs of GenAI of use in teaching and research at scale are likely to be substantial, and will certainly drive up the cost of our work significantly, demanding careful study and planning to ensure sustainable and responsible use.

II.2 Results of Campus-wide Survey

To gather a general idea of experience with, views of, and anticipated needs for GenAI at U-M, the committee launched a survey on all three campuses which yielded 6037 responses. The survey included both closed and open response items, and survey items varied according to respondent role. Staff, for example, were asked to check specific areas of work they anticipated being affected by GAI, while faculty and graduate students were asked about GenAI in relation to teaching, and undergraduates about opportunities they see in GenAI. Both qualitative and quantitative methods were employed to analyze the data.

The methodology and some additional information is provided in Appendix A.1. The main findings were:

1. Close to 60% of faculty, undergraduate and graduate students have used GenAI in some form, as have 40% of staff members.
2. Faculty indicate less experience with the tools than undergraduate and graduate students.
3. Respondents in all roles express concerns, cautions, and fears with regard to GenAI, particularly in matters of ethics and equity, although there is a reasonable element of "positivity and hopefulness."
4. Respondents in all roles describe potential affordances in GenAI but with less frequency than they express concerns.
5. Respondents in all roles indicate a need for more information, resources, and/or training in GenAI.
6. Faculty members and graduate students anticipate GenAI to impact many aspects of teaching and research.

Figure 1 shows a few snapshots from the survey. The top left figure shows that respondents are "mostly positive and hopeful" about GenAI, followed by "neutral," with a minority feeling "mostly negative and apprehensive." For all roles except staff "mostly positive and hopeful" is

the most frequent response. For staff, it is the third most frequent response by a thin margin. The top right figure shows the distribution of main concerns. The middle row of figures give some insight into faculty members opinions on the potential impacts of GenAI on research and teaching. The bottom row shows the particular interests of undergraduate students and the resources that they consider to be most useful.

To summarize briefly, respondents, particularly faculty and staff, share their concerns about GenAI, and they are aware of its many challenges. The most prominent challenges mentioned revolve around equity, ethical, and access issues. Nevertheless, many respondents of every level (student to faculty) expressed desire for further education around GenAI and clear guidelines for its use. Only a relatively small percentage expressed superlative sentiments either way, but those with the strongest opinions were more frequently negative than positive.

Open comments from all four respondent roles expressed a strong desire for UM to provide clear policies and guidelines with regard to use of GenAI (this is addressed in sections 2.1, 2.2, 3.1, 3.2, 3.3). All groups are also interested in training resources, website and open forums (these are addressed in section 4.0). Further results from the survey are provided in Appendix A.1.

II.3 Guiding Principles & Associated Recommendations

In the tables below we present our guiding principles resulting from committee deliberations, which connect our findings to specific recommendations, and which may serve to guide future actions not specifically identified he rein. Every U-M school & college should be encouraged to develop their own GenAI plan based on these guiding principles and recommendations.

PRINCIPLE	RECOMMENDATION - Immediate	LEAD
P1 Leadership Communication	Critical for engagement and galvanizing the community to develop a timed GenAI information campaign for broad and specific messaging	Administration
P2 Planning and Executing for Resilience	Immediate steps to begin the process of reformulating how to teach, learn, perform research, and provide administration in a GenAI- infused world.	Administration Instructors
P3 Equitable Access	U-M community members need to have equitable access to GenAI systems for use for their work at U-M. Data privacy and security are key design features and may vary depending on the type of work.	Administration IT Services

PRINCIPLE	RECOMMENDATION - Urgent	LEAD
P4 Compliance Communication	GenAI use should be codified in modifications of relevant U-M Standard Practice Guide (SPG) elements, and other established policy, regulation, and compliance vehicles (e.g., PEERS training).	Administration
P5 Intellectual Property Protection	Continue work with UMOR, Innovation Partnerships, ITS and Office of General Counsel (OGC) to define best practices and guidance around the use of GenAI technologies to protect intellectual property and novel research findings before publication. Similar rules and guidelines for coding using GitHub Co-Pilot, Open-AI, and other GenAI Assistants. Researchers should also be aware that, given the evolving nature of GenAI governance, U-M guidance might not always be sufficient to meet external IP legal requirements.	Administration

Figure 1: Snapshots from campus-wide survey

PRINCIPLE	RECOMMENDATION - Urgent	LEAD
P6 Privacy Protection	Researchers should not input personal, private, or HIPAA, FERPA, Common Rule, and Export Control protected information into a unsecure GenAI system. Researchers should follow U-M Guidelines and Policies, which should be updated to address changes brought on by GenAI.	All
P7 Appropriate Use	Responsible, ethical, and legal use of GenAI tools and platforms should be promoted as a means to enhance our education & training, research, and administrative missions, enabling evolution of our values of diversity, equity, inclusion, access, and wellness.	Administration
P8 Responsible and Transparent Research Use	Researchers should verify all outputs for accuracy and attribution and attest that this has been done in all cases, detailing the methods used to do so. All use of GenAI in research should be fully documented and reported in detail to sponsors for grants, editors for manuscripts and publications, reviews for conferences, and audiences for invited talks and presentations. Of note, sponsors, journals, and professional societies are generating their own best practices and policies in tandem so researchers should be aware to look for additional requirements and that adherence to only U-M policy might not be satisfactory for external entities.	All
P9 Account for and Limit Bias	Bias in AI systems is understood to be a major problem that must be understood, quantified, described, and mitigated. This is especially true with applying outputs to research involving human participants or using data from such studies.	All
P10 Framework for Change	A sustainable framework should be instituted for continued development, deployment, and evaluation of GenAI tools by establishing metrics for success and mitigating risks.	ITS

PRINCIPLE	RECOMMENDATION - Ongoing	LEAD
P11 Engagement	Faculty, students, staff, and administrators should commit to learning and using GenAI tools responsibly and with full transparency regarding its application and use.	All
P12 Institutional Alignment	Work to augment and force multiply the capabilities of existing institutes, centers and programs over creating new ones.	Administration Program / Institute Directors
P13 Strategic Alignment	The U-M GenAI plan should align with and supplement the emerging U-M Vision 2034 plan.	Administration
P14 GenAI Leadership	U-M should take bold steps to establish itself as a prominent and influential global leader in GenAI in Higher Education.	Administration
P15 National Alignment	The DRAFT U-M GenAI principles and guidelines to be developed should be aligned with the White House Blueprint for an AI Bill of Rights and the NIST AI Risk Management Framework.	Administration

II.4 Overarching Recommendations

Based on these findings and principles, the GAIA Committee suggests that the U-M administration address the following recommendations.

1. **Dissemination of guidance and launch of campus discussion (Timeline: immediate):** The Provost and VP/CIO, with the support of the President, is encouraged to call a meeting of Deans and other appropriate leaders across the Ann Arbor, Dearborn, and Flint campuses to review, discuss, adapt, and disseminate GAIA's findings, guiding principles, and recommendations for the responsible, ethical, legal, and transparent use of Generative AI. This should be done well in advance of the Fall Term, 2023.

    - Encourage each School, College, U-M Dearborn, and U-M Flint to review, discuss, adapt, and disseminate the DRAFT U-M GenAI findings, guiding principles, and recommendations and deploy for use beginning Fall Term, 2023.
    - Encourage each School, College, U-M Dearborn, and U-M Flint to establish a Task Force to implement these guiding principles across the missions of Education, Research, and Administration for all faculty, students, and staff within its academic and administrative operations.
    - Encourage each School, College, U-M Dearborn, and U-M Flint to review, refine, and disseminate the DRAFT revision of the U-M Honor Code with related provided directions for instructors, students, and trainees.
    - U-M administrative leaders form a GenAI committee (also refer to recommendation 3,4,6) to inform U-M leadership and support these discussions throughout the remainder of the 2023-2024 Academic Calendar and beyond. Deans and leaders can identify champions to build momentum and establish best practices.

2. **Teaching, Learning, and Academic Innovation (Timeline: Fall 2023):** U-M can approach GenAI as an opportunity to rethink how we teach and define meaningful learning objectives, promote inclusion and equity, and assess learning. This may also include efforts to vet, refine, and share language related to modifications to the U-M Academic Integrity, Honor Code, and syllabus language. **Instructors should be given complete flexibility to allow or disallow the use of GenAI tools.**
   2a. GenAI literacy & messaging: GenAI will necessarily change some existing models for authentic learning and assessment, and it will require us to define new foundational skills. GenAI literacy will be vital in the future and using it ethically and responsibly will necessarily become part of our academic mission. Therefore, we recommend that University leadership strives to accomplish the following:

    - *Tone:* Balance all messaging to the U-M community to emphasize the inevitability of GenAI integration into everyday academic life, while accounting for both the opportunities and the concerns. Leadership should be honest about the limited knowledge we have about the impact of GenAI and use this as incentive to inspire reflection, experimentation, and research in these areas.
    - *Transparency:* Work to define the minimum responsibilities and expectations of instructors and students in engaging with GenAI. This can take the form of practices that instructors should adopt as well as a clear pathway for answering questions or

handling conflicts that arise around the use of GenAI tools in the classroom. Messaging should also distinguish between "required" versus "recommended" actions and on what timescale to reduce training and confusion.

- *Collaboration:* Encourage conversation between instructors, students and administrators in each school and college around this issue. It is imperative that we do not frame this as a divisive issue, but rather an opportunity to come together to discuss the state of GenAI in higher education and co-create solutions to leverage the potentials of this technology in ways that are consistent with our community's values.
- *GenAI Innovation Fund:* Schools and Colleges should provide resources to support course development ("GenAI in the Classroom Innovation Fund") - (Immediate)

2b. GenAI strategy and tactics for teaching and learning: The Office of the Provost should encourage Academic Innovations, CRLT, the Sweetland Center for Writing, and other relevant organizations (also see Recommendation 2d) to develop a comprehensive strategy for transforming teaching and learning, focusing on three principal areas: reframing and positionality, stakeholder research, and faculty and student support. This should be disseminated broadly to all schools and colleges and the Rackham Graduate School via the Office of the Provost and its designates, who may further customize it. The present report details some important directions towards this end.

2c. Teaching and Learning Guidelines: OGC, Academic HR, and UMOR should lead revision of the ethical, legal, and compliance policies and rules pertaining to GenAI in education, guide these discussions with stakeholders, and generate necessary SPG revisions.

2d. Establish a U-M-wide initiative in the area of AI for Academic Innovation (AI^2) (Timeline: Fall 2023).

- Provide support to grow an AI^2 Initiative that brings together AI expertise and Academic Innovation to develop tools and methodologies for AI-augmented education. Organized by the Office of the Provost and VPIT.
- Identify appropriate partners for policy and infrastructure implementations (e.g. School of Education, CRLT, CAI, ITS).
- Emphasize academic innovation in teaching and learning focused on ethi-cal, legal, accessible, and equitable use(s).
- Regularly review and assess the impacts of GenAI technology as it relates to teaching and learning and oversee incorporation in course delivery tools (Canvas, etc.)
- Evaluation framework with continuous improvement and version updates at quarterly intervals.

3. **GenAI and Research Practice:** With assistance from the GenAI committee[4], it is recommended that the U-M office of research (UMOR) assess the use of GenAI in research and set best practice standards for privacy protections; data use controls; and updating research integrity related SPGs, PEERS modules, and RCR training.

    - U-M should aim to be a leader in setting exemplary standards for academic research country-wide.

[4]Also see recommendations 1,4,6

- U-M should protect its faculty and staff from being the subject of precedent-setting case law – so should move quickly to set institutional-level expectations that are both appropriate and in line with anticipated future government guidance.
- The Principal Investigator (PI), who is the driving force behind research projects and programs guiding their teams, including trainees and staff, should take full responsibility that all research outputs generated by the use of GenAI, and AI platforms more generally, are verified for accuracy with research references to ensure the validity of the claim(s) in sponsored research proposals, reports, and subsequent publications and presentations.
- The PI should attest to this and properly disclose the GenAI methods used to create research artifacts. Each and every researcher and trainee in the PI's group should also so testify. This will be further ensured by their department chair, their school or college associate dean for research, and ultimately by the U-M Office of Research (UMOR).

4. Provost, VPR and VPIT should establish a U-M wide research initiative in the area of Generative AI (Timeline: Fall 2023/Winter 2024)

- Establish and drive research and collaboration among AI experts, cognitive scientists, humanities, social sciences, public health, biomedical, and clinical AI experts to address economic and societal disruptions and address existential risk concerns.
- Centered around research innovation in reliable and ethical development of GenAI in different research domains.
- Also responsible for overseeing implementation of GenAI Research IT infrastructure extensions to ARC enabled by tight integration and partnership with ITS for infrastructure implementations and University support.
- Leverage existing units (e.g., AI Laboratory, MIDAS, MICDE, Weinberg Cognitive Sciences Institute, Computer Science and Engineering, School of Information, e-HAIL, ISR, and ICPSR).
- Regularly review and assess the impacts of GenAI technology as it relates to research and operations of the university and advise the administration on a quarterly basis.
- Align GenAI and AI more generally as a major component of U-M's 2034 vision.
- Initiate a multi-university research consortium to broaden expertise, scope, and scaling abilities.
- Engage donor networks and foundations with well-defined vision and seek support for specific GenAI research objectives.

4a. Given large uncertainties in the landscape of GenAI tools and questions on privacy, security, bias, reliability and cost, U-M should consider developing its own version of foundation GenAI models to enable research and innovation. (Timeline: Begin activities in Fall 2023).

- Starting from well-studied open-source models, U-M should place significant emphasis on developing home-grown versions of foundation models.
- Leverage U-M faculty expertise and research in GenAI, data science and cognitive science, etc.

- Create and deploy sandboxes for research groups and departments to train their own discipline-specific foundation models, along with the potential for interdisciplinary collaboration and learning when different department robots interact.
- Be cognizant of the significance of human feedback in the back-end labeling process in certain applications, emphasizing the need for a sustainable ecosystem to effectively utilize such models.
- Leverage partnerships with multi-university consortia and national laboratories

4b. Formulate a long-term vision to develop large-scale computational resources to support GenAI innovation (Timeline: Begin activities in Fall 2023).

- Sustained investment in large-scale computing will be required to maintain U-M's leadership and competency at the forefront of science and technology.
- Seek inputs from ITS, MICDE, MIDAS, AI Laboratory and Computer Science along with domain experts in various scientific disciplines.
- Invest in data infrastructure–including large scale data storage, pipelines to migrate data between contexts, and processes for access management and ethical oversight–to create a platform to train GenAI models. This will need to be done for each research area where we want to invest in GenAI- driven advancements.

5. **Expansion of IT infrastructure to accommodate secure and equitable access to GenAI platforms and tools: U-M can make the following GenAI Information Technology resources available to all members of the U-M community ensuring equity of access (Timeline: Immediate and Variable):**

   - Provide sustainable central IT support for GenAI tools and secure platforms, including guidance on appropriate use should be provided by ITS as required (e.g., Open-AI GPT-3.5, -4 access, Bing Chat, DALL-E 2, Midjourney, Stable Diffusion, Adobe Firefly, Claude/Anthropic, access to Google AI resources, MS Co-pilot, GitHub Co-Pilot, and selected and vetted open source LLMs[5].
   - Provide safe and secure research computing infrastructure for U-M researchers and research programs, centers, and institutes (safe and secure), for users and fine-tuners – (Starting Fall, 2023; Partner with ARC and MICDE)
   - Secure Clouds with LLMs for training/tuning for use in research and education) – (Starting August, 2023/Variable)
   - Provide safe and secure environments for processing sensitive data and education regarding their administrative use, sensitive data (HIPAA, Common Rule, FERPA, Export Control restrictions, etc.) – (Fall, 2023)
   - Provide GenAI platform training and support infrastructure for various stakeholders – (Fall, 2023)
   - Specify and enable interoperation with existing teaching and learning management tools (Canvas, etc.) - (Fall, 2023).
   - Track[6] and advise on new GenAI tools and platforms as they emerge and adapt to changing conditions (Immediate).

5a. Create and deliver new GenAI services. These services will be offered across three tiers, each catering to different needs and technical proficiencies and made available to Ann Arbor, Flint, and Dearborn. The aim is to make GenAI tools equitable and accessible to all members of our university community. Providing tools that support ev-erything from basic consumer usage to advanced research and experimentation (Fall Term 2023).

   - Tier 1: Consumer-Friendly GenAI Access: The most accessible tier provides access to popular hosted AI models such as ChatGPT and Google Vertex models. This tier is ideal for those who already use these services, providing a familiar interface and usage experience. Costs for this tier will be covered centrally and will come with usage limits to ensure fair access for all.
   - Tier 2: Customizable GenAI Tools: This tier gives users the ability to tune/train vendor models utilizing a codeless interface made available by ITS. This tier will be equitable and accessible for the U-M community. Usage of this tier is designed for advanced users wishing to pursue models trained with their own data, U-M data, those who wish to use persistent models for experimentation, research, training, business process redesign, etc.'
   - Tier 3: Advanced GenAI Model Creation: Tier 3 is the most advanced and flexible offering. It is designed for those who require full control over their AI environments and models, including those working with sensitive data. This tier requires deep technical knowledge to access and execute, and ITS will support hosting services only. Appropriate for use with some sensitive data.

[5] e.g. List of open-source LLMs

6. **VPIT to work with the GAIA committee to coordinate and establish an AI digital commons where our community can share best practices and emerging ideas in GenAI (Timeline: Immediate).**

    - AI commons will provide an opportunity for the community to share best practices and informational resources.
    - Initial membership of the transition team may be comprised of a few U-M GAIA Committee members and augmented upon recommendation of the Deans via the Office of the Provost.
    - The team will be tasked with keeping the U-M GenAI Website up to date, convene town halls with faculty and students, and to promote cross-unit collaboration.
    - The team will be tasked to work with ITS to ensure wide dissemination of tools and resources via synchronized unit-level and centralized websites.
    - All units will be encouraged to submit their unit-specific GenAI plans and participate actively.

[6] e.g. A critical look at AI-generated software

7. **Launch a U-M GenAI website providing strategy, policies, resources, and links. Coordinate this with a well-defined communication plan (Timeline: Immediate).**

    - Website should be a go-to informational resource for students, faculty, staff, and administrators.
    - Should prominently display U-M policies on the use of GenAI technologies in clear language, providing documentation on GenAI- related organizational management, oversight.
    - Should provide guidance on revisions to the U-M Honor Code with directions for instructors and students.
    - Should link to available IT and Infrastructure resources to enable responsible and legal use of GenAI.
    - Website should be a living resource, and thus constantly updated and will showcase exemplars of successful applications and best practices on GenAI.

The extensive capabilities and rapid evolution of GenAI tools necessitate the development of best practices for their effective use, development, and management. Though we have taken great care through several months of deliberation, reflection, and discussion to capture key stakeholder perspectives, the complexity and comprehensiveness of the task has no doubt yielded some gaps. We acknowledge this along with the fact that this is a moving target.

The U-M GAIA Committee has therefore recommended a set of timeline-defined recommendations to advance U-M's academic mission, shaping the next generation of scholars and innovators, and improving administrative and operational efficiencies. We now provide details in the following sections to help jump-start this process and position the entire U-M community to continue to adapt and evolve to this accelerating technology.

1 Science & Capabilities of Generative AI

The field of Generative AI (referred to as GenAI or GAI) has experienced exponential advancements in recent years, demonstrating remarkable progress across diverse modalities such as text, images, sound, and more. It is notable that the breadth, generality, and sophistication of capacities of models like ChatGPT has been a surprise to the broad community. That such capacities emerge from the training task of "predicting the next word" can be argued to be among the most sig-nificant discoveries in AI research. Such advancements can be primarily attributed to the three main factors: methods, data, and scale of computation. First, advances in deep learning tech-niques, specifically transformer architectures[7], have enabled more powerful and efficient mod-eling of complex relationships in the data. Second, the availability of vast and diverse datasets, encompassing extensive text corpora and image/video repositories, has significantly contributed to the quality and diversity of generated outputs. Third, the substantial growth in computational power has played a crucial role in enabling the training and deployment of increasingly complex generative models. Collectively, these technical factors have fueled the rapid evolution of GenAI, paving the way for breakthroughs in various domains of content generation.

1.1 GenAI Capabilities

Language generation. Language generation builds on the strong foundation of language models, dating back to 1948[8]. For instance, the GPT (Generative Pre-trained Transformer) model, including versions such as GPT-3, 3.5, 4, is a family of state-of-the-art language models developed by OpenAI. It relies on a transformer deep learning architecture, designed to process and generate natural language text. The architecture includes multiple layers of self-attention mechanisms, enabling it to capture the contextual relationships and dependencies between words and generate coherent and contextually relevant responses.

GPT models have been trained on an extensive corpus of diverse text data of more than 400 billion tokens, including books, articles, and web pages, using unsupervised learning techniques. The training process involves predicting the next word in a sentence based on the preceding context, enabling the model to learn grammar, semantics, and common language patterns. This pre-training phase equips GPT-3 with a broad understanding of human language and knowledge.

InstructGPT is a variant of the GPT (Generative Pre-trained Transformer) model developed by OpenAI. It shares the technical foundation of GPT, utilizing a transformer architecture and unsupervised learning. However, what sets InstructGPT apart is its specific training objective, which focuses on generating text conditioned on user instructions. During the pre-training phase, InstructGPT is trained to predict the next word in a sentence given both the preceding context and an additional instruction prompt. This conditioning enables the model to generate text that adheres to specific guidelines provided by the user. By fine-tuning InstructGPT on custom datasets with specific instruction-based tasks, it can be tailored to perform a range of practical applications, such as generating code, writing essays, answering questions, or providing detailed instructions. The technical aspects of InstructGPT leverage the power of transformer-based architectures and instruction conditioning to generate contextually coherent and user-guided text outputs.

Multimodal generation. Advances have also been made in the space of multimodal GenAI, which includes other modalities such as audio (including music), images, and video. For instance CLIP is a transformer-based model that uses a dual-encoder architecture, and encodes both images ~~and language. The image encoder pr~~ocesses images by passing them through a convolutional

[7]Vaswani, Ashish, et al. "Attention is all you need." Advances in neural information processing systems 30 (2017).
[8]Shannon, C. E. (1948). A Mathematical Theory of Communication. Bell System Technical Journal, 27(3), 379–423.

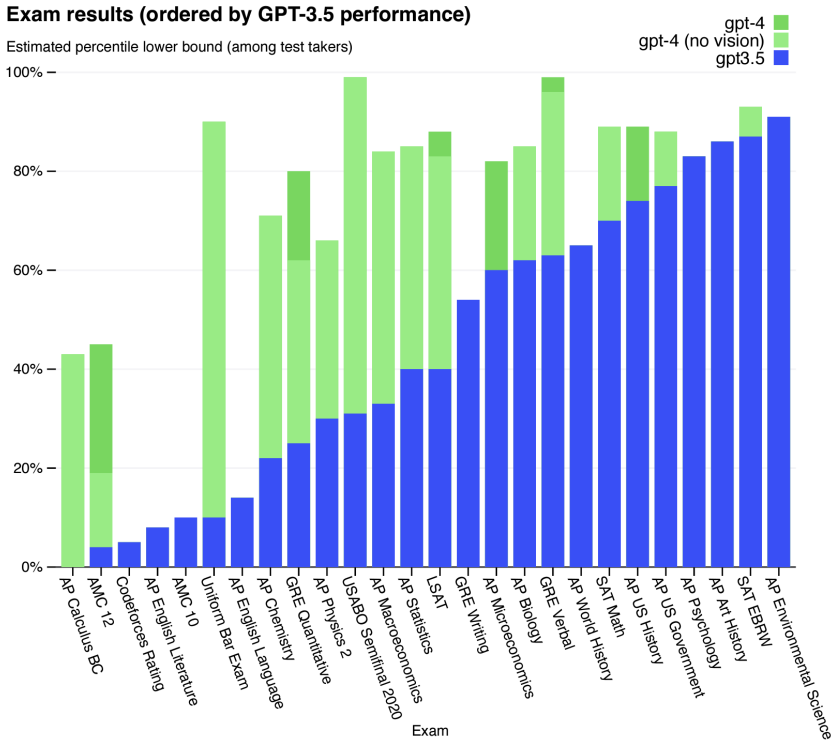


Figure 2: GPT4 shows greatly improved performance on simulated bar exam (top 10%) vs GPT-3.5 (bottom 10%) and many other exams at the high school, undergraduate, graduate and postgraduate levels. (Source: https://cdn.openai.com/papers/gpt-4.pdf)

neural network, while the text encoder utilizes a transformer-based architecture to process textual descriptions. By performing this process jointly across images and text, CLIP learns to align their representations in a shared embedding space, which allows it to capture meaningful relationships between images and their associated textual descriptions. By maximizing the similarity between corresponding image-text pairs and minimizing the similarity between non-matching pairs, CLIP learns to understand the semantic connections between visual and textual data.

Another example of a multimodal GenAI is DALL-E, which combines language models with an image encoder-decoder architecture. DALL-E has the ability to generate novel images based on textual prompts, showcasing impressive creativity in synthesizing unique and imaginative visuals. By learning a latent space representation of images, DALL-E can generate highly detailed and diverse images, transcending conventional image synthesis techniques.

Other models encompass acoustic modalities, such as audio or music. TANGO relies on a latent diffusion model that focuses on generating realistic audio from text. It can create a wide range of sounds, including human voices, animal noises, natural and artificial sounds, and even sound effects, based on written instructions. Other models like OpenAI's MuseNet and Jukedeck have demonstrated the ability to compose original music in different genres and styles. These models leverage deep learning techniques to capture musical patterns and structures, enabling them to generate coherent and musical compositions.

Autonomous GenAI systems. The first wave of widely adopted GenAI tools such as those introduced above are interactive or conversational agents that are dependent on human prompts to perform actions. More recently, applications that can plan and operate more autonomously have emerged: Auto-GPT is a system for autonomous task execution, built on top of other GenAI models, such as GPT. Unlike interactive systems such as ChatGPT, Auto-GPT operates without constant human input, by setting its own objectives to pursue, generating responses to prompts, and adapting its prompts recursively based on new information. It can autonomously perform several actions such as web searching, web form interactions, or API interactions. As an early self-driven system for task execution, Auto-GPT is an example of an AI system that can not only perform tasks determined by human users, but also define its own tasks, a step forward toward more complex AI-driven autonomy and problem solving.

The past few years in AI research have seen significant advances in planning and learning models of the world to plan with. These advances have yet to make their way into commercially available models. **Even if LLMs on their own do not improve by a large margin, they may already be sufficiently powerful to lead to dramatic new advances when integrated with planning and agency.** This new class of GenAI tools have the potential to revolutionize numerous technological and societal sectors. However, the deployment of unsupervised autonomous GenAI systems also introduces substantial technological challenges and societal risks, necessitating careful consideration and robust safeguards in their development.

Code Generation. GPT models and other open source models can be used for generating code, along with other more advanced systems such as the GitHub Copilot. GitHub Copilot is an AI-powered coding assistant developed by GitHub in collaboration with Microsoft and OpenAI. It utilizes the GPT-3 language model to provide real-time code suggestions and completions directly within integrated development environments (IDEs). By analyzing the context of the code being written, Copilot is able to generate code snippets including function definitions and even entire classes, and it can do so in multiple programming languages. The suggestions from Copilot are made either by starting with an existing piece of code, or by starting with a natural language comment describing what the code should accomplish. Through this integration into programming

environments, such coding assistant tools have the potential to help developers streamline the coding process, write code faster, and have fewer coding errors. More information about pedagogical issues related to AI-assisted software tools can be found in Appendix A.3.

1.2 Limitations and Risks.

There are several risks and limitations that come with the use of GenAI. A few of these risks are listed below:

- **Unintended bias:** GenAI models are trained on large language or vision datasets, which are often reflective of multiple societal biases. These biases can be propagated in the generated content, perpetuating and amplifying societal biases and prejudices.
- **Inaccurate cultural representation:** GenAI systems are currently built using a "one-size-fits-all" strategy, which fails to accurately capture and reflect cultural differences, potentially leading to the production of content that overlooks or misrepresents the rich cultural nuances and diversity of various communities represented on a university campus. In turn, this also has the effect of widening the socioeconomic gap, as the lower socioeconomic status group may find less value in these tools.
- **Misinformation and disinformation:** GenAI systems often produce misinformative statements and make unsupported claims. Their inability to provide a confidence level for the information they provide makes it difficult to determine when to trust these models. Further, these AI systems can be exploited to generate false or misleading information. The resulting misinformative content can have significant negative implications for trust, credibility, and the manipulation of public opinion.
- **Lack of transparency:** As a consequence of the underlying complexity, it is often challenging to interpret and understand current AI models. This lack of transparency can make it difficult to determine how the model arrives at its generated outputs, which also makes it hard to identify biases, errors, or potential ethical issues, attribute findings, and hinders accountability.
- **Privacy concerns:** Very large amounts of data are typically needed to build AI systems, which can lead to a risk of privacy breaches and unauthorized use of personal information during data collection, storage, and utilization. In addition, many individuals represented in AI datasets are not aware their data have been shared in this way and might be uncomfortable with this use. Intellectual property and copyright infringement: In a similar vein, the use of very large datasets, and the functioning of GenAI which often replicates patterns from the training data, can result in the unauthorized generation or replication of copyrighted or otherwise protected material.
- **Ethical considerations:** There is a vast set of ethical considerations surrounding GenAI. In addition to the risks mentioned above, other ethical concerns include the appropriate use of AI-generated content, research integrity, consent for data usage, potential impact on human creativity, impacts on labor markets and employment, and others.
- **Existential risk:** While there exists considerable enthusiasm about the potential of these tools[9], a small yet growing fraction of technology leaders have articulated apprehensions that GenAI systems - and AI systems more broadly - represent a potential existential threat to society. This

[9] https://a16z.com/2023/06/06/ai-will-save-the-world/

is predominantly attributable to the unpredictable characteristics of expansive AI algorithms and the potential for these systems to autonomously optimize themselves, which could result in unanticipated and undesirable consequences. Irrespective of one's position within the spectrum of these concerns, there is unanimous consensus that AI systems necessitate the establishment of stringent safeguards during their construction. Furthermore, it is imperative that robust policies are instituted at various levels to mitigate the risks associated with these systems.

Given its leading-edge expertise in many areas, U-M is uniquely positioned to provide leadership in developing GenAI technology that is beneficial while minimizing inherent risks. Section 5 presents recommendations regarding research and innovation in this space.

2 Near-term Guidance for Instructors

The most immediate and significant GenAI application domain at U-M is in the realm of teaching and learning. We thus begin our report with suggested guidance for instructors, who may benefit from immediate and practical support in planning for Fall 2023 courses.

2.1 Instruction in an AI-augmented world

AI augmentation refers to the use of artificial intelligence to assist, expedite, enhance, and in some cases, substitute for humans in accomplishing tasks. AI augmentation will significantly alter the education landscape, and we will need to re-evaluate teaching strategies to take advantage of the opportunities and mitigate risks. Our response to GenAI should be consistent with our core values of fairness, diversity, equity, inclusion, accessibility, research veracity, and ethical integrity. The rapid integration of AI in various sectors of society requires a re-evaluation of curriculum design to prepare students for a future where AI will be ubiquitous. On a more immediate note, our survey indicates that an overwhelming majority of U-M students are already using GenAI tools, so instructors should take action to prepare for the Fall 2023 semester in an AI-infused world. Given the rapid evolution of the technology and its adaptation, this section is focused on offering near-term recommendations, which will inevitably be superseded as the technology develops.

The use of GenAI in coursework is banned at some universities. **This approach is nearly impossible to enforce, partly because detecting tools are (at present) untrustworthy,** and partly because GenAI can be used to support processes that may not be directly shared with instructors, and so are not possible to assess, such as prompting ChatGPT to generate ideas, an abstract, an outline, or an essay draft, and later revised by the student. **Even if instructors determine that they do not want to integrate GenAI into their courses, there may be real benefit to be gained from encouraging instructors to become familiar with the technology and its likely impact on the future of our society and the workplaces our students will be entering after graduation**[10]**.** If GenAI is banned in specific contexts, it is vital to ensure that the instruction protects equity and accessibility for students. GenAI might, for example, be recommended as assistive technology for persons with disabilities; barring use of the technology could in this situation create inequity.

It is important to point out to students that although AI generated content may appear reliable, inaccuracies, biases, and false citations are common, and are easy to miss without critical evaluation of the content produced. Instructors may teach students about these weaknesses by explicitly demonstrating them. One simple exercise is to prompt ChatGPT to write a short biography of

[10]Darby, Flower. 4 Steps to Help You Plan for ChatGPT in Your Classroom: Why you should understand how to teach with AI tools — even if you have no plans to actually use them. The Chronicle of Higher Education (June 27, 2023).

the instructor, and then point out what the platform gets wrong. Another exercise is to enter a nonsensical ChatGPT prompt and show students the output. For example, GPT-4 responded to this prompt "explain for an academic audience why people who eat worms are more likely to make sound decisions when it comes to choice of life partner." with an academic-sounding paper that concluded: "While there is no direct causation between worm consumption and sound decision-making in life partner selection, the correlation can be better understood through the examination of underlying traits that are common among individuals who consume worms. Open-mindedness, adaptability, and nonconformity are qualities that contribute to a more discerning approach to personal relationships and partnership[11]." By showing students the platform's capacity for absurd fabrication, instructors can cultivate critical thinking and necessary skepticism.

There are multiple key components of courses that will likely need review in relation to GenAI capacities and risks. Instructors will be well-served by considering their answers to the following questions about each course they teach:

- Should GenAI be used in the course or not—and why or why not?
- If GenAI is to be used, how is the use to be documented?
- Should course learning objectives be revised?
- Should GenAI competencies be taught in the specific disciplinary context?
- Should assessments be revised?

2.1.1 Academic Misconduct Policies

Current definitions of academic misconduct do not take account of the new AI-based technologies. The same is true of Honor Codes and the policies followed by the Academic Judiciary. The Library's website offers a basic definition of plagiarism: "*Plagiarism: presenting others' work without adequate acknowledgement of its source, as though it were one's own.*" LSA's website details a range of misconduct, including cheating, plagiarism, falsification of documents, and unacceptable collaboration. The College of Engineering has an Honor Code that defines misconduct. We recommend that these and other schools' and colleges' policies should be updated this summer to take into account the potential and risks of GenAI in instructional contexts.

Common approaches to updating academic misconduct policies are:

- Determining that ChatGPT (or GenAI) is prohibited help from another "person" (e.g., UCLA),
- Defining GenAI as a "source" that should be acknowledged (e.g., UW Madison).

The GAIA committee believes that the "person" approach misleadingly attributes sentience and a reasoning capacity to GenAI, and proposes that the "source" approach is more workable, and aligned with our mission of teaching students to engage effectively and ethically with the world around them.

Treating GenAI as a source that should be acknowledged is more complicated than citing a print book or online article. Unauthorized GenAI use may constitute cheating (a student presenting

[11] Mills, Anna R. ChatGPT Just Got Better. What Does That Mean for Our Writing Assignments? An educator who tested the new GPT-4 before its release offers advice for faculty members on how to respond. The Chronicle of Higher Education (March 23, 2023).

ChatGPT output as their own original work) and/or plagiarism (copying output from a source without acknowledging that source). In addition, GenAI is not a socially recognized academic "source" in and of itself. Given the lack of transparency in information generation, the model makes it impossible to adequately attribute (or verify) training data sources. U-M schools and colleges will have to determine what misconduct policies will work in their contexts, in consultation with Academic Judiciary bodies.

As U-M makes GenAI technologies available to the campus community as a hosted service, U-M will then face requests (from instructors regarding concerns over ethical student use, in clinical discovery processes, as FOIA requests) to report how individual users have leveraged the technology, including what prompts were used, what data was shared/accessed, and what responses were generated. Legally, as the holder of the license, U-M owns the data involved. Guidelines will need to be established under which requestors will be permitted access to these data. All GenAI service users need to be notified about these expectations when accessing the technology. A few things to consider:

- If we permit instructors to request per-student usage, the demand for reporting is likely to be unsustainably high. It may be valuable to explore building systems to enable reporting at scale, although access should probably be limited to those with both expertise and need (i.e., academic misconduct specialists, OGC, etc).
- U-M's GenAI technology will not be the only services available to the campus. The more we enable detailed inspection of use in the context of academic misconduct cases the more community members will be encouraged to leverage non-U-M technologies.

2.1.2 Course Policy

Teaching in the presence of ubiquitous GenAI tools should be considered a dynamic endeavor that necessitates flexibility. Approaches and expectations will vary by instructor, course, assessment, and activity. To ensure transparency, **it is critical that expectations are clearly articulated in the syllabus and continually reinforced when assignments are given.** The committee recommends additional communication of expectations addressed explicitly via a dedicated course orientation module since it can be easy for students to overlook a policy statement buried in a syllabus. Instructors should align their course policies with their college's academic misconduct policies.

Instructors are discipline-specific experts responsible for formulating the course content, developing ap-propriate pedagogies, and assessing student work. GenAI may influence all three, and as such, **instructors should be given flexibility to allow or disallow the use of GenAI tools. If the latter approach is adopted, the committee discourages the use of surveillance and plagiarism detec-tion tools as they cannot be reliably counted upon at the present moment.** Further, clear policies have to be formulated regarding punitive measures and how they may be enforced. If GenAI tools are allowed, the instructor should be clear which tools are allowed and in what capacity. On the other hand, if GenAI tools are disallowed, the committee suggests that the instructor give rea-sons why the use of GenAI tools would hinder learning. Unless explicitly prohibited, the working assumption is that GenAI-based tools can be used to augment student learning at U-M.

Syllabus Language GenAI is changing rapidly, and new tools will become available. Course policies therefore need to be provisional and subject to change. Several principles can guide instructors to develop course policies appropriate for their contexts:

1. Protect the cognitive dimension of learning: GenAI should enhance, not hinder, learning.

2. Responsibility for content: Students are responsible for all content (ideas, facts, citations), however the work is generated. (Note: Chat GPT can generate untrue, biased, inaccurate, and hallucinatory content.)

3. Require ethical transparency: Students should be transparent about how they use GenAI and adhere to standards of academic integrity.

4. Explain academic misconduct: Instructors should distinguish between allowed and disallowed uses of GenAI, including how, when, and why GenAI may or may not be used.

Course policies might fall into one of three categories:

- Specific uses of GenAI are encouraged (generating ideas, editing, translating, outlining).
- Specific uses of GenAI are allowed if students clearly distinguish between their original work and GenAI output (highlighting output, tracking changes in GenAI output).
- Any use of GenAI constitutes academic misconduct.

Instructors could consider including in the syllabus, the following recommendations from http://sentientsyllabus.org, a project led by a team of multidisciplinary scholars at leading Universities throughout the world:

Referencing and validating. *You are taking full responsibility for AI-generated materials as if you had produced them yourself: ideas must be attributed and facts must be true.*

Openness. *We encourage you to use AI tools to explore the field, play with knowledge, and help you study. But you need to be open about this, and document your use.*

Documentation. *A portion of your term grade will evaluate your documentation of AI use throughout the course. By keeping track of your AI use and sharing your experiences, we all gain understanding, identify potential issues in this rapidly changing field, and discover better ways to use the resources for our objectives.*

Academic Integrity Statement. *Academic integrity is our foundation as a community of scholars and learners. It defines the values we personally uphold, and it expresses a shared understanding why we do so. This includes: a commitment to truth; a commitment to personal integrity; and a commitment to certain standards and shared values on which membership in this community is based.*

Assignment Instruction statement. *By submitting an assignment for evaluation:*

- *you assert that it accurately reflects the facts and to do so you need to have verified the facts, especially if they originate from generative AI resources;*
- *you assert that all your sources that go beyond common knowledge are suitably attributed. Common knowledge is what a knowledgeable reader can assess without requiring confirmation from a separate source;*
- *you assert that you have respected all specific requirements of your assigned work, in particular requirements for transparency and documentation of process, or have explained yourself where this was not possible.*

If any of these assertions are not true, whether by intent or negligence, you have violated your commitment to truth, and possibly other aspects of academic integrity. This constitutes academic misconduct.

2.1.3 Course and Assignment (Re-)Design

We cannot fully anticipate how GenAI will impact every course or assignment at U-M. We will need to approach GenAI with an experimental mindset, draw on what we know, prioritize high-impact pedagogical strategies, and plan for incremental, sustainable instructional development. High-impact pedagogy includes collaborative learning, interactive learning, higher-order thinking, service- or community-based learning, research, authentic learning and assessment, and writing-intensive courses. Writing-intensive courses present particular benefits, opportunities, threats, and risks.

To begin this process, we recommend that instructors practice using GenAI tools relevant to their disciplines, interests, and pedagogies—before the start of Fall 2023.

In preparation for fall term, instructors should evaluate several aspects of their courses:

1. What are the course objectives and rationale for them? Can GenAI be used to meet any of the objectives?
2. Are there new learning objectives in the areas of knowledge, skills, or values about GenAI that students need to meet? Will students have equitable access to GenAI for these objectives?
3. What tasks do students need to complete to demonstrate they meet the learning objectives?
4. How will learning be assessed?
5. Do the objectives, tasks, or assessments present problems with respect to equity, inclusion, diversity, or accessibility? If so, can they be adjusted to ensure fairness and inclusion?

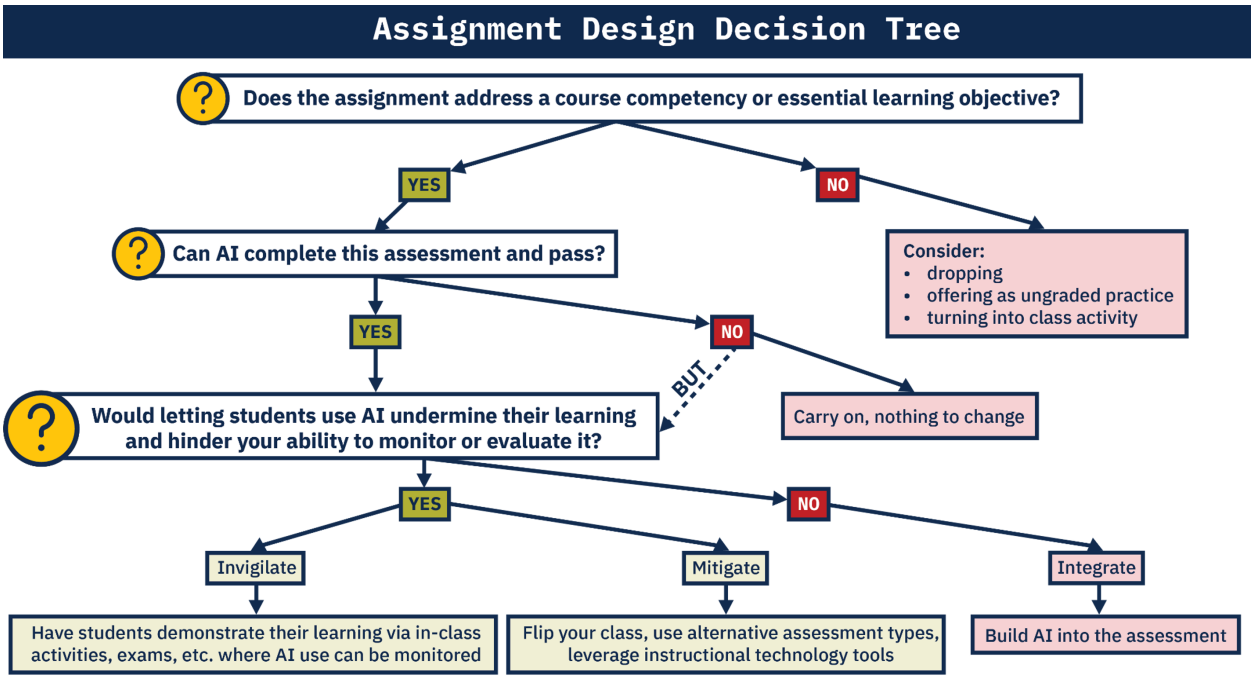
We recommend that the course design should include some parts that cannot be completed satisfactorily (solely) by GenAI tools, unless GenAI skills and values are the primary learning objectives. GenAI offers us an opportunity to rethink learning objectives as well as assessment methods. Several principles of effective pedagogy can guide us in adjusting courses to GenAI environments:

- **Larger component of technology-free in-class assignments:** including low-stakes writing, programming logic, etc. may be possible, while recognizing that in-class assignments can create inequities for some students with disabilities and English-language learners, unless appropriate accommodations are offered.
- **Focus on higher-order thinking:** require students to develop their capacity for creating, evaluating, analyzing, and applying what they learned to new contexts or problems. Emphasize the learning process over the product when appropriate: assign scaffolded tasks developed through several stages (low-stakes writing, outlines, proposals, outlines, drafts, peer review, revision).
- **Prioritize authentic instruction and assessment:** assign tasks that address real-world problems or simulate real-world tasks; require students to use disciplinary theories and methods in innovative ways; ask students to address complex and open-ended questions that have no easy or right answer; provide formative feedback that improves students' performance.

- **Require accurate and verifiable citation of sources:** have students include links to the sources they use in a project (at present, GenAI cannot reliably do this) Add metacognitive exercises to assignments: assign reflections about how formative feedback is understood and what was revised in response to feedback
- **Teach academic integrity:** In designing assignments, we should explain the purpose of the task to foster motivated learning. The purpose should align with learning objectives in the areas of knowledge, skills and values:
  - What do students need to learn and why—what is the value of the learning for them now and/or in the future?
  - What skills will students gain from using AI, what knowledge will they need to apply?

Instructors are encouraged to try completing assignments using GenAI tools before distributing assignments to students. GenAI output can productively be used in class as a prompt for discussion about what technology does well and not so well, as well as the potential social risks and harms implicit in the output (e.g. racial bias, misinformation).

The following decision tree[12] may be used to evaluate assignments in relation to GenAI environments. Instructors may find it useful to consider the principle of "transparent assignment design"



as they review the relationship between course learning objectives and assignments. A transparent assignment template created by Mary-Ann Winkelmes at the University of Illinois offers a concise and concrete example.

Instructors may decide to assess learning with a wider range of assignments than they employed before sophisticated GenAI tools became widely available. The following strategies may prove useful.

[12] Prepared by Frederique Laubepin, SPH

2.1.4 Strategies for Engagement and Assessment

In line with best practices for conventional teaching and learning, strategies for engaging and assessing students beyond memorization and superficial understanding will also prove to be effective pedagogical measures in the presence of GenAI tools. Diverse teaching strategies align with diverse approaches to assessment. The following table offers suggestions for instructors to consider as they redesign courses for GenAI environments.

PEDAGOGICAL STRATEGY	POSSIBLE ASSESSMENT METHODS
Active, experiential, and project-based learning sequences similar to those encountered in the discipline.	In-class polls, products of peer collaboration, self-assessment.
Flipped classrooms to develop interactive learning, peer collaboration, and problem- solving skills.	In-class polls, products of peer collaboration.
Reflections on learning and research processes .	Assign a description of research methods, evaluation of sources, explanation of how sources contributed to students' thinking, and discussion of problems encountered and solved in the process. Evaluate on the basis of completeness.
Live debates, oral presentations, role playing.	Evaluation rubric co-created with students before the performances. Evaluate on the basis of completeness.
Multimodal compositions, such as infographics, podcasts, drawings, websites, videos, alternative text creation for videos and images.	Evaluation rubric co-created with students during scaffolded composition process. Authentic group, individual, and self-assessments that require critical and creative thinking.
Social annotation of reading.	Peer review of annotation quality.
Requirements for students to contextualize information, make connections in written work to their lives, current events, and earlier course concepts or lectures, and/or incorporate required readings, videos, images, case studies, or datasets.	Evaluate on the basis of completeness and successful integration/synthesis of course materials, concepts, theories, or methods.
Poster displays and discussions.	Peer review according to a rubric co-created with students during the learning process.

Grading standards should be explicit when assignments are distributed and should prioritize higher-order thinking, veracity, critical and creative thinking, and learning processes over mechanical or grammatical correctness. The rationale for these priorities is that developing the human capacity for sentience, creativity, and reasoning aligns with the social value of higher education, while "correctness" (within narrow limits) can increasingly be accomplished by machines.

2.1.5 Integrating AI tools into Course Design

Teaching in an AI-augmented world will demand a reevaluation of the course design and pedagogical approaches. AI can be incorporated into a course in several ways. Examples include providing personalized learning experiences, predictive analytics to identify student progress towards learning goals, and automated grading systems. While integrating AI, it is important to critically examine:

- **Appropriate use of AI:** Ensure that AI is used in a way that supports the learning objectives of the course.

- **Necessity of AI:** While AI can improve various aspects of teaching and learning, it is crucial to discern if its implementation is necessary for a particular task or if a non-technological approach would be equally or more effective.
- **Pros and Cons of AI:** Understand the benefits, such as increased efficiency and personalized learning, against the potential risks and drawbacks such as privacy issues, technology dependency, or reducing human interaction.
- **Avoiding the Tail Wagging the Dog Scenario:** It is essential to ensure that AI serves as a tool to achieve educational objectives and not the other way round where the curriculum is altered to fit the AI tools.

2.1.6 Skills and Competencies for an AI-Augmented World

The future workforce will necessitate a unique blend of skills and competencies to thrive in an AI-powered world. While AI can greatly augment the teaching and learning process, it is critical to maintain the delicate balance between leveraging technology and nurturing the unique human skills that AI cannot replicate. Doing so can prepare our students for an AI-augmented world without compromising on the essence and social value of education. Accordingly, regardless of the field of study students could be exposed to the following aspects of GenAI:

- **Digital Literacy:** Students should understand how AI systems work and appreciate the intricacies of machine learning, data analysis, and algorithm design.
- **Ethical Understanding:** As AI systems become more complex, issues around privacy, bias, accessibility, and ethics will be prominent. Students need to be aware of these ethical considerations and equipped with the skills to make informed decisions.
- **Critical Thinking and Problem Solving:** While AI can automate many tasks, the ability to think critically and solve complex problems is something that cannot be replicated in the near future by machines. The cognitive dimension of learning is more important than ever, given the necessity of evaluating, fact-checking, and verifying AI output, as well as protecting against and mitigating the risks and harms of AI. These will remain key skills in the near-future workforce.
- **Adaptability and Lifelong Learning:** AI is a rapidly evolving field. Therefore, the ability to adapt to new technologies and a commitment to lifelong learning will be crucial.

2.2 Specific Implications for Writing and Other Disciplines

Though writing is just one of the many areas that will be transformed by GenAI - and it would be impossible to cover all possible subjects of interest that will be transformed by GenAI - we consider the impact of GenAI on writing and approaches to writing as a template. It is clear that implications for other areas will have some similarities and many differences in comparison to writing. Along these lines, Appendix A.3 addresses GenAI-related issues in the teaching of computer programming, while Appendix A.4 addresses the creative arts.

Writing is central to U-M's mission to create and publish new contributions to knowledge. Writing is a mode of learning and disciplinary thinking. GenAI technology is developing more rapidly than research can track, and the various instruments present strengths, weaknesses, opportunities, and threats to all aspects of our educational and research mission. How we respond to GenAI should be consistent with our core values of fairness, diversity, equity, inclusion, accessibility,

research veracity, truthfulness, and ethical integrity. Time and resources are needed to develop evidence-based knowledge, policies, and best practices about GenAI, and to analyze the impact of various GenAI instruments on writing practices and multimodal composition. In the meantime, we should prepare for fall term 2023, when students and instructors bring diverse GenAI experiences to their coursework.

To prepare GenAI-aware writing assignments for fall term, instructors should reflect o n some foundational tenets:

- GenAI will transform traditional academic writing, multimodal/multimedia composition, and creative expression in every U-M school and college. We need to commit to learning about it, experimenting with it for writing tasks, and teaching students to use it responsibly and ethically, with knowledge of its strengths and weaknesses, and with realistic expectations about what it can and cannot do.

- It is imperative that instructors continue to teach writing as well as multimedia/multimodal composition. Our knowledge is only as good as our ability to communicate it to relevant audiences.

- GenAI presents opportunities and potential benefits. It can be used at any point in the writing process to complement and expand students' thinking, project planning, brainstorming, research, outlining, drafting, and revision processes. There are risks involved in using GenAI in these ways: use of GenAI may impair original thinking and problem-solving; students' privacy is not protected; the output may contain fabrications, falsifications, biases, or errors. Students are nonetheless responsible for the work they turn in, including the truthfulness, academic integrity, and biases of content.

- GenAI weaknesses threaten academic veracity, the accurate transmission of existing knowledge, and the verifiable, reproducible creation of new knowledge. Use of GenAI should therefore be paired with critical evaluation of text output, fact-checking, and verification of acknowledged sources.

- GenAI tools can be used as a cheating machine, so threats to academic integrity should be anticipated and mitigated in U-M's academic misconduct policies and in syllabus statements (see Section 2.1).

- Some instructors will consider eliminating writing assignments from their courses with the intention of guarding against students' use of GenAI to complete tasks. This strategy could compromise students' academic development, understanding of disciplinary thinking, and problem-solving skills. It is in any event impossible to detect use of GenAI at numerous stages in the writing process. Instead of eliminating writing assignments, instructors should consider how they might adapt their goals for writing assignments to new GenAI environments.

- It is important that instructors not respond to GenAI by restricting writing assignments to what can be completed or handwritten in class. If in-class writing is necessary and appropriate, it should be assigned in a manner that does not create inequities for students with disabilities and for students learning English as another language.

- When instructors assign tasks that require use of GenAI, they should ensure that all students have equitable access to the necessary tools, with appropriate protections for privacy.

Given the complexity of adjusting writing pedagogy to GenAI environments, centralized teaching resources need to be widely available in advance of fall term to support instructors adapting their courses and writing assignments to GenAI environments. U-M writing centers and writing programs are already tasked with supporting and guiding transformative change for instructors and students. All such units should engage the strengths, weaknesses, opportunities, and threats of the rapidly changing technology in writing and multimedia composition pedagogy. This work will involve revising existing teaching resources and inventing new resources to support writing instruction and student learning in new technological environments. U-M writing centers, programs, instructors, and researchers should research GenAI in the context of writing pedagogy, multimodal composition, and creative expression, in order to develop ethical, responsible, and effective strategies for using GenAI to advance students' disciplinary learning and ability to communicate. At the time of writing this report, a Sweetland Center for Writing working group has been assembled in LSA to make new online resources available to instructors no later than early August; Tessa Tinkle, Sweetland's director and a member of the GAIA Committee, will offer consultations and workshops on assignment and assessment design from late July through fall term. It is unknown what other efforts are underway throughout U-M's campuses, schools, and colleges, so it is recommended that initiatives be identified and advertised as appropriate.

2.2.1 Best Practices for GenAI-Aware Writing Pedagogy

The goal of a writing assignment should be for students to learn from the experience of writing, as opposed to demonstrating what they have already learned. The following features characterize best practices for academic writing at all levels, from the first year through the dissertation. The Sweetland Center for Writing online teaching resources explain these practices and provide examples from multiple disciplines. Best practices have new implications specific to ChatGPT and perhaps other GenAI environments. The following table offers preliminary ideas about how instructors might add GenAI awareness to their pedagogy[13]. Since GenAI is constantly changing, all suggestions are provisional and will need to be updated as the technology develops.

BEST PRACTICE	GENAI-AWARE BEST PRACTICE
Make expectations for writing assignments clear by explaining the social context, academic conventions, genre, audience, and purpose for the task.	Test the assignment by putting it into - for instance - ChatGPT. Discuss the output with students, demonstrating the strengths and limits of the text in addressing a specific audience in a particular genre, using appropriate academic conventions of citation and documentation of sources.
Assign meaning-making and authentic learning tasks that require students to make their own sense of new information in light of their experiences, apply knowledge to specific real-world issues or problems, synthesize multiple sources, and evaluate information. .	Most current day GenAI models are not trained on data after 2021, and thus cannot respond plausibly to current events. Students' experiences are not in GenAI training data. Since responsible use of GenAI output requires critical evaluation, source verification, and fact-checking, the output can be the basis for critical thinking and meaning-making activities, based on current events where appropriate.

[13]See also Mills, "ChatGPT Just Got Better. What Does That Mean for Our Writing Assignments?" and Lang, James M. "How to Create Compelling Writing Assignments in a ChatGPT Age: A recent book offers a road map to new kinds of assignments to inspire your students to write." The Chronicle of Higher Education (April 4, 2023).

BEST PRACTICE	GENAI-AWARE BEST PRACTICE
Assign metacognitive exercises as part of the planning, drafting, and revision stages of a major writing assignment: e.g., require students to cogitate on how well their planning worked, what they learned from formative feedback, and why they revised as they did.	Machines can't think, but GenAI can output a reflection of sorts. Instructors should nonetheless require students to reflect on their writing process, what they learn from interaction with peers, instructors and even GenAI tools, the decisions they make about revision, and how they adhere to academic conventions (source citation, use of sources). Focusing on process, interactive learning, and metacognition foregrounds individual learning and awareness of learning that does not come from a machine.
Assign some high-stakes writing that is completed outside of class, scaffolded so that complex tasks are broken down into a manageable sequence, revised in response to formative peer and/or instructor feedback, and involving reflection on feedback.	Best GenAI-aware practices for process, interactive learning, and metacognition apply to high-stakes writing. Exercises using GenAI at various stages in the process can be added for the sake of comparing GenAI output with human invention.
Make standards for assessment transparent and explicitly connected to learning goals for the course, whether through a rubric or less formal tool.	ChatGPT can output mechanically and grammatically correct prose, but it also eliminates minoritized dialects. Since machines can produce "correct" prose, instructors should consider reducing the weight of correctness in grading standards. Assessment should prioritize critical thinking, the learning process, research, problem-solving, analysis, expression of linguistic identity, effective ways of addressing specific audiences, synthesis of multiple sources, application to unique real-world situations, personal relevance and application of concepts, fact-checking skills, and reflections on feedback and revision.
Explicitly teach how to evaluate sources, integrate primary and secondary sources into a composition, and document use of sources.	Scaffold the writing process to include fact-checking, verifying sources of information, identifying bias, recognizing fabrications, and adhering to academic genre and citation standards.

2.2.2 Strategic Short-Term Recommendations

- It will be important to prioritize support for instructors of and students in writing-intensive courses fall term. U-M has a range of writing centers and programs, and each has a specific mission, typically within a single school or college: Sweetland Center for Writing (LSA), Writing Center (Ford School of Public Policy), English Language Institute (LSA), CRLT, School of Public Health Writing Lab, the Program in Technical Communication (College of Engineering), Stamps Writing Program, the Writing Center at the U-M-Dearborn, and the Marian E. Wright Writing Center at U-M-Flint. These units can be surveyed to discover what their needs are and what would enable them to support instructors and students in GenAI environments. For the sake of efficiency and broad dissemination of best practices, a centralized archive of resources should be curated and updated as needed.

- Given that writing centers and programs may or may not have financial and human resources available to meet GenAI challenges at scale, they can work with their deans to identify resources to meet their needs.

- Undergraduate deans may find it useful to evaluate the needs of schools and colleges

without writing centers and inform the Provost of gaps in services. Existing centers may be able to fill in where gaps exist.

- Evidently, a universally applicable approach to the adoption and use of GenAI tools does not exist. Units such the School of Music, Theatre & Dance; Architecture and Urban Planning; SEAS; Kinesiology; Law; Nursing; Pharmacy; Social Work; or the Stamps School of Art and Design may require a different framing than has been discussed here, and should thus extend these policies, and formulate new ones to support instructors and students as we adapt to rapidly proliferating multimedia GenAI (see Appendix A.4).

3 Impact and Management of GenAI

3.1 Teaching and Learning Methods

Departments, instructors and students alike should be encouraged to explore the capacities, limits, and ethical concerns associated with GenAI to leverage the technology for beneficial creative and intellectual activity. Personalized instruction has been acknowledged[14] as a method capable of profoundly improving educational outcomes. GenAI has the potential to enable adaptive responses to the needs and abilities of individual learners, delivering real time tailored content and feedback in a manner that maximizes learning outcomes. We are not aiming for GenAI to replace human-generated outputs in teaching contexts; rather, we hope to see U-M as a community identify areas within teaching that can benefit from this technology and others where it will be critically limited or exclude it.

GenAI tools have the potential to fundamentally transform experiences and expectations of teaching and learning in both productive and unproductive ways in nearly every field. This raises critical questions around fairness, ownership, equity, and access in higher education that do not have ready-made answers. In section 2.1, we made near-term recommendations for instructors. In this section, we explore broader implications and recommendations for the community.

3.1.1 Findings

1. **Proliferation:** Instructors and students at U-M are already actively using GenAI tools for a range of tasks, from writing emails to help with final projects, and everything in between. We expect both the number of users and the range/quality of tasks that GenAI tools can complete will continue to increase at a rapid pace in the coming months.

2. **Responsibilities:** There is likely to be confusion around the roles and responsibilities of administrators, instructors, and students in the wake of GenAI, and a range of practical and emotional responses to this. If we can establish clear guidelines around acceptable uses, academic integrity, and accountability, our whole community will be able to navigate this disruptive moment more smoothly.

3. **Opportunity:** The proliferation of GenAI can be regarded as an opportunity to interrogate current pedagogical practices and promote more equity-focused principles and methods for instruction and assessment. This includes a deeper emphasis on the process of learning over the products, aiming for higher order learning like critical thinking and creation, and developing metacognitive skills in our learners.

[14] Bloom, Benjamin S. "The 2 sigma problem: The search for methods of group instruction as effective as one-to-one tutoring." Educational researcher 13.6 (1984) .

4. **Surveillance:** GenAI tools are advancing at such a rapid pace that detection technologies are constantly unable to keep pace. We recognize that some instructors will want detection tools to navigate the new and complex landscape of maintaining academic integrity in an AI-infused world. Unfortunately, our review indicates that it is likely to be costly and ultimately futile, given the continual improvements to GenAI tools. We are also concerned about the potential for detection software to produce so many false positives that it can result in seeding mistrust between students and instructors, compromise access needs, and amplify systemic inequities in higher education.

5. **Research:** At present, we do not have a deep evidence-base to inform our practices around teaching and learning with GenAI. U-M is in a unique position to help develop this evidence-base and be leaders in understanding the motivations, experiences and impacts of GenAI use in higher education. U-M researchers are beginning to experiment with GenAI to provide personalized learning.

6. **Training:** Both instructors and students will be operating in an increasingly GenAI augmented world. As an institution, U-M has an opportunity to foster the development of GenAI literacy and ethical use through the development of training materials for community members, with the goal of helping our community leverage these tools while being aware of the limitations and pitfalls. These could include asynchronous resources posted on the new GenAI website as well as workshops and consultations with teaching and learning units across campus.

7. **Coordination:** Given the range of disciplines and learning environments at U-M, there cannot be a "one size fits all approach" to addressing the needs of instructors and students. At the same time, encouraging coordination across academic and support units will help ensure that campus needs are met efficiently and sufficiently. We strongly recommend that approaches to GenAI use in teaching and learning contexts align with the principles offered in this report.

8. **Innovation:** There are many entities that are looking into using GenAI technology to enhance teaching and learning, lower barriers of entry, and address social problems, including making higher education more accessible and personalizable. By providing incentives and infrastructure for innovation, instructors, students and researchers can work together to develop strategic methods of leveraging GenAI in teaching and learning spaces.

Key principles & Recommendations

Several foundational (instructor-facing) pedagogical principles may serve as initial starting points for the work of resource development we urgently need to pursue:

- Value the **learning process** as well as the final product.
- Emphasize **metacognition** as a vital part of the learning process.
- Create assignments and assessments that foster learning and **higher order thinking**.
- Teach **critical thinking** about GenAI products, checking facts, discerning error and untruth, and citing sources.
- Include **GenAI skills** (such as prompt engineering) in course objectives.

- Be **transparent** about what GenAI tools may be used, how, when, and why.

Recommendation 1: Messaging and Communication

Instructors (faculty and GSIs) and students present a broad spectrum of attitudes toward GenAI. Several institutions have announced a ban on GenAI, while some instructors have already begun integrating it into their teaching and research. Our committee recommends that **U-M approach GenAI as an opportunity to rethink how we teach and define meaningful learning objectives, promote inclusion and equity, and assess learning. GenAI will necessarily change some existing models for authentic learning and assessment, and it will require us to define new foundational skills. GenAI literacy will be vital in the future, and using it ethically and responsibly will necessarily become part of our academic mission.** Therefore, we recommend that University leadership strives to accomplish the following:

- **Tone:** Balance all messaging to the U-M community to emphasize the inevitability of GenAI integration into everyday academic life, while accounting for both the opportunities and the concerns. Leadership should be direct about the limited knowledge we have about the ultimate impact of GenAI. The challenge can be framed as an opportunity for U-M to lead in advancing teaching and learning through active reflection, experimentation, and research in light of these disruptive technological advancements.
- **Transparency:** Work to define the responsibilities and expectations of instructors and students in engaging with GenAI. This could take the form of identifying practices that instructors should adopt as well as a clear pathway for answering questions or handling conflicts that arise around the use of GenAI tools in the classroom. Ideally, messaging can distinguish between "required" versus "recommended" actions and on what timescale completion is expected.
- **Collaboration:** Encourage conversation among instructors, students and administrators in each school and college around this issue. We hope to avoid framing GenAI as a divisive issue, but rather as an opportunity to come together to develop this further, and to discuss the impact this technology can positively have in higher education and co-create solutions to leverage the potentials of this technology in ways that are consistent with our community's values.

Recommendation 2: Research on GenAI in Teaching and Learning

Conducting research will be key to discovering and establishing best practices and guidelines for GenAI use, starting with a review of existing scholarship

- **Research repository:** Many U-M (as well as international) research teams and faculty members have been conducting GenAI research for years. Every day more research, especially in the areas of teaching and learning, is being published. To this end, we recommend that the University identify funding and researchers to:
  - Create a searchable database or repository of how GenAI is and could be used in teaching and learning contexts.
  - Create resources for instructors and students based on the findings of this database that could include examples of assignments or tasks enhanced by the use of GenAI tools.

- **Student experiences:** It is easy for educators and administrators to make assumptions about how and why students are using GenAI tools. Without understanding these motivations and experiences, we cannot appropriately address the proliferation of GenAI in teaching and learning contexts. Key questions include: Why are U-M students using GenAI? What kinds of tasks do they use GenAI to support or complete? What are their feelings or concerns about GenAI? What do they need from instructors and administrators to support them in their learning? To answer these questions and many more, we recommend that the university identify funding and researchers to:
  - Conduct surveys, focus groups and interviews with students to better understand their GenAI-related motivations, choices, and outcomes.
  - Create/support a student-instructor working group as a way to analyze this data and inform future recommendations around teaching and learning.
  - Consider participating in student-driven events, such as the AiX Education Conference: Driven by Students. Dedicated to Educators.
- **Classroom research:** As more and more instructors experiment with GenAI tools, the university community would greatly benefit by learning from their experiences. By creating pathways and incentives for innovation, we may be able to answer important pedagogical questions around the most efficient, productive and equitable ways to leverage GenAI in teaching and learning space. U-M should consider creating resources and infrastructures to propose and fund resources for the following activities:
  - Provide small grants to support individual instructors doing classroom experiments with GenAI, which could cover things like access to technology, access to consultants, data collection and analysis, along with an expectation of local dissemination.
  - Provide larger grants to support multiple collaborating faculty, departments or interdepartmental experiments with GenAI, which could also cover things like the development of new technologies and national/international dissemination. It is expected that these efforts will lead to external funding from federal agencies for larger projects.

Recommendation 3: Professional development for instructors

Instructors will need to develop knowledge about how GenAI changes fields of inquiry, and how new tools can best be used. It will be challenging for instructors to become familiar with GenAI tools, particularly given their continued and rapid evolution. Engaging with the unprecedented paradigm shift we face will be most effective if we can develop cross-disciplinary resources for teaching, learning, and research, such as guides for instructors about what GenAI tools exist, how to use them, and their potential benefits and limits. Creating and keeping these resources up to date may require identifying one or multiple units (likely some combination of CRLT, Sweetland, ITS, and CAI) to maintain these resources in the face of continuous change. Providing incentives and rewards for instructors to get up to speed on relevant tools is one way to facilitate U-M becoming an international leader in the field of GenAI design, assessment, and application.

- **Content:** A key step in creating professional development programming is identifying the learning outcomes for instructors who span a large range of interest and familiarity with GenAI tools. The level of exposure, immersion or mastery will depend heavily on the

disciplinary context and format of the course. We recommend the following starting point for identifying the knowledge, skills and values all instructors will need:

  - Knowledge: understand the capacities and limitations of GAI; how and why students are using it in their class; the emerging applications and implications of GenAI in their fields
  - Skills: familiarity with the tools themselves; prompt generation and tool-to-tool communication; effective models for teaching with GenAI; communicating and collaborating with students around GenAI
  - Values: understand ethical implications of GenAI in various dimensions such as environmental, academic integrity, social biases, risks and harms

- **Structure:** Providing professional development at both breadth and depth will be a challenge to complete before fall semester begins given the limited time of support centers to develop these trainings, and the limited time of faculty to master these skills. We recommend the following structures to reach instructors at the following levels, with highest priority given to the first level:

  - Introduction: Designed to be applicable to all instructors, regardless of disciplinary context, to enable them to be aware of the core aspects of GenAI and familiar with the likely impact of this technology on higher education and society at large. We propose training be made available to be done independently, as well as integration into real-time events within school/college communities:
    Asynchronous: videos, readings, tutorials, examples
    Synchronous: departmental conversations, virtual workshops, demonstrations
  - Course Revision: Designed for instructors who have a basic understanding of GenAI, and who have determined that they need to revise their course content or assignments to engage with these new technologies:
    Asynchronous: self-paced canvas course, self-guided reflection
    Synchronous: virtual workshops, consultations with teaching and learning units
  - Innovation: Designed for instructors who want to explore opportunities presented by these technologies in the classroom, we propose programs to incentivize research and experimentation and collaboratively develop mastery with other instructor innovators:
    Asynchronous: grants opportunities, teaching certificates, teaching awards
    Synchronous: faculty learning communities, consultations

3.2 Research practice

GenAI will create new opportunities across the entire spectrum of research activities, ranging from the natural sciences, social science, economics and political sciences, humanities, engineering, biomedical and clinical sciences, as well as the creative arts. GenAI will serve as a catalyst, instigating profound transformations across various domains. Concurrently, it will foster the emergence of novel fields of study, while potentially diminishing the prominence of others. U-M requires a comprehensive plan and a bold investment. The one peer institution currently dominating the conversation is Stanford with their Human-Centered AI institute. U-M has equally excellent faculty and research programs, but is not yet organized in a way that makes our collective voices focused to offer our public university perspective.

3.2.1 GenAI Potential and Research

GenAI has great potential to assist different kinds of researchers at various stages of their careers. Recently, it has been demonstrated that GPT-4 can act as a data analyst, capable of autonomously handling datasets, developing analytical strategies, cleaning data, running tests, and interpreting results. In addition, it can also conduct visualizations, descriptive analyses, regression analyses, and even create a first draft of sections of academic papers based on findings, showcasing its potential in revolutionizing academic publishing and data analysis. In addition, GenAI potentially challenges many current support mechanisms and personnel in research practice (including roles of scientific writers, coding support, library assistance, etc.). In addition, GenAI has also been shown to be prone to hallucination, bias, and sometimes, outright fabrication. Since the technology is constantly in development and in flux, response to these challenges will have to be nimble. Despite all of this, there is no question that GenAI will create new research opportunities across the entire spectrum, and will transform most fields of research, methods, and training.

Principles Related to using GenAI in Research

1. **Responsible Use:** Researchers should utilize GenAI systems in research only where they have been established as performing well and exhibit few hallucinations. Researchers should verify all outputs for accuracy and attribution and attest that this has been done in all cases, detailing the methods used to do so.

2. **Documentation:** All use of GenAI in research should be documented such that they are available for reporting, should it be required by sponsors for grants, editors for manuscripts and publications, and reviews for conferences. Of note, sponsors, journals, and professional societies are formulating their own best practices and policies in tandem so researchers should be aware to look for additional requirements and that adherence to only U-M policy might not be satisfactory for external entities.

3. **Account for and Limit Bias:** Bias in AI systems is understood to be a major problem that must be understood, quantified, described, and mitigated. This is especially true with applying outputs to research involving human participants or using data from such studies.

4. **Privacy Protection:** Researchers must not input personal, private, or HIPAA, FERPA, Common Rule, and Export Control protected-information into a unsecure GenAI system. Researchers should follow University of Michigan Guidelines and Policies, which should be updated to address changes brought on by GenAI.

5. **Intellectual Property (IP) Protection:** Continue work with UMOR, Innovation Partnerships, and Office of General Counsel (OGC) to define best practices and guidance around the use of GenAI technologies to protect intellectual property and novel research findings before publication. Similar IP guidelines should be established for software development using GitHub CoPilot, Open-AI, and other GenAI-based Coding Assistants. Researchers should also be aware that, given the evolving nature of GenAI governance, U-M guidance might not always be sufficient to meet external IP legal requirements.

It is recommended that:

1. **The Principal Investigator (PI), who is the driving force behind research projects and programs guiding their teams, including trainees and staff, should take full responsibility, and will be held accountable, that all research outputs generated by the use of**

GenAI, and AI platforms more generally, are verified for accuracy with research references to ensure the validity of the claim(s) in sponsored research proposals, reports, and subsequent publications and presentations.

2. **The PI should attest to this and properly disclose the GenAI methods used to create research artifacts. Each and every researcher and trainee in the PI's group should also so testify. This should be further ensured by their department chair, their school or college associate dean for research, and ultimately by the U-M Office of Research (UMOR).**

Areas of Research Practice where GenAI is likely to be beneficial

There are several areas of research practice where GenAI is likely to be beneficial. **A key caveat of all of these possibilities is the users inability to source language or data which raises research integrity concerns including plagiarism (described further below).**

That said, promising avenues include accessing and memorializing reference information, i.e., interpreting complex data based on curated data resources (including clinical text, unstructured notes, etc.) as well as suggesting visualizations, creating draft figures, and tables. Geospatial mapping could also be coupled with text summaries and data analytics. In the future U-M could also consider methods of consenting via an interactive chat, as well as ensuring that the information is at the right reading level, and perform comprehension checks. **Of note, research should still be conducted in compliance with federal regulation, which might lag behind GenAI capabilities.**

In terms of manuscript preparations, GenAI can be used for preliminary literature review. For example, Elicit is a research assistant using language models like GPT-3 to automate parts of researchers' workflows. Currently, the main workflow in Elicit is Literature Review. If you ask a question, Elicit will show relevant papers and summaries of key information about those papers in an easy-to-use table. It might also be able to quickly summarize content from manuscripts and groups of manuscripts or reformatting and interpreting information based on text input from references. GenAI can also help with proofreading, generating preliminary drafts of language for investigator consideration, comparing and contrasting research methods, and revising content for various audiences, target journals, and for readability. It can potentially harmonize the flow of multi-author manuscripts or shorten or translate text. GenAI might be able to provide sources for quotations or data in future more refined iterations.

Programming and coding might also be made easier, generating information about what is possible instead of knowing details of how to implement code, creating a first draft of code for validation/test runs, bug detection/troubleshooting, automatic annotation of code or code optimization, addressing repetitive tasks of coding, translating code between languages and reading and generating files and execute Python code; generating GIFs, PDFs, and other content without human guidance.

3.2.2 Key Findings & Recommendations

Though the potential benefits can be significant, GenAI presents serious challenges owing to **limitations in the technologies and its rapid pace of change at the individual, institutional, and national level.**

Individual level concerns

Hallucinations, fabrications, bias, and the lack of stable GenAI systems to ensure reproducibility of results are all threats to productive use that should be carefully controlled, studied, understood and mitigated. Agreed upon formal extensions to the definitions of Fabrication, Falsification, and Plagiarism because changes necessitated by the use of GenAI systems may be required (see further below).

It is well-recognized that the success of image generating AI (e.g., DALL-E, Stable Diffusion) will make deep fakes a huge challenge. However, images are just the start. Fake text generation beyond simple coursework is going to be a growing problem—especially as text is written in the style of particular authors. In addition, fake audio files, created with minimal training from audio texts often available on the Internet or recorded legitimately or surreptitiously, present additional challenges. Existing GenAI systems are not capable of reasoning and do not qualify as expert sys-tems. These are mostly black box systems which do not often provide reliable references or web links to substantiate their claims. As such, all outputs from GenAI systems need to be verified by the researcher or trainee using the resource. This validation might indeed become a new research field in and of itself. This level of oversight may require training and certification to use these systems effectively, safely, and within compliance with U-M and Federal regulations, including data sharing requirements.

Institutional level concerns

U-M will need to provide IT systems which will ensure privacy of personal data, protected health information, FERPA and other sensitive data types. Major mistakes can also happen at systems level and the U-M will need to have a way to brake AI system(s) as needed if they exhibit unexpected behaviors or malicious outputs. Research sponsors, journal editors, and professional societies have many rules about GenAI that are in flux, are likely to change, and need to be tracked carefully by U-M research administration, researchers, and trainees.

National level concerns

GenAI can also bypass systems of ethical standards or professional censure put in place via our current peer-reviewed journal structure. For example, for decades, many of the most prestigious scientific journals have agreed to not publish data that was considered dangerous if accessed by bad actors (e.g., how to aerosolize bird flu) or science that was ethically prohibited by international standards (e.g., the application of CRISPR CAS-9 in an embryonic germline which Nature refused to publish). The concept that publishing in prestigious journals is the best way to disseminate scientific and medical information might be waning - along with the control that came with it. The resource and environmental costs of GenAI in research at scale are likely to be quite substantial, and will certainly drive up the cost of performing pre-award and post-award research significantly, demanding careful study and planning to ensure sustainability and responsible use.

Institutional level recommendations:

1. U-M should establish best practices on how to use, and when to prohibit, GenAI in research
2. U-M should provide investigators with tools, such as plagiarism detection software, to check, verify, and assess GenAI output.
3. Given large uncertainties in the landscape of GenAI tools and questions on capability, privacy, security, bias, reliability and cost, U-M should develop its own version of foundation GenAI and LLM models to enable research and innovation (Also see Section 5.2)
4. Given recent evidence of the critical importance of scale of computing to research impact,

U-M should formulate a long-term vision to develop large-scale computational resources (Also see Section 5.2)

5. Given the wide-ranging implications of GenAI on research practice, U-M's research integrity standards should be updated (see below)

3.2.3 Integration of GenAI to U-M Research Integrity Standards

Procedures for investigating allegations of misconduct in the pursuit of scholarship and research can be found under U-M SPG 303.03. In it, U-M adopts the definitions of research integrity violations from federal regulations (42 CFR §§ 93.100-09) and the Office of Research Integrity (ORI): fabrication, falsification, and plagiarism. All three types of research integrity violations may be impacted by GenAI.

ORI is the Department of Health and Human Services (US DHHS) enforcement arm for research integrity. Its functions include developing regulations related to the detection, investigation, and prevention of research misconduct; reviewing and monitoring research misconduct investigations conducted by applicant and awardee institutions, intramural research programs, and the Office of Inspector General (OIG) in US DHHS; and recommending research misconduct findings and administrative actions.

All federally funded researchers must follow these regulations and violations may include both civil complaints (i.e. financial) and criminal (e.g., jail) charges which may include debarment from eligibility to receive federal research funds, certification requirements, correction/retraction requirements, and criminal allegations.

If a violation of research integrity is alleged, ORI will conduct its own external process, and it might also call upon U-M to conduct its own internal review. U-M can also initiate the investigation on its side and report any violations found in federally funded research to ORI.

In January 2022, OSTP released a new report on Protecting the Integrity of Government Science. It was written before the release of ChatGPT but does address concerns regarding general AI with a specific focus on data biases and implications for historically excluded communities. While updating government regulation is a long complex process, U-M should anticipate that ORI, FDA etc. will issue guidance related to how they will interpret their regulations as applied to GenAI in the short term. Guidance also might come from administrative law proceedings against investigators who have successful grant applications which include GenAI- generated substantive errors.

Institutional level recommendations:

1. U-M should be a leader in setting exemplary standards for academic research and

2. U-M should protect its faculty or staff from being the subject of precedent-setting case law – so should move quickly to set institutional-level expectations that are both appropriate and in line with anticipated future government guidance.

The U-M research integrity system is inherently related to Federal standards. U-M can be more restrictive in terms of being an employer but must adopt the baseline protections as required by ORI. U-M will therefore have to be nimble and responsive to any direction from the federal level. That said, no updated federal guidance is available currently, so it is appropriate for U-M to make their standards responsive to GenAI while we await official guidance.

An initial guidance from NIH was recently released which prohibits "NIH scientific peer reviewers from using natural language processors, large language models, or other generative Artificial Intelligence (AI) technologies for analyzing and formulating peer review critiques for grant applications and R&D contract proposal." The justification for this guidance is ensuring confidentiality as, NIH argues, "AI tools have no guarantee of where data are being sent, saved, viewed, or used in the future…" This might be a limited understanding of the technology given that there are some systems that only operate locally - but is the current standard.

GenAI also has serious implications for the three components of research integrity violations: Fabrication, Falsification, and Plagiarism:

1. **Fabrication** is defined as making up data or results and recording them in the research record.

   GenAI Implication: GenAI can and does consistently fabricate facts, citations, as well as other information. Whether and how a researcher will be held responsible for GenAI- generated fabrication should be addressed.

2. **Falsification** is defined as manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.

   GenAI Implication: GenAI can and does consistently falsify facts, citations, as well as other information. Whether and how a researcher will be held responsible for that falsification should be addressed.

3. **Plagiarism** is defined as the appropriation of another person's ideas, processes, results, or words without giving appropriate credit.

   GenAI Implication: GenAI generates both de novo as well as existing language in response to queries. What is the allowable integration of GenAI- generated language in publications, authorship credit, and whether and how a researcher will be held responsible for any plagiarism of other available work should be addressed.

In addition, a key component of a finding of a violation of research integrity is to have the appropriate mens rea, which captures the intentionality to commit a violation of research integrity. While the federal law on this is evolving (see ORI v Kreipke 2018), at U-M we adhere to the traditional standard that a violation needs to be conducted

> Intentionally (there is evidence that the researcher knew they were engaging in a violation), or
>
> Knowingly (the researcher either knew or should have known, based on the reasonable researcher standard that a violation was occurring), or
>
> Recklessly (behavior that is an extreme departure from the care a reasonable person would exercise in similar circumstances).

In fact, the NIH Deputy Director for Extramural Research on 6/23/23 wrote the below section of a blog post confirming our arguments above:

"We do not know, or ask, who wrote a [grant] application. It could have come from the principal investigator, a postdoc, a professional grant writer, or involved the wider research team. If you use an AI tool to help write your application, you also do so at your own risk. This is because when we receive a grant application, it is our understanding that it is the original idea proposed by the institution and their affiliated research team. Using AI tools may introduce several concerns related to research misconduct, such as including plagiarized text from someone else's work or fabricated citations. If we identify plagiarized, falsified, or fabricated information in a grant write-up, we will take appropriate actions to address the non-compliance."

Institutional level recommendations

1. Immediate: Most violations of research integrity have an intentionality component, and the University should update SPG 303.03 to be clear that any mistakes generated by GenAI and subsequently used in publications, grants, and other business are the sole responsibility of the author and will be seen as a "knowing" or "reckless" use of GenAI for the purposes of employee relations and investigations of research misconduct. Faculty should also be warned that it may also be considered fraudulent by the government if GenAI-generated errors are used in support of a successful federal grant application.

2. Short term: UMOR should convene a committee, inclusive of all schools and colleges at U-M, to assess the use of GenAI in research and set best practice standards. There are several topics which are urgent including: privacy protections; data use controls; and updating research integrity related SPGs, PEERS modules, and RCR training.

3.3 Ethics and Equity

U-M, including all three campuses, and each school/department should create a position state-ment describing their position and policies that address how GenAI will advance their mission while attending to critical ethical, legal, and social implications (ELSI) on the use (or non-use) of GenAI. The statement should be forward-thinking in how GenAI is used in key areas including teaching, research, administration, service, outreach, and others. Additional attention and policy-making will be needed in the University's professional schools, such as the School of Medicine, regarding how GenAI can and will be integrated into their service model.

As GenAI is a new technology, there is no new legislation specifically targeting its general governance at this point, nor is it entirely clear that there will be in the near future. That said, there are existing regulations (such as those that surround research integrity - Section 3.3) which will have to be quickly updated to disclose how the government will interpret the use of GenAI - likely through non-binding guidance or administrative judicial proceedings.

Areas in which the government might be interested in exploring further include the use of GenAI in federally funded research and its application in healthcare or defense. But, because the technology and its applications are moving so rapidly, clear government guidance will not move as quickly as those generated by individual institutions to prospectively protect faculty, staff, and students from being the target of these new interpretations. This means that nimble institutional policies, such as this one, will be critical to expeditiously set standards for the use of GenAI in specific communities. In some cases, issues of ELSI may be addressed in appropriate Standard Practice Guides, such as SPG 601.12 covering institutional data or 303.03 on research integrity. Also, to balance the need to proactively address these issues while being pragmatic about attendant administrative burdens, we believe that many units may effectively adopt the GenAI vision

statement of a larger unit.

One approach may be to consider design principles to support an ELSI position statement, for example:

1. Protecting and enabling populations traditionally excluded from technological advances
2. Holding those responsible for harm and damage liable for that damage and harm; and
3. Transparency in use.

3.3.1 Specific ELSI Issues to Consider in a Position Statement

As position statements are created, we recommend that the following issues be considered. These may be used as a discussion guide, or in other ways, towards development of the position statement:

1. Adoption, Access, Equity, and Accessibility Issues Adoption of GenAI tools will involve a period of transition, which will cause confusion, as well as knee-jerk responses to the technology that might not benefit students as a whole. Some questions here include:

- What training will be provided for students/staff/faculty/everyone?
- Can faculty retain autonomy over the use of GenAI?
- Should we be incentivizing adoption?
- Does it pass accessibility minimums?
- Are there issues where people in some geographical locations may be blocked?

Recommendations

- University-wide site license and standard training
- Incentives for each stakeholder group:
- Students: prepare for the workforce; bridge learning gaps and improve resource and information accessibility
- Faculty: prepare for teaching when students may be early adopters, enhance research
- Staff: enhance efficiency and effectiveness, align with mission
- All: raise personal productivity
- Accessibility assessment undertaken, standards developed, and standards enforced

2. Usage Usage concerns address some similar topics and questions in Adoption but from a perspective of ethical deployment and accommodation concerns. These include questions such as:

- Are there jobs/tasks that we feel should not be replaced with GenAI?
- What if a university member has a moral obligation to not use it?
- Should GenAI usage be available to everyone, or on a case-by-case basis?

- What are the boundaries that exist for using GenAI and academic dishonesty?
- Who should be held responsible for errors generated by GenAI?

Recommendations

- GenAI available to everyone (see above)
- Usage policies in course syllabus
- Usage policies for departments, units, etc.

3. Transparency In this case, transparency refers to how GenAI is being used, and how it affects the populace that interacts with it. Questions include:

- Should community members know when GenAI is being used?
- How do we ensure that vulnerable communities are protected?

Recommendations

- Disclosure statement for certain usage categories (determined by the University and/or individual units) to mitigate unanticipated harms. Examples include student assignments and scholarly research. Choice considerations include: a) Extent of disclosure and associated biases present in doing so; b) Changing transparency requirements over time; c) Potential for harm if disclosure is not provided.

4. Privacy & Ownership Privacy concerns stem from the black-box-like nature of current GenAI models, compounded by clouded techniques used by private AI companies for their data collection for these tasks. Questions of consideration here include:

- What will happen with the data?
- What will happen with the prompts?
- Where will this data be stored?
- Who will own the research? Can it count for tenure and grades, for example?
- Who will own the training data (and all collected data as an extension)?

Recommendations

- Embody our principles in negotiated site license with vendor
- Faculty determine what counts for grades
- Site license negotiated to ensure privacy of prompts
- Prompt data possibly available for research under strict usage requirements (such as IRB).

5. Costs Costs include access restrictions through means of a subscription to GenAI tools, limitations via hosting requirements and infrastructure, and more. Questions include: What are the resources/cost of access for students/faculty/staff to utilize generative AI? Who pays for this?

Recommendations

- Centralize service provision for economies of scale
- University bears cost, as with other services such as Google Drive, Microsoft 365, etc.

6. Support and Enforcement These needs arise primarily from a requirement to fulfill the considerations above, but in itself incurs significant resources in the maintenance and enforcement of policies. Questions here include:

- Who ensures the tech remains both secure and up-to-date?
- Who is checking for data bias?
- Who is evaluating the efficacy of our policies?
- How is our community contributing to the conversation?
- Who will ensure/check for accessibility?

Recommendations

ITS should have responsibility for support and enforcement

3.3.2 Long term Discussions

These are topics that do not fit into the above categories and are a bit more philosophical in their nature. Their effects are no less significant if not immediately tangible. Questions here include:

- How will the existentialist ideas of knowledge and learning change as GenAI evolves?
- How will the perception of GenAI change as it gets more humanized?
- What are the concepts of creativity and curiosity in the context of humans and GenAI?
- How does this relate to your existing core?
- How do we address roles and training currently underway that are/will be made redun-dant with the progress of GenAI?

With these broad categories in mind, it is important to emphasize the need for a framework of guidance rather than a fixed set of rules. For example, these are simple questions that apply to different stakeholder groups at the University:

Students

- Is using GenAI helping me learn more?
- Is GenAI helping me think better?
- Is GenAI enabling or hindering my mastery of the stated course objectives?
- Is the content I create accurate and verifiable?
- Is my usage of a GenAI tool equitable to other students in my course?

These questions will have different answers based on each student and their coursework.

Teaching Staff (Faculty)

- Does my coursework require the usage (or lack thereof) of GenAI tools?
- How do I keep my course accessible to all students?
- How do I incentivize students to not use GenAI for cheating?
- How do I let my students know about their rights using GenAI?
- How do I teach students to use GenAI to obtain deeper understanding of the material instead of as a means to circumnavigate learning?

A number of these questions are answered in Sections 2.1 and 2.2.

Administration

- How will the data be used and safeguarded?
- What is the environmental impact of GenAI infrastructure?
- Are biases already present being amplified by GenAI? What can be done to mitigate this?
- What greater good does GenAI aim to serve in education?
- How does the implementation of GenAI tools impact human-to-human engagement and relationship value?
- What responsibilities do we owe to assisting people currently in training or in roles that are/will be made redundant by GenAI?

3.4 Future Impacts on University Life and Administration

In November 2022, President Santa Ono announced that U-M would embark on the creation of a 10-year strategic vision plan: "U-M Vision 2034". This comprehensive blueprint will encompass all facets of the University and involve its three campuses and Michigan Medicine. The strategic plan will encapsulate a collective agreement among university members on the direction and focal points the institution will adhere to, aiming to better serve society in the 21st century.

Given the swift advent of GenAI tools and the anticipated emergence of other AI technologies in the near future, it is essential that the University's future vision acknowledges the significant role that AI is expected to play in many aspects of our lives. **This purposeful alignment should not merely be about keeping up with trends or avoiding falling behind.** Our intention should be to take on a leadership role in shaping the world we would desire to inhabit. We seek to proactively design a future that resonates with our aspirations and ideals of excellence, fairness, equity, and inclusion. This process should start by imagining how AI might affect our daily lives. With further increases in the capabilities of GenAI, it is expected that many university functions will be impacted and some of them transformed in a beneficial manner. It is also important for U-M to carefully evaluate potential scenarios where these tools could have harmful unintended consequences.

This section proposes scenarios that illustrate both the benefits and potential drawbacks of these technologies. The aim is not to dissuade the campus community from adopting them but rather to ensure adequate safeguards are established to mitigate unintended harm. It should be noted that the listed examples and scenarios are not exhaustive, given the nascent stage of realizing the potential of these tools. As we gain more experience, our understanding will undoubtedly evolve.

3.4.1 Potential Positive Impact of GenAI Technologies on Campus Life

GenAI technologies can improve efficiency and productivity across various university activities. Some of these activities include:

- **Personalized Learning:** GenAI can customize learning experiences to meet individual needs. Students, faculty, and staff can take a more active role in their learning journey while the University integrates these tools into standard instruction modalities.
- **Virtual Assistants:** GenAI can provide tailored assistance to the university community. Chatbots/prompts can offer real-time support for various tasks, improving convenience, response times, and accessibility.
- **Research Enhancement:** GenAI promises to accelerate research, make it more accessible, and allow for laboratory- and research-specific Large Language Models to be developed and utilized, which will increase research impact and help create new understanding and new fields of research.

- **Multilingual Support:** GenAI can facilitate communication for international students by translating course materials, live lectures, and simultaneous translations, fostering inclusivity.
- **Accessibility:** GenAI can promote inclusivity by providing alternative formats for educational and administrative materials, such as real-time captioning and transcription services, to those with disabilities.
- **Administrative Efficiency:** GenAI can automate routine tasks such as scheduling, grading, screening of applications, summarizing information-dense documents, and facilitating written communication among university constituents.
- **Fan Engagement:** U-M can ready itself for an immersive, data-rich, augmented campus experience during its events. This could involve the application of predictive analytics to enhance the enjoyment and safety of large gathering activities, such as sports and concerts, where song lyrics are automatically transcribed, and the intensity of the music is graphically represented on handheld devices. To facilitate these real-time experiences, U-M requires robust infrastructure.
- **Enhanced/personalized social experiences:** GenAI has the potential to enable/create a dynamic campus where appropriately connected buildings and people can interact, engage and inspire new social and educational connections. Novel and real-time opportunities, such as tutoring and shared interest groups, can be spun up and attended in real-time.

3.4.2 Potential Unintended Consequences of GenAI Technologies

Despite their potential benefits, GenAI technologies may have negative impacts. In addition to the many risks discussed in the previous sections, additional impacts in the present context include:

- **Mental Health and Well-being:** Unchecked use of GenAI can inadvertently cause increased stress. Overly high-performance expectations can lead to burnout and negatively affect mental health. Additionally, interactions with AI personas can develop into inappropriate relationships that can have harmful consequences.
- **Challenges to Academic Integrity:** Without a clear understanding of the capacities of GenAI and appropriate uses of these capacities, both faculty and students will be vulnerable to suspicion and anxiety.
- **Diminishing the Quality of Education:** While GenAI provides individualized experiences, there is a risk of eroding the human connection that education offers, potentially decreasing student learning.
- **Digital Divide:** Access to GenAI tools requires computers/devices with access to the internet, and much of GenAI is pay-to-play. Since a large portion of the student interaction with GenAI will take place off campus, uneven personal computational resources among the students will not only hinder their learning but can also reinforce inequalities.

- **Bias in GenAI Models:** GenAI models are trained on large datasets and can reproduce the biases present in the data. If, for example, a GenAI model is used to generate a personalized educational plan, and the training data represents mainly white, middle to high-income individuals, the model will not be effective for minorities from low socio-economic stratum.
- **Loss of Human Touch:** While GenAI provides personalized learning experiences, there is a risk of eroding the human connection that traditional education offers, potentially exacerbating feelings of loneliness and isolation and hindering student learning.
- **Carbon Emissions:** GenAI models require significant amounts of computations to be trained, fine-tuned and maintained. As a result, demands for more computing power in data centers continue to rise. U-M's use of GenAI will contribute to carbon emissions. These emissions will continue to climb as use is normalized and promoted. U-M should consider programmatic carbon footprint reduction in consideration of its GenAI use and strive for neutrality.

3.4.3 From 2023 to U-M Vision 2034

Is U-M in a position to revolutionize educational assessments? Are we ready to leverage the power of large language models to offer 24-7-365 tutoring to reshape the notion of traditional office hours? Can we trust GenAI to generate rich, engaging content for all academic fields, tailoring experiences to each student's unique learning journey?

Are we prepared to reassess long-standing workflows? Will we trust GenAI to bring efficiencies and new methodologies to operations?

Is our institution on the verge of harnessing AI's predictive capabilities for insightful data analysis, breakthrough experimental design, and future forecasting? Could U-M take the lead in incorporating AI into its educational model to create the most equitable and inclusive learning environment on a global scale?

Are we ready to redefine the college sports experience by enhancing, for example, football games with technology, boosting fan engagement by providing tailored, age-appropriate augmentations?

Can U-M envision a future where traditional campus structures are reimagined as an immersive, interactive learning lab? Are we ready to intertwine technology with brick and mortar, personalizing learning, access, engagement, and social experiences to redefine what a university campus can be?

As we stand on the brink of a digital transformation, we should boldly address these challenges to harness the full potential of GenAI, thereby shaping an inclusive, engaging, and innovative future for higher education.

3.4.4 Recommendations

The following recommendations aim to address key concerns raised in sections 3.4.1 and 3.4.2:

1. **Value Proposition:** The committee recommends that the University leadership clearly and strongly communicate to campus the potential benefits of GenAI tools, including productivity increase and task completion efficiency. It should also clarify the risks associated with their use while encouraging safe, legal, and ethical adoption.
2. **Equitable Access:** The committee recommends that U-M ensures that all members have the opportunity to learn and use these technologies equitably. To facilitate rapid and

fair distribution, a coalition involving central units supporting learning technologies (ITS, CRLT, CAI, University Library) along with representatives from all schools and col-leges should form to develop a competency-raising plan for the 2023-2024 academic year.

3. **Unbiased Models:** The committee recommends that U-M takes the necessary steps to ensure that the models consumed by and produced for U-M are trained using data that accurately reflects the heterogeneity of the University's population, minimizing unintended biases.

4. **Mental Health Safety and Wellness:** The committee recommends that the university leadership charges the Counseling and Psychological Services (CAPS) with monitoring mental health trends to determine whether GenAI technologies are contributing to increased stress. Any University-approved AI tool that may replace human connection should come with a cautionary statement encouraging users to seek CAPS support if needed.

5. **Inclusion in the University's Strategic Plan:** The committee recommends that U-M carefully considers the evolving role that AI and GenAI will have on Higher Education and in the context of its effect on society-at-large, in the U-M Vision 2034 strategic plan.

4 Facilities & Resources

4.1 Website

A dedicated website (genai.umich.edu) has been launched to align with the goal of integrating GenAI into U-M's academic and operational framework. This initiative should be coordinated with a well-defined communication plan to ensure effective dissemination of information.

The U-M GenAI website is intended to serve as a comprehensive informational resource for all university stakeholders, including students, faculty, staff, and administrators. It will provide a centralized platform where users can access detailed information about the university's GenAI initiatives, policies, resources, and related links. One of the primary objectives of the GenAI website is to make U-M's policies on the use of GenAI technologies clear and accessible. It will provide detailed and up-to-date documentation on GenAI-related organizational management and oversight, ensuring that all users understand their responsibilities and the university's expectations when it comes to using GenAI technologies.

In addition to policy information, the GenAI website will (in the near-term) provide guidance on the revised U-M Honor Code, with specific directions for both instructors and students. This will help ensure that the use of GenAI technologies aligns with the university's academic integrity standards. The GenAI website will also link to available IT and infrastructure resources to enable responsible and legal use of GenAI. This will include information on how to access and use these resources, as well as guidelines for their appropriate use.

Recognizing that the field of GenAI is rapidly evolving, and that policies will have latency, the GenAI website will be designed to be a living resource. It will be constantly updated to reflect developments in GenAI technology, policy, and best practices.

4.2 Training resources

Recognizing the importance of preparing our entire campus community of faculty, students, and staff alike to navigate this technology, we are recommending a comprehensive training strategy.

The main priority is to ensure an equitable foundation of GenAI knowledge, fostering a learning environment that embraces innovation while upholding our values of academic integrity.

- **Knowledge:** It is important we establish an understanding of GenAI across the university community, ensuring everyone has an equal opportunity to learn foundational knowledge. This process involves developing robust and innovative resources that align with university policies providing guidance on GenAI use and its integration into academics, research, and operations. Work should be done collaboratively between program directors, chairs, and faculty to integrate GenAI concepts into the curriculum, encouraging a higher level of integration of humanities concepts in science and technology courses where GenAI plays a pronounced role. It is also recommended the university develop a repository showcasing how our faculty and students are leveraging GenAI in their teaching and learning.

- **Skills:** Units and departments should develop training and practice sessions where our university community can interact with the technology directly, where they can foster technical literacy and analytical skills. Among the focus areas of training we will emphasize resources related to redesigning course materials and assessments, where we can demonstrate transparent teaching principles and best practices for authentic assessment. Additionally, we encourage exploration and experimentation as it relates to GenAI and research, developing partnerships with industries for practical exposure for our students.

- **Values:** Training should explore GenAI's impact on ethics, diversity, equity, and inclusion (DEI), and academic integrity. Design resources to foster diplomatic and civil discussions about ethical GenAI use. We will inform our faculty, students, and staff so they understand proper use of the technology and provide opportunities for mutual education and growth, underlining our commitment to a respectful, inclusive, and innovative university commu-nity.

4.2.1 Recommended Training Workshops and Courses

The following list is an introductory blueprint for initiating training. We envision this as a curated 'suite' of courses designed to equip university stakeholders with the skills to employ Generative AI effectively in academics.

- **Transparent Teaching Strategies** Transparent teaching is a minor instructional adjustment that can yield valuable results. It involves disclosing the Purpose, Task, and Criteria of an assignment based on an easy-to-follow template. Incremental changes to a single assignment can result in significant learning gains, higher student retention rates, and greater course satisfaction. In this workshop, participants will learn the procedures of integrating transparent teaching strategies into their courses.

- **Authentic Assessments** In this training module, faculty will learn effective strategies for integrating authentic assessments into their courses. These assessments are designed to encourage critical and creative thinking, particularly in group, peer, and self-assessment settings. This approach helps authenticate learning outcomes by demonstrating the practical relevance and application of the knowledge acquired.

- **Generative AI Basics** This workshop is designed for instructors, students, and staff who are interested in learning the basics of generative artificial intelligence and its applications

in both academic and everyday settings. By completing this workshop, participants will gain a basic understanding of common GenAI tools and their relevance to various educa-tional and professional contexts. Additionally, participants will be introduced to high-level ethical and equity issues, which will prepare them for further, more extensive training opportunities.

- **Generative AI in the Classroom** This training course is designed to equip faculty with the necessary skills and knowledge to effectively integrate Generative Artificial Intelligence into the classroom setting. The course will also focus on linking transparent design principles and authentic assessments to ensure that students are able to apply their learning in practical, real-world situations.

- **Generative AI in Research** This workshop will focus on exploring different models of conducting engaged research, including action-based research and community-based participatory research through the lens of GenAI. It should also explore the ethical and legal implications related to GenAI.

- **Equity in Grading** This training will delve into the role of GenAI as it relates to bias and ensuring fairness in assessment methods, presenting a forward-thinking approach to grading. This workshop will guide faculty in conceptualizing how to develop a more inclusive and objective grading system, paving the way for fair educational opportunities for all students.

- **Prompt Literacy** It is important that all members of the university community understand how prompting AI works, as the quality of prompts directly influences the caliber of the output. Everyone should be on equal footing as it relates to understanding of how GenAI interprets inputs and formulates outputs.

- **Civil Talks** Participants will explore social, cognitive and technological dimensions that can make civil discussions a powerful learning method. Various discussion methods will be aligned to particular instructional objectives. In addition, participants will learn how to have effective and productive conversations in a difficult setting.

4.3 GenAI services

U-M should provide services catering to different needs and technical proficiencies and made available to Ann Arbor, Flint, and Dearborn. The aim is to make GenAI tools equitable and accessible to all members of our university community. We should provide tools that support everything from basic consumer usage to advanced research and experimentation.

- **Tier 1: Consumer-Friendly GenAI Access** The most accessible tier provides access to popular hosted AI models such as ChatGPT and Google Vertex models. This tier is ideal for those who already use these services, providing a familiar interface and usage experience. Costs for this tier will be covered centrally and will come with usage limits to ensure fair access for all. Key Features:
  - Access to popular hosted GenAI models
  - Centrally covered costs
  - User-friendly interface (Equitably available for all U-M faculty, students and staff; Fully accessible)

- **Tier 2: Customizable GenAI Tools** Tier 2 gives users the ability to tune/train vendor models utilizing the tools provided by vendors that are supported at the University of Michigan. This tier will be fully equitable and accessible for the U-M community. Usage of this tier is designed for advanced users wishing to pursue models trained with their own data, U-M data, those who wish to use persistent models for experimentation, research, training, business process redesign, etc.

  Some "free" use allocation will be provided to all U-M faculty, students and staff. After free use is utilized, costs for this service tier are borne by the entity utilizing it. Support is provided by Information Technology Services (ITS) and external vendors. Key Features:

  - Run and fine-tune popular hosted GenAI models (Persistent environment)
  - Dedicated support from ITS and vendors
  - Appropriate for use with some sensitive data

- **Tier 3: Advanced GenAI Model Creation** Though preliminary, recent evidence[15] suggests that LLMs - if carefully constructed - need not be of an enormous scale to be useful, and thus useful discipline-specific models could be developed using university-scale resources. Such efforts will be enabled by Tier 3, which is the most advanced and flexible offering. It is designed for those who require full control over their AI environments and models, including those working with sensitive data. This tier requires deep technical knowledge to access and execute, and ITS will support hosting services only. Key Features:

  - Full control over AI environments and models
  - Suitable for handling sensitive data
  - Hosting support from ITS through federated environments

It is critical to invest in computing technology in such a way as to reduce the cost of experimentation and ensure equitable access to the shifting technological landscape. Much of today's AI methods and applications require training on vast amounts of data, which imply significant computational resources; **advances we have seen in recent years from tech companies are not just because of advanced expertise, but primarily because they have access to more computing power and data pipelines.** Keeping at the forefront of AI means access to the right set of resources. While existing U-M computing infrastructures such as Great Lakes are helpful, they are not of a scale and type that is sufficient for certain classes of tasks, and often become overloaded because of the growing computational needs that our researchers have.

Significant investments in clusters with hundreds of GPUs can accelerate the AI progress made by our researchers, and can significantly amplify our technical s trength. This will allow us to build our own in-house models by building on top of open source efforts, and leverage the large amount of data and knowledge that we have at U-M. The speed at which the space is moving, including new iterations of technology being released that addresses previously substantial issues, makes it challenging to establish a long term strategy.

GenAI will be instrumental for progress in several areas of science and engineering - as an example, foundational materials models can be used to generate novel material structures and compositions that can potentially lead to breakthroughs in areas such as energy storage, electronics, and pharmaceuticals. Thus, **a sustained investment in large-scale computing will be required to keep U-M at the forefront of education, science and technology. Alternately, a failure to invest at the present time will lead to a decline in U-M's research impact.**

[15] Gunasekar, S., et al "Textbooks are all you need," arXiv:2306.11644, 2023.

5 Research & Innovation

5.1 AI for Academic Innovation (AI^2)

We propose the establishment of a strategic initiative to foster a collaborative space between AI expertise and academic innovation with the goal of developing tools, policies and methodologies for AI-enhanced education. This initiative will be housed within the Office of the Provost and ITS, signifying its central role in the University's academic and technological endeavors. The AI^2 initiative will identify and collaborate with appropriate partners including the Center for Research on Learning and Teaching (CRLT), and the Center for Academic Innovation (CAI). The AI^2 initiative will place particular emphasis on academic innovation in teaching and learning, while ensuring ethical, legal, access, and equitable use(s) of AI.

Below are some recommended areas of focus in the near-term.

- **Personalized Education:** AI can be used to develop adaptive learning systems that personalize educational content and instructional approaches based on individual student needs, learning preferences, and performance. This enables more effective and tailored education experiences for students, leading to improved learning outcomes. For instance, we could integrate such personalized suggestions into ECoach and Atlas to create pathways to success for students and provide personalized advice based on large scale historical curricular and performance data. In addition to providing personalized education directly to students, we have opportunities to build systems that provide insight to faculty, academic advisors, department chairs, and campus leadership to gain insight into student performance, identify challenges and opportunities, and make data-informed decisions regarding improvements.

- **Intelligent Tutoring Systems:** AI-powered intelligent tutoring systems can provide students with personalized feedback, guidance, and support in various subjects. These systems can analyze student performance, identify areas of weakness, and offer targeted interventions to help students overcome challenges and enhance their understanding of the material.

- **Automated Grading and Feedback:** AI algorithms can automate some of the grading process for assignments, exams, and essays. This not only saves time for educators but also provides students with timely feedback, enabling them to understand their strengths and weaknesses. AI can also assist in providing more detailed feedback by analyzing patterns and trends across multiple submissions.

- **Educational Research and Discovery:** AI can aid researchers in analyzing vast amounts of data, identifying patterns, and generating insights. Machine learning techniques can assist in literature review, data analysis, and hypothesis generation, accelerating the research process and facilitating new discoveries in various academic fields. This can be especially useful in fields such as healthcare, where it is critical to keep abreast of the most recent discoveries.

- **Intelligent Virtual Assistants for Educational Support:** AI-powered virtual assistants can support administrative tasks in educational institutions, such as answering frequently asked questions, managing schedules, and providing information to students, faculty, and

staff. These assistants can enhance efficiency, streamline processes, and improve the overall experience within academic institutions.

To support both educational research and transformation work improving teaching and learning at U-M, we will need to effectively bring together datasets from Canvas, the Student Data Warehouse, various homegrown and licensed educational technologies implemented across campus, lecture capture recordings, and others. Rigorous principles and policies have to be developed for ethical and legal use of this data. Additionally, human judges with expertise in various disciplines may be required to conduct annotation work and create the "instructional layer" that is key to adding value to GenAI.

Recommendation Funding a few research projects in GenAI-assisted educational tool development, and piloting these tools in a number of courses across U-M.

A key responsibility of the initiative will be to regularly review and assess the impacts of GenAI tools as it relates to teaching and learning. This includes overseeing the incorporation of GenAI technology into course delivery tools, such as Canvas, to enhance the learning experience. To ensure the effectiveness of its initiatives, the initiative will develop an evaluation framework that allows for continuous improvement. This framework will be updated on a quarterly basis to reflect the latest developments in AI technology and education.

5.2 Catalyzing GenAI Research

Given the wealth of existing technical expertise already thriving in Artificial Intelligence as well as broad and deep expertise in autonomy, computational, data, cognitive and information sciences, we are well positioned to lead through both basic research and applied experimentation in a number of areas from medicine to engineering to science to education. We need to take steps to amplify this expertise and establish U-M as one of the leaders in this space. To do this we need sustained institutional investment, with leading-edge infrastructure and computational and data resources to provide our researchers with the support they need to push the boundaries of AI innovation. We also need to actively engage with national laboratory and industry partners, academia, and the wider AI community to form strategic alliances and collaborations, to amplify our impact and accelerate progress.

This initiative will leverage existing units such as the Artificial Intelligence Laboratory, MIDAS, MICDE, Weinberg Cognitive Sciences Institute, Computer Science and Engineering, School of Information, ISR, ICPSR, and Medical School and have a tight integration and partnership with ITS for infrastructure implementations and support. Particular emphasis should be placed on research, with a focus on ethical, legal, access, and equitable use(s) of AI. This includes fostering collaboration between AI experts, cognitive scientists, humanities, social sciences, public health, biomedical, and clinical AI experts to address economic and societal disruptions and address existential risk concerns. A consortium consisting of multiple universities and national laboratory partners will be initiated to broaden expertise, scope, and scaling abilities. In addition to coordinating and catalyzing large federal grant proposals, below are sample responsibilities that can be coordinated by the initiative.

Given large uncertainties in the landscape of GenAI tools and questions on privacy, security, bias, reliability and cost, U-M should consider developing its own version of foundation GenAI models to enable research and innovation.

- Starting from well-studied open-source models, U-M can place significant emphasis on developing home-grown versions of foundation models.

- Leverage U-M faculty expertise and research in GenAI, data science and cognitive science, etc.
- Create and deploy sandboxes for research groups and departments to train their own discipline-specific foundation models, along with the potential for interdisciplinary collaboration and learning when different department robots interact.
- Be cognizant of the significance of human feedback in the back-end labeling process in certain applications, emphasizing the need for a sustainable ecosystem to effectively utilize such models.
- Create and leverage partnerships with multi-university consortia and national laboratories

Given recent evidence of the critical importance of scale of computing to research impact, U-M should formulate a long-term vision to develop large-scale computational resources

- Sustained investment in large-scale computing that may be required to maintain U-M's leadership and competency at the forefront of science and technology.
- Obtain input from ITS, MICDE, MIDAS, AI and Computer science along with domain experts in various scientific disciplines.
- The role of large scale data in the advancement of GenAI is foundational. In parallel with investments in computing technology we need to invest in data infrastructure–including large scale data storage, pipelines to migrate data between contexts, and processes for access management and ethical oversight–to provide on which to train models. This will need to be done for each research area where we want to invest in GenAI- driven advancements.

A key responsibility of the GenAI initiative will be to regularly review and assess the impacts of GenAI technology as it relates to the operations of the university. The GenAI initiative will enable engagement with federal sources as well as donor networks to secure funding for its initiatives. This will involve crafting a well-defined vision and seeking support for specific objectives. By clearly articulating the goals and the potential impact of its work, the university can attract the resources needed to make the GenAI initiative a success.

This initiative is a strategic move to integrate GenAI and AI broadly into the university activities and to provide a pathway to integrate these developments into the 2034 vision.

A Appendix

A.1 Survey Results

Surveys were emailed to staff, undergraduates, graduate students, and faculty at all three U-M campuses. The survey opened on June 6 and closed on June 22, and yielded 6037 responses: with the largest number, 2670 (including 33 from U-M Flint and 48 from U-M Dearborn), coming from staff; 1688 (153 from UMF, 137 from UMD) from undergraduates; 977 (50 from UMF and 14 from UMD) from graduate students; and 702 (with 31 from UMF and 22 from UMD) from faculty. The committee is careful to mention that because of (i) uncertainties in the data collection, (ii) the fact that some roles are of a mixed type, and (iii) many community members having multiple affiliations, we urge the reader to factor in an error of 5% in interpreting the data.

The survey included both closed and open response items, and survey items varied according to respondent role. Staff, for example, were asked to check specific areas of work they anticipated being affected by GenAI, while faculty and graduate students were asked about GenAI in relation to teaching, and undergraduates about opportunities they see in GenAI. Both qualitative and quantitative methods were employed to analyze the data.

Qualitative analysis consisted of open coding of all textual responses for each open response item. In each case six coders read the entire corpus of responses to a given item, developed tentative codes, tested application of the codes, and when agreement on the codes was established, pairs coded randomly assigned sequences of responses.

Quantitative analysis included data cleaning, descriptive modeling, and inferential statistics. This included performing Pearson χ^2 test for independence on coded text responses by respondent roles (faculty, staff, graduate, undergraduate), as well as similar tests on categorical responses by respondent roles. All tests for independence were supplemented by post-hoc analysis to determine contributors to non-random variation, usually with residual analysis.

Table 1 shows the response to a survey question asking respondents whether they have used a GenAI tool.

Table 1: Have you ever used a generative artificial intelligence tool?

	faculty	staff	undergrad	grad
No	42%	61%	44%	34%
Yes	58%	39%	56%	66%

The results show that staff are less likely, and graduate students are more likely, to have used a generative artificial intelligence tool than would be expected if there were no association between status and use of such a tool. However, the survey also indicated that **faculty were in general found to have less experience with these tools than the students. This may have some implications for Fall 2023**. ChatGPT was the most used tool by a large margin, followed by DALL-E.

Table 2 presents a contingency of the challenges faced by the analyzed roles. Graduate students show a significant deviation from the expected count in both challenging (Pearson residual: -3.183) and non-challenging (Pearson residual: 2.481) situations, indicating that graduate students report significantly fewer challenges than expected. Conversely, the staff reports more challenges than expected (Pearson residual: 2.041). The differences among faculty and undergraduates are not significant due to the lower residual values.

Analyzing the relationship between academic status (faculty, staff, undergraduates, and graduates) and the propensity to leave comments and suggestions, a significant difference was observed among the groups. Examining the residuals, faculty were found to be more likely to leave comments than expected (residual: 4.788) while undergraduates are less likely to do so (residual: -3.283). On the other hand, the deviations in staff and graduates' commenting behavior from the expected values are not as notable. This is informative for two reasons. First, it shows that faculty are likely to have opinions that they feel are worth sharing to shape policy. Second, that the voices of undergraduate students (the largest population to be impacted by these changes) are underrepresented in this study.

Table 2: Frequency of "Challenges" mentioned by role

		faculty	grad	staff	undergrad
Not mentioned					
	observed	200	170	413	244
	expected	199.055	140.583	446.630	240.732
	Pearson residual	0.067	2.481	-1.591	0.211
Mentioned					
	observed	120	56	305	143
	expected	120.945	85.417	271.370	146.268
	Pearson residual	-0.086	-3.183	2.041	-0.270

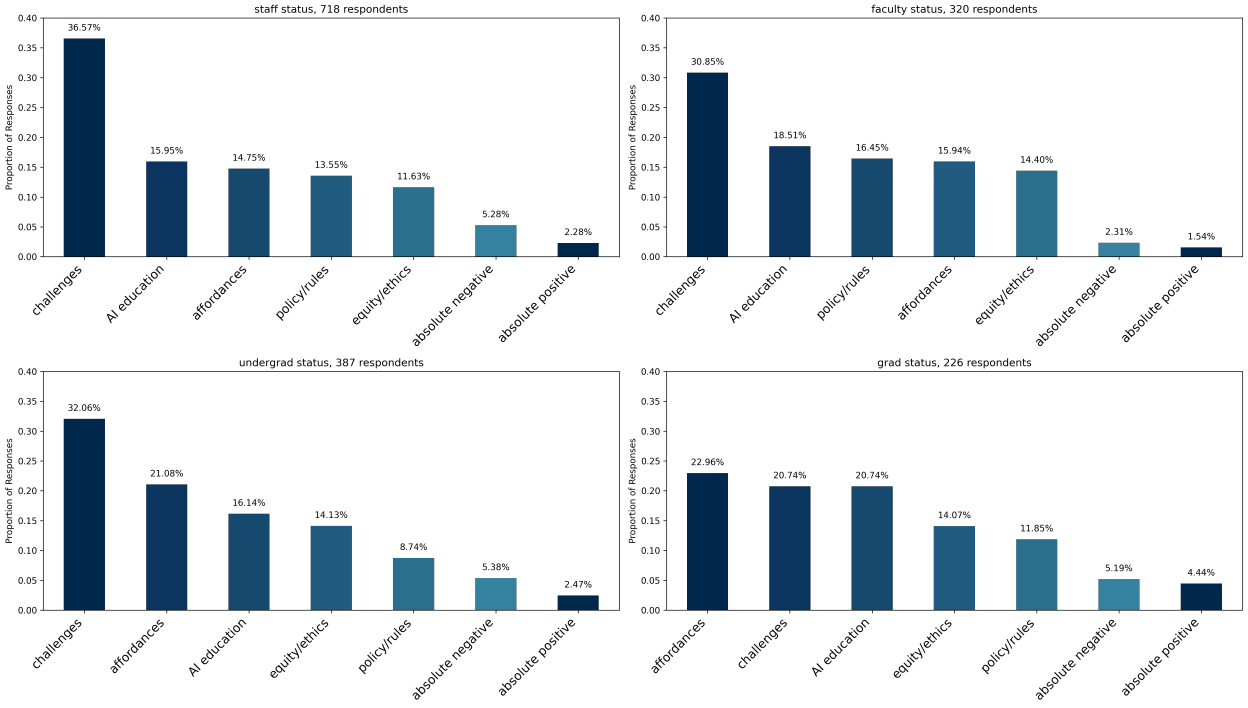


Figure 3: Results of manual annotation of the question "What comments or suggestions would you have for the Generative AI Advisory committee?"

Figure 3 shows results of manual annotation of the question "What comments or suggestions would you have for the Generative AI Advisory committee?" This open-ended question at the

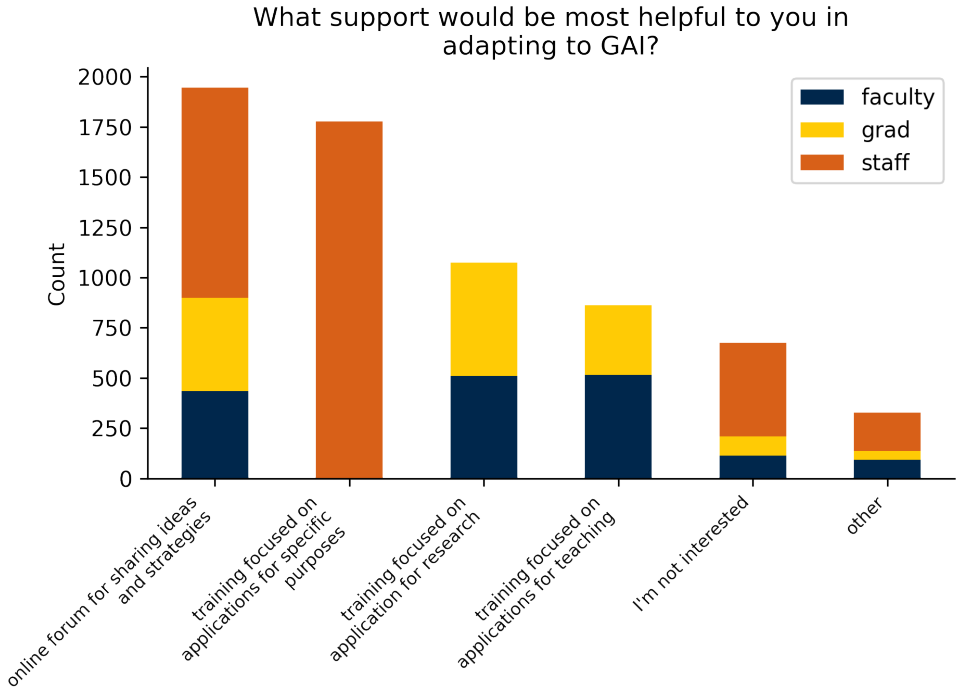


Figure 4: Results of the question "What support would be most helpful to you in adapting to GAI?"

tail-end of the survey generated more responses than any other text field, with 4021 respondents addressing the committee with their thoughts. Staff members voice the greatest number of challenges. Faculty and Undergrads are also more likely to comment on the challenges of generative AI than any other topic. Graduate students are nearly equally likely to mention affordance and challenges of AI. Of the minority with extreme comments, all roles are more frequently extremely negative than extremely positive. Also interesting is the slope/drop-off relationships between groups. Staff and Faculty mention challenges roughly twice as frequently as the second most frequent response (education). Responses from undergraduates and graduates exhibit a more linear relationship. Graduate students mention challenges less, staff mention them more. Figure 4 shows the interest level of the different groups in support resources. Staff members want training focused on specific applications and purposes.

The above results are preliminary and represent a small set from the survey. The analysis yielded a host of rich insights, which will be analyzed further and presented in detail in the website.

A.2 Goals & Methodology

The U-M GAIA Committee (please refer to Appendix A.6 for a full committee list) was formed on March 15th to provide guidance to the University community for the use and development of GenAI and provide strategic advice to the Office of the Provost and VPIT-CIO.

At the outset, the committee started with the following goals:

- Provide clarity on GenAI tools, including strengths, weaknesses, new developments and future developments to monitor
- Provide pragmatic guidance for the U-M community on how to handle the impact of GenAI tools for Fall 2023 and beyond

- Recommend training and support infrastructure for the development and use of GenAI tools
- Solicit faculty, student, and staff input
- Identify ethical, legal, and policy implications
- Study longer-term implications of the impact of GenAI on work and life at U-M
- Recommend sustainable management and infrastructure for future research / development / adaptation of GenAI technologies & tools at U-M
- Recommend mechanisms to evaluate, assess and update committee's recommendations

The committee was organized into several sub-groups (which met on an as-needed basis) and met as a full group (on average) once a week to re-define overarching goals, get updates from sub-groups and to plan for the upcoming week. In addition, several retreats were organized for the committee:

Generative AI retreat : May 3rd, 9am-3pm. The GAIA Committee invited thought leaders from across campus. Speakers: Michael Wellman (COE), Raj Rao Nadakuditi (COE), Jerry Davis (Ross), Josh Pasek (LSA/MIDAS), Rick Lewis (LSA/Weinberg Institute), Perry Samson (COE/SI), HV Jagadish (COE/MIDAS), Charles Friedman (Medical School), Maggie Levenstein (ICPSR).

GAIA Committee writing retreats : May 9th (10am-2pm), June 5th (11:30am-3pm), June 9th (11:30am-3pm), June 23rd (8:30am-12:30pm).

In addition, the following guests were invited to share their thoughts on specific topics: Frederique Laubepin (SPH), Brian Doughty (Office of General Counsel), Alfred Hero (COE/LSA/NSF). On an individual/sub-group basis, the GAIA committee also reached out to a large number of faculty, staff and students across campus.

The following undergraduate student interns helped with research relevant to the committee: Kartik Sundaram, Latitude Brown, Adria Shines, Kezia Kok.

The following PhD students from the joint program in English and Education helped with the analysis of the survey: Aaron Bush, Jason Godfrey, Christopher Kingsland, Alaina Perez, Andrew Appleton Pine, Crystal Zanders.

A.3 Implications for Teaching Computer Programming

Similar to the discussion of writing in Section 2.2, computer programming is a mode of thinking, learning, and problem solving. We use programming to synthesize, analyze, visualize, and understand data, as well as simulate real and virtual spaces and experiences. Programming assignments can foster valuable higher-order cognitive skills, such as critical thinking, evaluating, assessing, analyzing, integrative thinking, questioning, and comparing.

ChatGPT, GitHub Copilot, and more than 70 other GenAI models[16] are capable of both writing computer code, from code snippets and functions to complete classes and programs, in a variety of programming languages, as well as providing line-by-line explanations. In addition, these tools are capable of utilizing popular libraries, such as NumPy, STL, etc. The AI-generated code comes with no guarantees of syntactic or semantic correctness. However, for a wide variety of problems, it can produce code that is at least a good starting point for further development.

[16] A Critical Look at AI-Generated Software.

Even with the above caveat of not always producing correct code, GenAI tools are being widely adopted in industry. GitHub conducted a survey of 500 US-based developers at enterprise companies. They found that 92% of respondents reported using GenAI coding tools in their professional work, and 70% think that using GenAI tools gives them a competitive advantage by improving the quality of the code they write, as well as shortening time to completion[17].

Computer programming educators have long used industry standard tools, like integrated development environments (IDEs), so that students can hit the ground running when making the transition from student to working professional. It appears likely that GenAI tools will become part of the toolchain that software developers use for their work, and as a result, instructors who teach programming should consider teaching students how to effectively and responsibly use a variety of GenAI tools capable of assisting in the task of generating computer code. In fact, textbooks are now being written with GenAI tools in mind [18]. Instructors and researchers should also be attentive to the emergence of new computer programming languages and libraries designed with AI in mind, such as Mojo and tinygrad.

Potential Uses of GenAI for Computational Thinking

We see many useful applications of GenAI tools in learning to program, particularly for beginning students. GenAI tools can not only write computer code, but can provide explanations of the code it produces, as well as make connections between the code and more general computing concepts.

At present, students are expected to use online resources when creating code, from official language documentation, to collaborative message boards, etc. In addition, an effective pedagogy approach is pair-programming, where students collaborate with a partner. It is very likely that instructors will not only encourage, but also expect students to engage with GenAI programming tools. By engaging in dialogue with the GenAI, students are able to get personalized assistance and feedback. They are also able to study the auto-generated code to identify possible coding errors and to find alternate solutions.

Creating quality code usually involves a series of tests to check for correctness with multiple inputs and situations. Auto-graders are widely used in CS education as a way to give students timely feedback on their work. GenAI tools open the possibility for students to receive feedback at all stages of the software development process, and not just a Yes/No evaluation of the final product.

Current Weaknesses of GenAI Tools for Computational Thinking

At present, GenAI as a coding tool is susceptible to many of the same weaknesses as other tools and/or the peer-programming process. The four that are most prevalent include:

1. Students may defer to the provided answer even if they believe that the solution is incorrect.
2. The answer provided may use advanced techniques beyond the current skills of the student.
3. The student may use the provided answer without taking the time to check it at all.
4. The student may take more time debugging the AI-generated code than it would take to write the code themselves, resulting in wasted time and unnecessary frustration.

[17] Survey reveals AI's impact on the developer experience.
[18] LLMs: A New Way to Teach Programming.

From a pedagogical point of view, the most obvious threat of GenAI is that students may submit code that they do not fully understand. It is the responsibility of faculty to reexamine their assessment tools to ensure that students are, in fact, meeting the learning objectives of the course. UM faculty can take a lead in developing new Gen-AI informed course materials[19] and assessments[20].

Academic Integrity and Course Policies

Many courses rely on autograders that check hundreds if not thousands of submissions in a matter of minutes. GenAI will be able to create code that can pass these checkers. Efforts to update the tools to correctly identify GenAI code are an unwise choice given the rapidly advancing technology, and, in the case of introductory courses, the commonality among all submissions. Instructors will need to examine their coding assessments carefully and identify a course of action (i.e invigilate, mitigate, and/or integrate as in section 2.1) to achieve the learning objectives. We expect there will be a shift in forms of assessment, away from merely assessing the final product, to assessing critical cognitive skills, like making sound judgments from the information at hand and the ability to articulate the "why" behind their design decisions. In this way a submission that "surpasses" a GenAI submission may include peer reviews, annotations, etc. (section 2.2).

A.4 Implications for the Creative Arts

As in other disciplines, the introduction of GenAI brings about new opportunities and significant challenges to the creative arts. AI generated art has already been used to invent visual art; for example, in 2018 Christie's sold the "Portrait of Edmond de Belamy," created by the artist collective Obvious, for $432,500. AI-driven creations have proliferated in digital spheres over the past 6 months, often initiated by very simple inputs such as natural language prompts. This has been followed by intense criticism from the artist community who argue that these systems create unoriginal visuals by processing millions of artworks, often without explicit consent by the creators.

Section 1.0 distinguishes among three models: Language Generation (ChatGPT 3, 3.5, 4; InstructGPT), Multimodal Generation (CLIP, DALL-E, Tango, etc.), and Autonomous GenAI systems (AutoGPT). Among many other capabilities, these models generate audio, video, words, and/or images. Platforms that generate or refine images include Adobe Photoshop, Corel Painter, Procreate, Firefly, MidJourney, and Stable Diffusion. In music, Chordify analyzes chords, and has the capacity to search for music with specific chords, or analyze chord structures. The various platforms are trained on different data sets and operate in diverse ways.

One perspective is offered by Cowan, et al.[21] : *Note that the prompts are not simply descriptions of the image that we want. Trying to give the AI "orders" will only produce frustration. Instead, think of the AI as a "collective unconscious of humanity," a' la Carl Jung (who is Jung? Ask GPT!). You are trying to tap into that collective unconsciousness at a point that is interesting and in furtherance of your goals.*

A platform may output images based on an artist's training, or based on algorithms that impose specific styles. A platform may be trained on stock images or on artists' work. Because the platforms vary considerably, they raise many ethical concerns about intellectual property, authenticity, and social impacts such as inequity of access, privacy and data security, and responsible use.

GenAI is fundamentally altering some creative processes and is being used to compose music, write movie scripts, and design workplaces. While GenAI cannot fully understand or reproduce

[19] Assigning AI: Seven Ways of Using AI in Class

[20] Education in the Age of Generative AI

[21] Cowen, T., and Alexander, T. "How to learn and teach economics with large language models, including GPT." Including GPT (2023).

the complex social, cultural, and intellectual influences that a human creator or performer might incorporate into their work, it can still provoke meaningful reactions among the audience. GenAI can be used to generate ideas, personalize learning, and define or explore new forms for art. The benefits include democratizing access to music composition, image and video creation, and drawing; the technologies can enhance multimodal communication. GenAI has the potential to diversify creative activity and give rise to new interdisciplinary collaborations (e.g. tighter links between artists and computer science). GenAI can also increase accessibility of art and creation of art to persons with physical disabilities as well as those with technical and economic limitations. You are trying to tap into that collective unconsciousness at a point that is interesting and in furtherance of your goals.

At the same time, these models are predicated on extracting patterns and information from existing artistic media, which raises questions about the ethicality of training data, how training influences outputs, and how to determine authorship and copyright[22]. In the classroom, there is concern that some students may not learn essential artistic skills. The platforms can also have a downside of homogenizing and standardizing creative output, for example by preferring particular racial features, or by reducing representation of diverse ethnicities and socioeconomic groups. GenAI can be used to create deep fakes that appear realistic. Users of GenAI tools should consider the broad social and ethical implications of the platforms' output, including use by bad actors. The social risks of deep fakes and plagiarism are serious.

Disciplines that depend on GenAI-augmented modalities need to create customized policies and guidelines for responsible technology use, and for intellectual and creative ownership. The human and social benefits and costs of the technology need to be evaluated and mitigated. Policies and guidelines similar to those presented in Sections 2.1 and 2.2 may be customized, extended and adapted for the creative arts.

A.5 Ethical Reasoning Theories and Implications for GenAI

There are many interesting and important ethical, legal, and social considerations related to the creation, implementation, and use of GenAI. While a comprehensive primer on this topic is beyond the scope of this report or appendix, there are several major themes leaders should be aware of moving forward.

An important form of ethical reasoning applied at U-M and across the US is "principlism" or adherence and balancing of several central values. In human subjects research, these have been defined as 1) respect for persons, 2) beneficence, and 3) justice. In the medical context, these are traditionally expanded into 4 principles with the addition of 4) non-maleficence. While there are many other philosophical traditions of interest to GenAI (e.g., deontology, utilitarianism, casuistry), principlism is often most easily understood and applied by non-philosophers, so is a reasonable starting point for this conversation.

Respect for Persons

The Kantian virtue of "respect for persons" is most often translated in western philosophy as respecting a person's "autonomy," which is then often embodied by ensuring that people provide "informed consent" to certain experiences.

In medicine and human subjects research, "informed consent" requires adherence to three major elements including 1) Capacity, meaning that the person must have the ability to understand information being presented and apply it to their own values in a way that supports decision-

[22]Epstein, Ziv, et al. "Art and the science of generative AI." Science 380.6650 (2023):

making. Not all people have capacity (e.g, children or people with severe mental illness), and some people have capacity to make some decisions (e.g., whether to enroll in research) but not others (e.g., whether to end life-saving care); 2) Information, meaning that a person with capacity has enough information about potential risks, benefits and alternatives to make a decision for themselves in adherence with their values, and 3) Choice, meaning that the person is not facing structural, situational, or individual coercion (e.g., a doctor trying to convince a cancer patient to enroll in her precision medicine research protocol).

GenAI Implication: GenAI has several interesting potential intersections with respecting the autonomy of individuals. Some examples include whether and if people consented to have their data included in the databases from which GenAI draws, whether people should know or consent to have GenAI- derived information used in an interaction with them, or whether things that people create (e.g., drawings, music, writing) can be used or republished without their knowledge or consent. This concept is particularly relevant to the issues of research integrity discussed in this report in terms of acknowledging the contributions of GenAI or the underlying databases.

Beneficence/Nonmaleficence

The principle of beneficence/nonmaleficence is often attributed to the foundational medical ethic of "first do no harm" and also an expectation that we act in ways that encourage the wellbeing of others while minimizing harms which may befall them.

The general standard of social contract societies is that members should not act in ways that harm other members of that community. Those expectations might be codified into laws (e.g., against murder or theft) that come with penalties for non-adherence, or be reinforced by social conditioning.

Expectations for beneficence can also be situational. While certainly there are sometimes societal expectations that one contributes to the benefit of another (e.g., taking up a collection for a sick colleague), there are also many times in which a person or entity has a duty to act in beneficial ways of another (e.g., a teacher supervising a class, a parent taking care of their child).

GenAI Implication: Beneficence and nonmaleficence also have interesting implications when applied to GenAI. Educational institutions, like U-M, have both a moral expectation and sometimes legal requirement to work in ways that will benefit its student body, faculty, and staff and avoid actions that will unduly harm them. Beneficence might require, for example, offering training on how to use GenAI programming to improve their work. Nonmaleficence might require, for example, working in thoughtful ways to incorporate GenAI in ways that still prepare students for future careers and do not detract from the education they need to be successful adults.

Justice

The last, and perhaps most important principle, is justice. As summarized by The Belmont Report (1979), its formulations include: (1) to each person an equal share, (2) to each person according to individual need, (3) to each person according to individual effort, (4) to each person according to societal contribution, and (5) to each person according to merit. Since that formulation, there has been much critical work, led by scholars of color, expanding this definition of justice to also incorporate an awareness of societal, structural, and individual biases including racism, misogyny, homophobia and other types of bigotry. This work has led a renewed effort to focus on "equity" as opposed to "equality" per se, because distributing equal amounts of (both tangible or intangible) social goods will generally not achieve justice or equality for populations with less to begin

with. Entities also have a moral obligation to assess the impact of policies on communities historically excluded from educational, medical, scientific, and professional opportunities to ensure that policies improve inclusion, rather than compound such exclusion. Justice also calls us to question what is "fair" or "unfair" at both the individual and community level.

GenAI Implication: Justice has many implications for GenAI. In its negative form, justice might compel punitive actions for students or faculty who breach U-M standards for GenAI use - but it also requires that such actions are applied in fair and consistent ways across different communities. In its positive form, it affirmatively encourages or even requires increases in accessibility and application. For example, while arguments for beneficence might support U-M allowing the use of GenAI in the classroom and for homework, it is justice that requires us to also ensure equitable access for all students non-dependent on their personal finances. Justice also requires assessment of GenAI tools to ensure that certain individuals or communities are not exploited, underrepresented, or left out.

While the applications of these four basic principles to assess the creation, implementation, and use of GenAI are vast, and the above explanations and examples few, we hope that these general standards can help guide and inform decision-making at U-M moving forward.

A.6 GAIA Committee Members & Affiliations

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A7. Integration of GenAI into Clinical Care, Delivery Efficiency, Clinical Training, and Human Health Research at U-M

Artificial Intelligence (AI) and Generative AI (GenAI) (hereinafter both described as "GenAI") both hold great promise to improve clinical care, delivery efficiency, and health research at U-M. Aspects of this potential improvement include pedagogical, clinical, interpersonal, and administrative uses. That said, **U-M must commit to ongoing assessment of GenAI risks and opportunities, technological advances, and best practices – in addition to ongoing community engagement and education – to enable improvements and limit negative consequences** across all U-M care facilities and training venues.

The intent of this section is to offer guidance to **all healthcare professionals (HCPs), clinical trainees, and human subjects or human health data researchers** throughout the Michigan Medicine Network, School of Dentistry, School of Nursing, Pharmacy School, School of Public Health, School of Social Work, Psychology Department, the University Health Service (UHS), Counseling and Psychological Services (CAPS) and other wellness support units, and the Athletic Department.

It covers use of GenAI in clinical care, delivery efficiency, and **clinical training, and human sub-jects or human data health research.** The research application scope covers spectrum from basic, to clinical, to clinical trials, to translational, and to health outcomes and health services research (HSR). Further details pertaining to GenAI use in research can be found in section 3.2.

A7.1 Use of GenAI in Clinical Care, Delivery, and Health Research at U-M

A first area of note of the potential use of GenAI in the clinic is in increasing patient access and visibility of U-M clinical services. This might include targeted advertising of services, care re-minders, and automated / dynamic appointment scheduling. While these applications have the ability to increase the impact of U-M services across patient populations who need it most, and streamlining and increasing efficiency in scheduling, concerns include ensuring the health privacy of patients, not acting in ways indicative of exploitation, and ensuring patients that need individualized support are still able to receive it.

In the context of **care delivery**, GenAI can be utilized in creating scripts for scheduling and re-sponding to calls/ inbox messages. It can generate pre-written scripts to efficiently schedule appointments and respond to patient inquiries, streamlining the communication process. By analyzing various factors such as the estimated length of appointments and wait times, generative AI algorithms can also prioritize patient appointments, ensuring efficient utilization of healthcare resources. It can also consider factors like patient commute burden, time off work, and finan-cial considerations to inform decisions about rescheduling appointments or making necessary adjustments to accommodate patients' needs. It can be used to generate educational materials for both outpatient and inpatient settings, whether delivered virtually or in-person. This ensures that patients receive comprehensive information about their conditions, treatments, and self-care guidelines.

GenAI can also send automated notifications to patients and care teams if patients lack important documents like friends or family forms or advance directives. The frequency of such reminders can be adjusted based on factors like age and underlying/emerging disease state. A chatbot powered by GenAI can be offered to answer frequently asked questions from patients regarding di-rections, logistics, appointment timing, basic medical information, HIPAA privacy and security policies, and other relevant policies. The chatbot can also inquire about the presence of a com-panion and their relationship during the appointment. Last, GenAI can help clinicians anticipate common risks, discuss potential benefits, and provide clarity regarding alternative treatment op-tions, ensuring comprehensive and informative conversations with patients.

In the context of **patient appointments**, GenAI can support the generation of personalized scripts that introduce everyone in the room, including their names, job titles, and patient preferences (e.g., prefix, preferred pronouns). AI algorithms can provide a concise summary of an out-patient's clinical history, including the last time they were seen and what was previously discussed. GenAI can deliver an overview of the patient's specific disease, focusing on the questions and background information previously input by the patient.

AI algorithms can also **generate summaries and interpretations of informed consent forms** in the patient's primary language, emphasizing risks, benefits, and alternatives tailored to their educational and reading level. During the appointment, generative AI can provide live recording, translation, and organization of information, known as "ambient voice." This can include a **comprehensive visit summary**, covering general information as well as specific details discussed during the appointment. This should cover clinicians, trainees, friends, or family present, the patient's concerns, goals of care, alternatives to consider, next steps, follow-up appointments, necessary prescriptions, and sending care summaries to the patient's primary care provider or referring physicians. Of note there are liability, discovery, and subpoena concerns raised by the generation of such specific information, and whether its use increases efficiency should be seriously considered with the Office of General Counsel.

Post-appointment, generative AI can translate the live recording into draft visit notes, ensuring accurate and comprehensive documentation of the appointment. The generated visit notes can then be automatically distributed to all individuals present during the visit, ensuring that everyone involved has access to the relevant information. This may implicate the 21st Century Cares Act's information blocking rules in ways not yet clear from government guidance. The AI system can also extract and send relevant sections of the visit notes to consulting clinicians, facilitating effective collaboration and continuity of care.

GenAI can also be very useful in the management of the **Mi-Chart Epic EHR** patient-originated message "in-baskets" by, for example, synchronizing the triage of messages to administrator, nurse, PA/NP, physician, etc., and offering a more engaging patient facing message system above the currently used dropdown menu that asks patients about their concerns, pain, and changes in symptoms or their severity. In addition, the use of **Generative AI to summarize elements of a patient's EHR and inform caregivers of treatment options** have several potential benefits as well as several potential detrimental outcomes to be aware of and mitigated. A sample list - originally generated by a prompt to GPT-4 and then heavily edited and reordered - follows:

Potential beneficial applications enabled by GenAI analysis of the EHR

- **Predictive Analysis:** AI can process vast amounts of structured data to predict disease progression and potential health risks, and identify preventive measures.

- **Automated Summary Generation:** GPT-4, as a language model, can process unstructured text (like doctors' notes and radiology reports) and generate a brief summary for a quick review by the primary care physician.

- **Anomaly Detection:** AI can identify inconsistencies or anomalies in structured data that might indicate a data entry error or a medical condition that needs attention.

- **Risk Stratification:** By analyzing past medical history, lifestyle factors, and genetic infor-mation, AI can help stratify patients based on their risk of developing certain conditions.

- **Personalized Treatment Plans:** AI can analyze genetic information along with medical history to suggest personalized treatment options or identify potential drug interactions.

Potential detrimental outcomes enabled by GenAI to analysis of the EHR:

- **Data Privacy Concerns:** AI analysis of EHRs could lead to additional opportunities for unauthorized access or misuse of sensitive patient data.

- **Over-reliance on AI:** If physicians become too reliant on AI, they may become de-skilled themselves and overlook critical information that the AI has missed or misinterpreted.

- **Misinterpretation of Unstructured Data:** Errors can occur when AI interprets unstruc-tured data such as clinician notes, especially when there is the use of colloquial terms, abbreviations, or lack of context.

- **Algorithmic Bias:** As is currently true, AI will continue to be trained on data that does not represent the entire patient population, which introduces bias in predictions or treatment suggestions. For example, a recent survey found that 71% of algorithms were trained on datasets from three coastal states (California, Massachusetts, and New York) which are more likely to have major academic medical centers with state-of-the art data capture, harmonization, and sharing capabilities.

- **Patient Anxiety:** If the patient has access to AI predictions and misinterprets the informa-tion, it may cause unnecessary anxiety or confusion. That said, the information blocking provisions of the 21st Century Patient Cares act already considered this tension in releasing patient notes and test results directly to patients in real time and legislatures determined the interests of the patient in direct access to their medical records outweighed concerns about anxiety and confusion over test results delivered directly.

In conclusion, AI in healthcare and its application to EHRs offer promising benefits but come with significant challenges. It is important to maintain a balance between traditional medical judgment and GenAI-assisted decision making to provide the best patient care.

A7.2 **Guiding Principles**

In order to achieve any of the above goals, however, there are several critical substantive and procedural principles for implementation of GenAI in clinical care that must be considered. Sub-stantive principles include **respecting the autonomy interests** of patients, which is often done by ensuring informed consent of adult patients with capacity. **Beneficence and non-maleficence**, or increasing benefits for patients while decreasing harms, is also essential. In addition, the principle of justice requires us to seek equity in the distribution of both benefits and burdens across individual patients and patient communities.

In addition to these substantive goals, it is worth directly stating some of the procedural principles to which MM also commits to adhering. These include **transparency** in our actions and reasoning that inform those choices, **accountability** for commitments and failing to achieve stated outcomes, **quality assurance and improvement** for all clinical recommendations ensuring that they are living and evolving rather than stagnant and non-responsive to advances and innovations, and **community engagement** across faculty, staff, and patient communities in all of our actions.

These substantive and procedural principles lead to the following recommendations:

It is recommended that U-M commits to principled implementation of GenAI into clinical care, delivery efficiency, clinical training, and human subjects or human health data research at U-M that is respectful, private, safe, and equitable.

In order to ensure adherence to this recommendation, the implementation and deployment of this technology should be overseen by Michigan Medicine and other relevant units, be subject to human risk assessment, and not enhance misinformation. GenAI's use will range from basic research to human subjects research to health service research, with access provided to qualified campus clinical delivery and clinical research colleagues, while an IT plan ensures secure application and data protection in compliance with current and future UM SPG guidelines. While so doing, oversight mechanisms will keep in mind the following:

- **GenAI will be used in ways that are respectful of the populations upon which they are trained and applied. This likely will require iterations of notice and/or express consent.** In order for the use of GenAI to be respectful, oversight, use, and application must respect the needs of patients, research participants, friends and families, faculty, and staff. This respect must also include dedication to transparency and accountability. Any plans or approaches to GenAI at UM should be transparent to all stakeholders and held account-able to the above substantive principles. Plans should be developed to ensure access by qualified U-M campus research colleagues with inputs from all stakeholders.

- **GenAI systems will protect patient privacy and operate in compliance with applicable regulations that might include the HIPAA privacy and security policies, FERPA, EEOC employment regulations, the Human Subjects Research Regulations, and other appli-cable federal and state law and best practices.** Development of a secure IT infrastructure plan is necessary to protect the privacy of individuals involved in GenAI, ensuring data protection with approval from Michigan Medicine and the University of Michigan Compli-ance office. Specifically, there must be a secure and approved Cloud service with clinically optimized LLM to be deployed with no sharing of data beyond what is currently allowable under federal and state law and UM policy. All clinical GenAI involving use of PHI use will conform with UM SPGs on Information Security and Information Security Incident Reporting. Thus, no personal GenAI tools and platforms can be used to perform clinical or health research duties. Individuals are responsible for both the information they provide as input into GenAI tools and for how the output produced by GenAI tools is used.

- For web based GenAI tools, sensitive data cannot not be provided. This is because Michi-gan Medicine does not currently have access to enterprise tools that would allow for the use of sensitive data. This policy will be updated if such enterprise tools become available. Per university policy, GenAI tools should only be used with institutional data classified as LOW, according to the ITS Data Classification Definitions. Usage may not violate exist-ing legal, institutional, or vendor policies (see references for more information). For local GenAI tools, sensitive data, such as personally identified information or protected health information, should only be used in computing environments where that form of sensitive data is allowed (e.g., Core Imaged HITS machine, see Artificial Intelligence and U-M Institutional Data for others. (From S. Meyer and K. Singh, 2023-06-06, Initial Draft HITS Policy, in U-M and MM compliance review).

- **The use of GenAI by HCPs for clinical care must put the safety of patients first and foremost. Any use must be assessed for risk, verification or correctness, and assurance of the application of best practices.** Responsible GenAI use increases measurable healthcare benefits and opportunities while limiting burdens. It is important to maintain a balance between GenAI-assisted decision support and traditional medical judgment to provide the best patient care. U-M's commitment to safety also ensures due diligence and quality assessment in the implementation of technologies that are suspected or known to create hallucinations, misinformation, or falsification of knowledge representation, references, and misrepresentation(s) and develop the means to ensure elimination of hallucinations and misinformation.

It is recommended that this report should be understood as adding responsibilities for entities and individuals who use GenAI in Clinical Care, Delivery Efficiency, Clinical Training, and Human Subjects or Human Health Research as opposed to adding additional privileges, such as broader data sharing between UM entities. It should be read in tandem and concurrence with all applicable and existing U-M and Michigan Medicine policies as well as applicable federal and state law. In order to help assure compliance with the above procedures, the use of unauthorized GenAI products for covered purposes is prohibited.

- **Technological advances should be applied in ways that are equitable, mitigating or limiting social biases across demographics or at the very least ensure they are not com-pounded. This commitment should specifically focus on populations historically excluded from clinical care. This will require engagement with both patient, student, faculty, and staff communities for their input and guidance.** Technological advances should be applied in ways that mitigate or limit social biases across demographics or at the very least ensure they are not compounded. This commitment should specifically focus on populations historically excluded from clinical care, technological advancements, or used as a means to the end of others. GenAI clinical use will ensure that any benefits or burdens generated are distributed equitably across both individual people and communities.

  Users of GenAI must commit to understanding the evolving challenges in using and im-plementing GenAI technology fairly, transparently, ethically, and legally.

It is recommended that Michigan Medicine convene an ad hoc Task Force of representa-tive stakeholders identified by participating units to develop the detailed operations and the secure IT infrastructure plan to apply GenAI methods safely and responsibly for clinical care, clinical delivery, clinical training, and any research involving Personal Health Data (PHI) or other sensitive information. For efficiency and rapid translation, this process will involve the Michigan Medicine and University of Michigan Compliance Office and the Office of General Counsel throughout.

- The intent of this recommendation is to offer uniform guidance to **all healthcare professionals (HCPs), clinical trainees, and human subjects or human health data researchers** throughout the U-M, including Michigan Medicine Network, School of Dentistry, School of Nursing, Pharmacy School, School of Public Health, School of Social Work, Psychology Department, the University Health Service (UHS), Counseling and Psychological Services (CAPS) and other wellness support units, and the Athletic Department.

In order to ensure adherence to this recommendation, the implementation and deployment of these technologies should be overseen by Michigan Medicine and other relevant units, be subject to human risk assessment, and not enhance misinformation, working with campus IT partners, ITS and HITS. Clinical GenAI use will also range from basic research to health service research, with access provided to qualified campus clinical delivery and clinical research colleagues. The delivered plan from the ad hoc committee will ensure secure application and data protection in compliance with current and future UM SPG guidelines.

A7.3 **Oversight**

The overall GenAI integration plan should be overseen by Michigan Medicine and other relevant clinical units. This oversight must ensure due diligence and quality assessment to limit hallucinations, misinformation, or falsification of knowledge representation, references, and mis-representation(s). Access to secure and appropriately trained GenAI platforms (i.e., GPT-4 vs GPT 3.5) should be ensured for all qualified U-M campus clinical delivery and health research colleagues, covering a broad research scope from basic to health services research. And imple-mentation of GenAI models must start as research use at first, establishing performance baselines to measure future improvements, leading to the eventual prototype for translation to clinical care.

At Michigan Medicine specifically, this implementation will be managed by President of U-M Health with oversight by the EVPMA/Dean of Michigan Medicine/Medical School, supported by the EVD for Academic Affairs and the EVD for Research; based on a plan vetted by the Univer-sity of Michigan and Michigan Medicine Compliance Office, the Office of General Counsel, and the U-M Health Board. On campus, Michigan Medicine will work the U-M Health Officer with the U-M administration and the Health Science Deans to convene a diverse set of stakeholders to ensure equitable and fair planning against agreed upon principles. An incomplete list would cer-tainly include the U-M Chief Health Officer with inputs from the deans of the Schools of Nursing, Dentistry, College of Pharmacy, and the MM Ethics Office. ITS and HITS will also have appropri-ate representation.

Of utmost importance to ensure the above guiding principles, U-M healthcare providers (HCPs) may only use clinical GenAI products licensed by U-M specifically for this use. The use of unau-thorized GenAI products for clinical purposes is prohibited and individual HCPs will be held responsible for their adherence to this and other MM policies on the topic.

Generative Artificial Intelligence Advisory Committee Report