

Twelve tips to harness the power of AI for curriculum mapping

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ABSTRACT

The systematic alignment and analysis of educational content through curriculum mapping serves as a critical yet complex undertaking in developing, executing, and assessing medical education programs. In alignment with Kern's steps for curriculum development, the process of curriculum mapping consists of connecting curricular standards to learning objectives, educational strategies, and evaluation methods. Artificial Intelligence's (AI) Large Language Models are powerful tools for medical educators looking to optimize curriculum mapping. Following Kern's process, our twelve tips demonstrate how medical educators can harness the power of AI to enhance the efficiency and creativity of the curriculum mapping process while highlighting the limitations and boundaries of such tools.

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Introduction

Curriculum mapping is a fundamental but challenging process for medical education curricular planning, implementation, and evaluation [1]. The process of curriculum mapping consists of connecting curricular standards to learning objectives, educational strategies, and evaluation methods. Curriculum mapping aligns well with Kern's six-step model for medical education curriculum development, which is a framework that helps educators design and implement effective medical curricula [2]. Kern's approach emphasizes systematic planning and ensures that the curriculum is student-centered, evidence-based, and aligned with educational goals. The six steps include: needs and targeted needs assessment, goals and objectives, educational methods, implementation, and evaluation [2]. The map transparently documents the curriculum so that students, educators, and administrators alike may visualize the relationships between components [1]. Institutions rely on Learning Management Systems to store vital curricular information for medical education and accreditation [3,4].

The methodical mapping process demands sustained focus and attention to detail. It involves disaggregation of educational programming into codified and structured curricular matrices amenable to systematic analysis through curricular evaluation, improvement, and renewal [2]. Artificial Intelligence (AI), a term coined in 1955, has progressed through stages of technological advancement from simple

computational logic to rule-based reasoning, to the current stage of data-driven machine learning [5]. Generative AI (Gen-AI) has been evolving for decades, but it was brought to the attention of the masses with the development of large-scale language models. The release of Chat-GPT in late 2022 made the use of the LLM widely accessible to individuals without advanced computational training or organizational access. The Natural Language Processing power of Artificial Intelligence (AI) [6–9], together with generative capabilities and broadened access, has spawned new opportunities to enhance curricular mapping efforts.

There are existing examples of AI utilization in curricular development in the general educational literature. Qualitative research has explored the AI capabilities in curricular adaptation ranging from content assessment to instructional experience enhancement [10]. However, descriptive examples of AI application capabilities for administrative educational tasks are lacking or limited in scope. Two examples related to curriculum mapping demonstrated a reduced time requirement for learning objective categorization and gap identification with promising accuracy [11,12].

In their scoping review of AI in medical education, Gordon and colleagues compared medical education's approach to AI as 'culture shock' [13]. As Gordon and colleagues concluded, currently medical education is 'in awe of AI's capabilities juxtaposed with apprehension about its implications' [13]. To move 'adaptation' and 'acceptance,' we need

practical, effective, and responsible ways to use AI in medical education. Using Kern's six-step model as a framework, our *Twelve tips for harnessing the power of AI for curriculum mapping* seeks to provide medical educators practical and effective ways to utilize AI tools in the creation, maintenance, and evaluation of curricular mapping while highlighting the limitations and boundaries of such tools.

Curriculum developmental step 1: Needs assessment

Tip 1: Navigate changing accreditation requirements

Accrediting agencies exist internationally, and when each revises their guidelines, Large Language Models (LLMs) are capable of standards alignment analysis, a process of: (a) identifying substantive changes, (b) mapping related standards, (c) detecting when requirements are added, removed, or modified, and (d) analyzing the impact on compliance needs. We deployed AI to assist in curriculum map updating for changes to accreditation requirement changes.

We created customized comparison prompts, as exemplified in the prompt and output detailed below. The application reduced the time required to perform the task by two working days. It accurately flagged areas in need of updating. The application recognized errors including manually overlooked areas requiring revision. Our human oversight detected minimal errors. We manually reviewed generated output, highlighting updated or novel requirements and pinpointing critical differences between versions.

Customized prompt:

'Compare documents in the different versions. Identify differences and changes between versions. Summarize the changes. Strictly use the uploaded documents without conducting an online search.' We uploaded the current and revised versions of compliance documents to an LLM with commercial data protections.

Generated response:

The response was specific to our institutional documents, highlighting updated or novel requirements and pinpointing critical differences between versions.

Tip 2: Mapping additional competencies to an existing curriculum

Medical curricula must undergo processes of continuous improvement to address emerging knowledge, skills, or insights. Therefore, the curriculum map must be updated to incorporate new standards or competencies. Our institution implemented a

novel undergraduate medical education (UME) curriculum to address artificial intelligence in healthcare.

The content creator used the AI model to analyze how to better embed proposed AI competencies, such as 'critical AI appraisal,' into existing curricular maps [14]. See Table 1 for an example of the prompt and output for Tip 2. We found that the output was well-founded in Kern's framework and aligned the new competency with existing content. The framework provided a strong outline for the consideration of novel approaches. The use of the model reduced faculty time to outline an initial approach by 50% and provided a skeleton for editing purposes.

Curriculum developmental step 2: Targeted needs assessment

Tip 3: Curriculum keyword mapping

Medical schools receive inquiries regarding specific aspects of their curriculum, such as inclusion or frequency content related to a particular subject. By systematically mapping keywords to curricular objectives, medical educators may easily identify content within the curriculum. We created an optimized prompt to accurately match the keyword list to content embedded within our curriculum. See Table 1 for an example of the prompt and output for Tip 3.

Our optimized prompt [15] used the following strategies: (1) The persona pattern was used to instruct the model to act as an expert in curriculum mapping in medical education [16]. (2) Specific instructions narrowed the task scope, enhancing precision of mapping and limiting the model's creativity in output generation, such as creating novel keywords. (3) Examples were included within the prompt to aid in formatting the output response. (4) Data context, in this case, the keyword list, was integrated within the prompt rather than uploaded as a separate file. The use of the model to match keywords to content improved efficiency with regards to time spent and reduced the number of faculty and staff needed for task completion. Inclusion of the data within the prompt improved consistency and reliability of the output.

Curriculum developmental step 3: Goals and objectives

Tip 4: Map training-year-specific competency-based objectives for rotations

Designing competency-based goals and objectives is often a challenging task for educators and program leaders [17]. This complexity is heightened by accreditation standards present in medical education

Table 1. The table contains an example prompt and output for each tip. Due to the comprehensive nature of the outputs, many have been truncated for brevity.

Prompt	Output
<p>1 Compare documents in the different versions. Identify differences and changes between versions. Summarize the changes. Strictly use the uploaded documents without conducting an online search.</p>	<p>The response was specific to our institutional documents, highlighting updated or novel requirements and pinpointing critical differences between versions.</p>
<p>2 Act as a curriculum development expert. Propose strategies using Kern's six step curriculum developmental framework to integrate a novel AI competency. Critical appraisal of AI into an existing medical education curriculum map.</p>	<p><i>[The output has been condensed for brevity]</i> Problem Identification and General Needs Assessment Identify knowledge gaps in: <ul style="list-style-type: none"> • Core statistical concepts necessary for AI appraisal • Understanding of AI validation methodologies [...] Map current curriculum elements that could align with AI appraisal: <ul style="list-style-type: none"> • Evidence-based medicine modules • Biostatistics courses [...] Goals and Objectives At key curriculum points <i>[Output included year by year objectives and sessions linked to curricular phase]</i> Evaluation and Feedback Multi-level Assessment <i>[Output included examples of course and program outcomes]</i> </p>
<p>3 This*LLM is an expert in curriculum mapping in medical education and assists users by taking a list of keywords and matching them to provided educational objectives. The model will only use the keywords from the provided list to match appropriate keywords to each objective. Emphasize accuracy in matching keywords and strictly use the provided keywords without creating new keywords. <i>(The keyword list was inserted).</i></p>	<p><i>[The output has been condensed for brevity]</i> Objective: A&E: Identify how social determinants of health can affect imaging services and lead to health disparities. Keywords: Imaging, Social Determinants of Health, Health Disparities. Objective: A&E: List some ways that imaging can reduce costs when used appropriately and increase costs when used inappropriately. Keywords: Imaging, Medical Economics, Value Based Care.</p>
<p>4 Create progressive learning objectives by training year (PGY-1, PGY-2, PGY-3) for Practice-Based Learning and Improvement in an orthopedic trauma rotation. Include an overall rotation goal, as well as a goal and a measurable objective for each year, showing increasing responsibility.</p>	<p>Overall rotation goal: Develop residents' abilities to self-assess, integrate feedback, and lead improvements in trauma care through evidence-based practices. Practice-based learning and improvement objectives by training year PGY-1: <ul style="list-style-type: none"> • Goal: Begin self-assessment and apply supervisor feedback to enhance trauma skills. • Objective: PGY-1 residents will review feedback after each trauma case and implement one actionable improvement plan, demonstrating measurable progress by the end of the rotation. PGY-2: <ul style="list-style-type: none"> • Goal: Incorporate evidence-based practices to improve patient outcomes. • Objective: PGY-2 residents will review trauma care literature and apply findings to at least 3 cases, with documented improvements in patient management and procedural outcomes. PGY-3: <ul style="list-style-type: none"> • Goal: Lead practice improvements in trauma protocols. • Objective: PGY-3 residents will conduct a review of trauma care practices, present evidence-based recommendations to the department, and track measurable improvements by rotation completion. Here's a table that connects the content features to the corresponding learning objectives. <i>[Output is truncated for brevity]</i></p>
<p>5 Make a table that connects the following content features to</p>	<p>Here's a table that connects the following content features to</p>

(continued)

Table 1. Continued.

	Prompt	Content features	Learning objectives	Output
	the learning objectives. In the table, remove the content features that are not addressed by the learning objectives. [Relevant content features and the session level objectives were uploaded within the prompt].	Hemodynamics, blood flow, pressure, vascular resistance	Learning Objective 1: Explain the Fluid Flow Equation and how its components of pressure, flow, and resistance apply to the cardiovascular system.	
6	Using only the following standards and learning concepts of structured verbal feedback, outline best practices for supporting resident development in ways that align with the standards. For each recommendation, cite specific standards and relevant structural feedback concepts to demonstrate alignment with program standards.	metabolism, oxygen consumption, biochemistry	Related to vascular tone (objective 2) and neural/hormonal regulation (objective 3), particularly in terms of atrial natriuretic peptide and metabolism.	
7	Create a table comparing self-directed eLearning, case-based learning, and simulation-based training for teaching Systems-Based Practice. Include factors, such as engagement level, scalability, cognitive load, real-time adaptability, faculty preparation time, assessment complexity, and learner autonomy.	<p>The standards emphasize the importance of formative evaluation and feedback to support resident development, recommending timely feedback during each educational assignment. Evidential learning concepts related to structures verbal feedback: Learners identified the importance of and preference for structured verbal feedback. Verbal feedback was associated with objective measures of improvement.</p> <p>Method</p> <p>Self-directed eLearning</p> <p>Case-based learning</p> <p>Simulation-based training</p>	<p>Recommendation: Implement regular structured verbal feedback sessions to provide residents with actionable guidance, focusing on both strengths and areas for improvement.</p> <p>Alignment with Standards:</p> <p>The standards emphasize the importance of formative evaluation and feedback to support resident development, recommending timely feedback during each educational assignment. Evidential learning concepts related to structures verbal feedback: Learners identified the importance of and preference for structured verbal feedback. Verbal feedback was associated with objective measures of improvement.</p> <p>Engagement level</p> <p>Moderate</p> <p>High</p> <p>Very high</p>	<p>Assessment complexity</p> <p>Moderate</p> <p>High</p> <p>Very high</p> <p>Application to clinical practice</p> <p>Indirect—focuses on foundational knowledge</p> <p>Strong—promotes critical thinking and decision-making</p> <p>Direct—replicates real-world clinical scenarios</p>
8	List active learning methods to teach first year medical students about systolic and diastolic heart failure using pressure-volume loops	<p>[Output is condensed for brevity]</p> <p>Here are several active learning methods tailored for teaching this topic in a small group setting. [Output included nine comprehensive strategies. One is listed for brevity]</p> <p>Concept mapping</p> <ul style="list-style-type: none"> Description: Have students create a concept map that ties together key concepts related to heart failure and pressure-volume loops, such as stroke volume, preload, afterload, contractility, and their effects in systolic and diastolic heart failure. Activity: As a group, create a large concept map on a whiteboard, linking how changes in the P-V loop [...] Goal: Concept mapping helps organize complex ideas and illustrates the interconnectivity of various factors in heart failure. Outcome: Students develop a visual, organized understanding of how heart failure impacts cardiac mechanics, especially through P-V loop alterations. 		
9	Highlight potential faculty training needs if our program includes objectives on interprofessional collaboration and systems-based practice.		The curriculum objectives stress interprofessional collaboration and systems-based practice, both of which require effective teamwork and knowledge of healthcare systems. It may be beneficial to provide faculty with workshops on team-based communication and strategies for navigating complex healthcare systems	

(continued)

Table 1. Continued.

	Prompt	Output
10	<p>Act as a faculty expert in use of AI for healthcare designing a 50-min session for medical students on best prompting practices and prompt engineering. Create an implementation checklist including the steps needed to implement the session using principles from Kern's 5th curriculum developmental step [2], implementation.</p>	<p>I've created a comprehensive implementation guide following Kern's curriculum development principles, specifically focusing on the implementation step. The guide includes detailed checklists and considerations across multiple domains:</p> <ol style="list-style-type: none"> 1. Temporal organization (pre-session, during session, post-session) 2. Resource requirements (technical, personnel, material) 3. Risk mitigation strategies 4. Assessment and evaluation plans 5. Quality improvement processes <p>[The full guide was five pages in length. An excerpt of pre-session planning is presented below.]</p> <p>Pre-session planning (4–6 weeks before)</p> <p>Administrative preparation</p> <ul style="list-style-type: none"> • Secure appropriate classroom/learning space with internet connectivity • Confirm session timing within curriculum schedule [...] <p>Test internet bandwidth requirements</p> <ul style="list-style-type: none"> • Ensure AI platform access (educational licenses if needed) • Prepare backup offline examples in case of technical issues [...] <p>Educational materials</p> <ul style="list-style-type: none"> • Develop slide deck with embedded examples • Create handouts with prompting templates [...]
11	<p>Make a multiple-choice question for preclinical medical students to assess knowledge of the learning objective 'Describe the hemodynamics changes as obtained by right heart catheterization seen in the four classes of shock.' Please generate a high-quality single best answer multiple-choice question that assesses application of knowledge per Bloom's taxonomy. [25] Follow the principles of constructing multiple-choice items in medical education.</p>	<p>A 56-year-old man hyperension, hyperlipidemia, and recent myocardial infarction presents to the emergency department with severe chest pain, dyspnea, and hypotension. [Truncated for brevity]</p> <p>A right heart catheterization is performed, and the following measurements are obtained: [Truncated for brevity]</p> <p>Which of the following is the most likely diagnosis based on the hemodynamic findings?</p> <p>A) Cardiogenic shock due to acute myocardial infarction B) Hypovolemic shock due to gastrointestinal bleeding [Output included options A-D]</p> <p>Correct Answer: A) His hemodynamic profile is consistent with cardiogenic shock. [Output included a detailed description of correct and incorrect answers]</p>
12	<p>Describe assessments that evaluate a learner's competency at a systems level with tasks like identifying patient safety issues and opportunities for quality improvement.</p>	<p>The framework includes multiple assessment methods to evaluate different aspects of competency:</p> <ol style="list-style-type: none"> 1. Direct observation assessments allow evaluators to see how learners identify and respond to safety concerns in real clinical settings 2. Written assessments test theoretical knowledge and analytical capabilities through case studies and structured questions 3. Practical assessments measure hands-on skills through simulations and project work 4. Integration assessments evaluate how learners apply their knowledge across different contexts <p>consistent evaluation. The framework also provides guidelines for: Assessment frequency, Performance standards, Remediation processes, Documentation requirements</p>

*Large language model.

world-wide. AI models can assist in crafting these goals and objectives for each rotation, specifying the competencies residents are expected to meet. See [Table 1](#) for an example of the prompt and output for Tip 4. In one instance, our team used the model to draft goals and objectives, which program leadership collaboratively refined. The finalized objectives met accreditation standards and were completed within an hour, illustrating how AI can efficiently support curriculum development while preserving faculty oversight for quality and compliance.

Tip 5: Map accreditation requirements, competencies, and content descriptors to educational learning objectives

Educators use content lists endorsed by governing, accrediting, licensing, or programmatic leaders. Content lists may be specific to their country, specialty, or institution, and the content features from these lists inform educational objectives. LLMs may be used to connect accreditation standards to learning objectives by efficiently summarizing, categorizing, and tabulating data extracted from text. For example, content lists may be tabulated alongside corresponding learning objectives to identify content features falling outside existing objectives as curricular gaps.

We used an AI model to complete a curricular gap analysis for block phases in the pre-clerkship UME setting. See [Table 1](#) for an example of the prompt and output for Tip 5. Use of the AI model reduced the time to review and ensure appropriate linking of content features and curricular content by >50%. Our prompting resulted in high sensitivity for inclusion of related learning objectives, such that content relevancy to the descriptors was at times minimal and needed human oversight. To further constrain the output, we prompted the model with a follow-up prompt to remove extraneous data which ensured desired specificity thresholds for content relevancy.

**Curriculum developmental step 4:
Educational methods**

Tip 6: Restrict the LLM to a specific knowledgebase when aligning requirements or educational research to instructional or assessment methods

Configuring an LLM to reference specific standards ensures responses precisely align. By instructing the AI model to cite specific sections from these documents, educators can fact check the accuracy of recommendations. For example, when focusing on feedback, uploading both learning concepts from

research and summaries of related requirements allows the model to align strategies with standards. See [Table 1](#) for an example of the prompt and output for Tip 6.

By using the model to cross-reference requirements with learning concepts from educational research, faculty can streamline the process of mapping research-based insights onto required standards. This approach reduced the time spent locating and aligning supporting evidence with specific requirements, enabling faster development of instructional strategies and assessment methods. Prompting the AI model to provide exact section numbers and page references helped faculty efficiently verify the alignment and accuracy of recommendations. While manual validation of citations remains necessary, the model offers a reliable starting framework, shortening the initial research phase.

Tip 7: Use tables for comparative analysis in developing educational strategies

LLM's can generate comprehensive comparison tables formatted to include desired elements like learner autonomy, real-time adaptability, cognitive load, and faculty resource needs. These detailed tables provide faculty with an in-depth view of how various instructional methods address specific competencies, supporting more informed decisions tailored to the unique demands of medical training. See [Table 1](#) for an example of the prompt and output for Tip 7. The AI model's output (see Tip 7 on [Table 1](#)) clearly compares methods (self-directed eLearning, case-based learning, and simulation-based training) across critical factors like engagement, scalability, cognitive load, and real-time adaptability.

Using the AI model-enhanced decision-making by presenting complex information in a digestible format helped faculty identify the most suitable teaching methods. By integrating this tool, faculty saved time evaluating instructional options and making evidence-based decisions tailored to medical education. These tables also served as learning aids, giving residents a clear understanding of training methods and their clinical applications.

Tip 8: Mapping best practice educational methods to goals and objectives

When selecting educational strategies for specific learning objectives, active learning methods are a superior approach as they have been shown to promote better retention and application of knowledge [18]. LLMs can be utilized to link active learning strategies to specific learning objectives where active

learning may be less easily envisioned. See [Table 1](#) for an example of the prompt and output for Tip 8.

Use of LLMs for implementing active learning in curricula saves time and generates multiple novel ideas when difficult to envision change. A review of the suggestions generated by an LLM is essential to ensure accuracy, as LLMs can include incorrect information or generate infeasible ideas that may not be evidence based. See Tip 7 for ways to perform a comparative analysis of educational strategies.

Curriculum developmental step 5: Implementation

Tip 9: Map faculty development needs to curricular objectives

LLM's can assist in reviewing curriculum objectives to identify areas where faculty might benefit from additional development and resources. For example, if objectives emphasize interprofessional collaboration, an AI model can suggest where faculty development may be enhanced. This approach helps curriculum designers ensure that faculty skills and available resources are well-matched with requirements, promoting a cohesive and supportive learning environment. See [Table 1](#) for an example of the prompt and output for Tip 9.

Literature suggests that systematic needs assessments are often missing from faculty development initiatives [19]. AI model recommendations bridge this gap by providing an initial framework to align faculty development with curricular objectives, streamlining the planning process and saving time while offering a structured starting point. While outputs require refinement to ensure their applicability, this approach enables faculty to focus on implementing strategies that better address curricular demands, fostering a more effective educational environment.

Tip 10: Create an implementation plan and checklist

Successful curricular implementation involves diligent project management with consideration of a specific implementation plan. LLM's can generate an implementation plan and checklist, providing educators with a helpful framework for considering needs. We applied this to the implementation of a novel session within an existing UME AI curriculum. See [Table 1](#) for an example of the prompt and output for Tip 10. The implementation guide output was comprehensive. It included all the elements considered by the team and elements that had not been anticipated by the team, preventing potential implementation missteps.

Using an LLM saved an estimated 32 hours of faculty and administrative time by addressing the implementation design in a proactive and comprehensive manner rooted in Kern's curriculum development framework [2]. The output included elements that lacked relevance to our implementation, and it did not identify elements unique to our institutional structure. Both limitations were easily identified through traditional processes.

Curriculum developmental step 6: Evaluation

Tip 11: Write multiple-choice questions mapped to specific learning objectives

In Kern's curriculum development process, learner assessment is an essential step to ensure appropriate transference of knowledge [2]. LLMs are excellent tools for multiple-choice question (MCQ) generation and there are many studies demonstrating the utility of AI with MCQ generation [20–23]. One article used AI to find gaps between assessment and learning objectives from a curriculum map [24]. When starting from a curriculum map, LLMs can generate new MCQ in alignment with specific levels of Bloom's taxonomy [25] (i.e. recall vs. application of knowledge) from learning objectives. By constraining the model to specific learning objectives, learner characteristics, and level of Bloom's taxonomy, educators may produce precise questions with assessment intentionality. See [Table 1](#) for an example of the prompt and output for Tip 11. LLMs reduced the time required to write a single MCQ by 80%. Human oversight is required to identify questions or answers that contain inaccuracies.

Tip 12: Aligning programmatic evaluations with accreditation requirements and programmatic objectives

The final step in curriculum mapping involves evaluation of the health education program itself to ensure it has achieved its aims while identifying areas in need of improvement. UME and Graduate Medical Education (GME) aim to ensure physician accountability and have moved toward competency-based assessment [26]. Foundational competencies for UME define observable and measurable abilities of students. Curriculum evaluation may involve mapping the competency to the existing curriculum using strategies in the above tips, such mapping the competency to learning objectives, educational strategies, or assessments. LLM capabilities extend beyond these functions of text summary, synthesis, or transformation.

We utilized an LLM as an idea-generating collaborator to co-design plans to improve assessment strategies for foundational competencies. In this

example, we utilized it to design assessments for one systems-based practice foundational competency [27]. See Table 1 for an example of the prompt and output for Tip 12. The output included a document presenting the framework and involved elements. We found that this single prompt and output saved four faculty hours involved in generating ideas and organizing novel approaches to assessing competency. Faculty were able to brainstorm ideas and compare them to the framework, editing the framework to achieve their desired approach.

Conclusion

Artificial intelligence holds terrific promise for enhancing curricular development by improving the efficiency and effectiveness of fundamental curricular mapping processes. These twelve tips demonstrate the utility of AI applications of textual analysis, synthesis, and transformation in stages of curriculum mapping. Refer to Appendix 1 for details about which AI tools were used. The tips show AI capabilities for generating curricular objectives, instructional methods, implementation tools, and assessments.

Educational teams utilize curricular mapping to visualize curricular components and recommend strategies for curriculum development and continuous educational quality improvement. A major limitation of traditional curriculum mapping is the inability to track changes overtime as they apply to individual learners progressing through the curriculum. For example, as curriculum maps evolve, it can be difficult for a teacher to understand exactly what a fourth-year student studied as a first-year student. Current AI applications demonstrate both promise and limitations in dynamic medical curriculum design. AI holds promise for identifying relationships between mapping variables through machine learning algorithms, thereby lending valuable insight to curriculum specialists [28]. AI has established its utility as a technological collaborator to assist with curriculum mapping tasks, making contributions that facilitate the work of educational teams [10,11]. As the use of AI grows in medical education, AI can be used to transform Learning Management Systems to be teacher and student oriented, adaptive, and monitor changes over time [29–31]. While both human and technological collaborators share capability limitations in their potential to produce errors and biases, both additionally possess promising potential to mitigate error or biases by reflecting on their own processes for improvement. The current human-technological collaboration represents merely the initial phase of a continual transformative journey, with vast unexplored potential for revolutionizing medical education processes still on the horizon.

Responsibility and accountability, however, remain qualities that are distinctly human and render distinctly human capabilities. Educators' oversight of educational structures and processes extends beyond tasks of monitoring curricular alignment with requirements, objectives, or educational research. Humans have moral agency to make conscious decisions based on their understanding of ethical and emotional consequences. Educational teams have the ability to learn from subsequent feelings of pride or remorse when evaluating educational outcomes. They contend with the consequences of their educational actions, be they legal, professional, or personal, and their reputations and relationships are impacted by their choices.

Human-AI collaboration uses AI systems to enhance rather than replace human cognitive capabilities. We believe these tips demonstrate the potential of medical education to adapt curriculum mapping processes using AI tools. As medical education embarks on a journey toward AI acceptance, the tips represent early steps in moving from AI-resistance toward the constructive work of deploying the tools in a professionally responsible and ethically accountable manner.

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31. Mavroudi A, Giannakos M, Krogstie J. Supporting adaptive learning pathways through the use of learning analytics: developments, challenges and

Appendix A. Portions of this work were assisted by Anthropic Claude, Microsoft Copilot, Chat GPT, and Open AI. The tools were used to support tasks, such as drafting, generating output, and refining text. The authors reviewed and verified all AI-assisted content to ensure accuracy and appropriateness. The tools were accessed from April 2024 to May 2025. The following models were used:

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