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# Twelve tips on applying AI tools in HPE scholarship using Boyer's model

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### Twelve tips on applying AI tools in HPE scholarship using Boyer's model

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#### ABSTRACT

Al has changed the landscape of health professions education. With the hype now behind us, we find ourselves in the phase of reckoning, considering what's next; where do we start and how can educators use these powerful tools for daily teaching and learning. We recognize the great need for training to use AI meaningfully for education. Boyer's model of scholarship provides a peda-gogical approach for teaching with AI and how to maximize these efforts towards scholarship. By offering practical solutions and demonstrating their usefulness, this Twelve tips article demonstrates how to apply AI towards scholarship by leveraging the capabilities of the tools. Despite their potential, our recommendation is to exercise caution against AI dependency and to role model responsible use of AI by evaluating AI outputs critically with a commitment to accuracy and scrutinize for hallucinations and false citations.

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### Introduction

Recent advances in Artificial Intelligence (AI) have the potential to transform the educational landscape. With the release of new tools and features at a rapid pace, Health Professions Educators (HPE) are often overwhelmed by the possibilities, and require guidance to acquire competence and familiarity with these tools [1–3]. HPE efforts to develop skills in using and implementing AI solutions in health education should be recognized as scholarship due to their potential for dissemination and adoption. Having a good understanding of the types of AI [4,5] is crucial before we delve into applying AI solutions. Although impressive, these tools have significant limitations.

As HPE consider integrating AI in the curriculum, they need to be aware of their strengths and limitations. HPE need to be intentional and utilize these tools in pedagogically sound learner-centered approach [6]. HPE should critically analyze the outputs from AI and not blindly follow information generated by Large Language Models (LLM) like ChatGPT due to their tendency to hallucinate and generate erroneous results [7].

To define how to use AI for scholarship, we highlight the domains of scholarship as described by Boyer [8]. We chose Boyer's model due to its utility for HPE to convert their everyday scholarly activities to scholarship using the four scholarship domains of discovery, integration, application, and teaching (Figure 1). The tips will be arranged according to the model with each domain sub-divided into three parts, explained and then supported by examples of AI.

### Scholarship of discovery

Scholarship of discovery contributes to improving the stock of human knowledge and also improves the intellectual climate of one's learning environment by providing insights and challenging understanding. It is not focused only on the outcomes, but also on the process of obtaining knowledge, especially the passion to pursue knowledge, hence making the effort of knowledge acquisition exciting. The pursuit of the scholarship of discovery must be assiduously cultivated and defended, as this new knowledge enlivens faculty and invigorates learning. Al fosters this excitement, with the potential to supercharge mundane everyday activities.

### Tip 1: Using Al-powered searches to generate and prioritize knowledge feeds

Knowledge building starts with filtering out unwanted information and prioritizing relevant knowledge specific to the needs of HPE, by differentiating signal from noise. Al's application in synthesizing medical knowledge and aiding education, helps HPE stay current [9] through personalized and customized recommendations [10]. Prioritizing alerts from journals, newsletters from professional communities and feeds from scientific databases such as PubMed can enable knowledge discovery. PubMed uses a controlled hierarchical vocabulary organizer for indexing, cataloging and searching called Medical Subject headings (MeSH) [11]. These terms translate key words into controlled vocabulary leading to precise searches, using synonyms and related concepts.

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### **AI SOLUTIONS TO APPLY BOYERS MODEL OF SCHOLARSHIP**

### **Scholarship of Discovery**

AI solutions for HPE problems and questions with useable knowledge

**Tip1:** AI feeds address information overload (Scite, Pubmed, Inoreader)

**Tip 2** Al searches with citation mapping (Research Rabbit)

Tip 3: Al generates smart citations to identify articles to read (Scite)

### Scholarship of Integration

### Al solutions for interdisciplinary approaches problems with HPE silos

**Tip 4:** Al network mapping identifies related articles and authors from collection (Research Rabbit) **Tip 5:** Al network graph identifies seminal articles

(Connected Papers, Litmaps)

**Tip 6:** Al summaries identify important lietarture in a topic (Consensus, Elicit)

### Scholarship of Application

AI provides solutions to apply knowledge in real world contexts

Tip 7: Al solutions for clinical decision making (OpenEvidence) Tip 8: Al for point of care recommendations (Dynamed)

Tip 9: Al solutions to enable Faculty

(Struugling Student Custom GPT, Khanmigo)

Figure 1. Al Solutions to apply Boyers model of scholarship.

Leveraging these advanced search features within PubMed can refine results for feed generation. Articles from these feeds auto populated to repositories are easily accessible to HPE and their learners. Feed generators that incorporate ML (e.g. *Semantic Scholar, Scite, Inoreader* and *PubMed*) identify the latest articles on a topic. HPE can rapidly review one-line summaries from Semantic Scholar feeds to identify relevant articles in their collection. These collections can be used for scholarly activities such as journal clubs, community learning and collaborative manuscript writing (Figure 2).

### **Tip 2: Amplify searches**

Over time, health professions' efficiency in literature searches has rapidly improved, as we have moved from searching library catalogues to online databases, to Al-powered searches. Most HPE use MeSH headings and keywords to search articles, which involves a 'sifting' process of going through irrelevant articles to identify relevant articles. The creativity and latitude in this process is time-consuming and occasionally frustrating.

### Scholarship of Teaching

Al enables best practices to achieve educational purpose Tip 10: Al lesson plans to apply instruction using PICRAT (NotebookLM) Tip 11: Al provides learner centered question bank (Custom GPT, Gems) Tip 12: Al assisted adaptable learning (Custom GPT, Computerized adaptive testing)

Al can be used to streamline and amplify searches that are specific and targeted to deliver high yield results using Research Rabbit. This open access software can be used to find linked and associated articles on a topic. Starting with a topic search, HPE can upload additional articles of interest (by title or DOI) to create a collection. This collection is amplified to identify related articles under 'similar work,' and 'prior work' visually portrayed in a citation mapping tool. HPE can explore further from 'network' and 'timeline' connections on the mapping tool and identify associated authors (discussed further in Tip #4). The search results can be filtered for relevance, citations, recency, and authors. However, efficiency should not be the only consideration when amplifying searches. The network features do not work effectively for a recently published article. Tip 5 offers a solution. Litmaps is an additional tool with similar functionality that can be used for amplifying searches with full functionality accessible with a subscription.

## Tip 3: Identify supporting, disputing facts on articles

After identifying the relevant articles through feeds and by amplifying search, the next step is synthesizing and

	Tools to implement Boyer's Framework						
	Tools	Functionality	Access	Scholarly Activities			
ery	PubMed	Create feeds specific to keyword seraches and topics of interest	Open	Create library of latest articles for group activities, create repositories for learning communities			
	Inoreader	Feed generator, review abstracts	Open upto 150 feeds Subscription	Discuss the recent articles as hot topics chalk talk			
SCOV	Research Rabbit	Citation mapping tool amplifies searches	Open	Create group folder for manuscript writing,			
Dis	Scite	Provides supporting and disputing facts with smart citations.	Open Subscription	Journal club to reflect on accuracy of smart citations			
Integration	Research Rabbit	Citation mapping tool to identify authors in other specialties	Open	In class activity on applying Connectivism to identify GenAI experts outside of HPE			
	Litmaps	Provides mapping based on citations	Open- 20 searches Subscription	Perform a search on a hot topic and expand search			
	Connected Paper	Provides expanded search on a topic , provides prior and derivative citations	Open 5 graphs/mth	Create a bibliography on topic of interest			
	Consensus	Summarizes, performs initial literature review	Open - 10 results/ mth Subscription	Compare how consensus fared with traditional literature review			
	Elicit	Extracts data and provides list of concepts from article collections and generates summaries	Open/ ulimited searches, Subscription	Use extracted data during in-class activity for crtical analysis			
Application	Open Evidence (OE)	Provides latest evidence on patient care management questions, suugests work up, acid base balance calculations	Open to health care professionals with licence	Reflect on how clinical management from OE compared with real patient management follwoing teaching rounds			
	Dynamedex	Provides medication dosing with details on side effects, provides CME credits for courses, specialty specific	Open for health care professionals	Compare Dyanmedex with UpToDate recommendations			
	Khanmigo	Adaptable learning management system resources for students	Open	Create a lesson plan for a struggling student			
eaching	NotebookLM	Creates podcast and lesson plans from articles	Open	Reflect on a podcast created by NotebookLM during journal club			
	Custom GPT	Interactive GPT that can be tailored to needs of the learner	ChatGPT subscription	Provide pre-class activity for students to gain deeper understanding			

Figure 2. Al tools to implement Boyers framework.

analyzing the articles for application in various contexts. Frequently, this requires cognitive processing, deep learning, and analysis of scientific articles in journal club discussions and application in clinical contexts. Al can be leveraged to identify articles that cannot be overlooked. *Scite* enables researchers to discover supporting and disputing facts on the curated collections, through *Smart Citations*. This feature can be integrated into an open access citation manager tool such as *Zotero* (Figure 2).

Smart citations demonstrate how a scientific paper has been cited by providing details on context of the citation by classifying with supporting or contrasting evidence for the cited claim or if the fact has just been mentioned [12]. We recommend using the *Scite* plugin in *Zotero* to identify smart citation features. Scientific article collections can be leveraged for manuscript writing by a team using *Zotero* groups and for instruction as discussed in Tip 9 and 10.

### Scholarship of integration

Having discovered new knowledge, the next step is to identify interconnectedness across disciplines by posing the question 'what do the new findings mean?' Scholarship of integration involves making connections across disciplines while synthesizing information to reveal new insights. It helps to view the HPE research in relation to others. We highlight Al solutions that enable exploring the interconnectedness with other specialties through Connectivist approaches [13].

### Tip 4: Discovering and exploring articles and authors related to your specialty

Healthcare professionals live in silos, reading their own profession's literature and attending conferences specific to their specialties. Answers to questions that a particular discipline might be struggling with might be available in other groups. Increasingly, the solutions and products created by professionals working on data science, robotics and machine learning are being integrated into healthcare. It is thus even more important for HPE to review and synthesize information from these disciplines.

Several new Al tools make this task easier. An example is *Research Rabbit* which use Al-powered, visual citation mapping tool for literature discovery by generating a map revealing a network of related works, showing relationships between articles their citation, authors, and research areas. *Research Rabbit* detects the common area of interest from a collection of papers and their mapping tool makes it easier to identify connections between specialties, identifying seminal articles, related authors, topics, or fields. These tools make it easier to bridge related disciplines and help HPE with integrating information across specialties.

### Tip 5: Discovering and exploring papers and authors from a single paper

While similar to *Research Rabbit*, other tools expedite discovery of related papers and authors with a single paper. *Connected Papers*, analyzes thousands of papers related to the original article. It presents the most relevant papers as a network graph. The most closely connected papers are placed closer together, allowing for easy discovery of literature around related concepts. The ability to start with a single paper, however recent, makes it extremely useful when building a database of literature on a particular topic. It highlights the seminal papers in the area and their connected areas of research.

Currently, *Connected Papers* allows for generation of five network graphs per month for free. HPE should consider limitations that these tools may not be freemium or may even become defunct. It is essential to focus on their functionality and readily adapt to a changing technology landscape. *Litmaps* allows for exploring additional and related publications using citations and authors.

### Tip 6: Summarize/synthesize articles for scholarship and teaching

Having highlighted how to use AI for knowledge generation and identifying interrelated articles, we discuss using AI for synthesis and summarizing literature. Integrating knowledge across disciplines reveals new knowledge and enables us to recognize expertise outside of health care silos through connectivism [13].

*Scite, Consensus* and *Elicit* can synthesize articles to generate brief summaries and metrics about articles allowing for deep exploration and learning by providing facts from analytics on articles. These summaries can be filtered based on the recency of articles, type of study, and the rigor of peer review process. These instruments can alert reviewers to articles that are retracted, and inform institutions of how their articles were cited rather than simply state that they have been cited [12]. It should be noted, however, that contradicting citations in *Scite* were rare even in the cases of retracted articles [14]. *Elicit* and *Consensus* have limitations to the number of searches and functionalities on the free account.

### Scholarship of application

To disseminate newfound knowledge constructed from discovery and integration of multidisciplinary information, we consider Scholarship of Application. This translates research and knowledge into practice, bridging theory with realworld contexts such as clinical decision making, education and patient care.

### Tip 7: Use latest evidence-based articles for clinical decision making

With the volume of medical literature growing rapidly, HPE are increasingly challenged to keep pace with the latest research and its application to clinical practice. General LLMs like ChatGPT should not be used for medical advice, as the data used to train them may not be based on the

latest peer-reviewed literature. *OpenEvidence* utilizes LLMs, but the model is paired with a pool of constantly updated data from medical journal articles. This allows the model to aggregate and synthesize clinically relevant evidence to generate in-depth responses to support HPE decision-making with updated information.

The model's performance relies upon its extensive, current medical knowledge base which includes published clinical guidelines and high-impact journals. The responses generated include citations and links to referenced publications providing transparency and veracity. The HPE can engage in further dialogue to gain a deeper understanding or explore related topics. The latest features include prior auth applications, anion gap calculations and the ability to get notifications to previous management queries, HPE can truly stay current and informed. However, HPE should take the responsibility of determining the value of the output while critically reviewing results.

### Tip 8: Employ GenAl in point of care settings

GenAl tools have been designed to enhance specialty specific point-of-care use. *DynaMedex* employs LLMs with a curated database of evidence-based medical content to address queries pertaining to drug information delivered on a mobile platform. The tool utilizes *Micromedex*, a comprehensive database for drug information, toxicology, and disease management. Using the Al assistant, HPE can ask questions in conversational style, such as: 'what is the pediatric dosing for amoxicillin for otitis media?,' or 'is warfarin safe to use by a breastfeeding mother?' The ability to converse naturally and receive immediate focused responses eliminates time spent searching and scrolling through pages of drug information.

### Tip 9: Enable faculty to use AI in education

In this rapidly-evolving landscape of Al, it is essential to keep up with the changing functionality, tools, and best practices by belonging to a community of practice. Like our experiences in COVID-19, if we don't take the time to discuss and learn how to best use Al in pedagogically informed ways, we may miss crucial discussions on ethical considerations and practical implications.

Faculty need more than a basic understanding of AI (e.g. defining LLMs, prompt engineering techniques), with exposure to AI tools that provide adaptable learning. These examples include personalized learning platforms and intelligent tutoring systems (ITS) such as *Khanmigo and* custom GPTs [15] which provide learner-centered teaching. Another approach to introduce AI is to explicitly model use of AI in scholarship, normalize its use, critically analyze outputs and develop faculty skills in various roles and applications [16,17] to actively address the 'fear of the unknown'.

Adopting approaches such as microlearning, learners as teachers and workplace-based learning may lend themselves to a pragmatic faculty development approach on Al [18]. Now that we have familiarized ourselves with the tools, let us consider how to apply them through teaching.

### Scholarship of teaching

The valuable work of the HPE only becomes consequential when understood by the learner through the Scholarship of Teaching. This involves the systematic study and dissemination of knowledge related to educational practices. Harnessing the full potential of the AI tools enables HPE to transform education rather than merely transmit information.

### Tip 10: Create lesson plans with journal articles

It is important for HPE to ensure that teaching improves learner outcomes by using evidence-based practices. GenAI tools allow both pedagogic integration in the curriculum and sharing of instructional resources with other HPE. They make it easier to create interactive multi-modal learning activities based on principles of Constructivist and collaborative learning.

Google's *NotebookLM* is a free resource that provides all these functionalities. It generates educational resources called 'notebooks' from a collection of curricular content. These include questions for short and essay-type assignments, glossaries, frequently asked questions, audio overviews (podcasts), study guides, summaries, and timelines. The HPE can use these for flipped classrooms, in-class interactivity, group work and deep dives into a topic. These notebooks can be shared with learners and other HPEs. Their effectiveness can be studied using educational research methodologies.

### Tip 11: Create learner-centered question bank

Question creation, whether for formative or summative assessment, is resource intensive. GenAl tools can create at least the first draft of these questions. Inaccuracy is a limitation of GenAl systems, as they draw unfiltered information from the Internet. The result is that GenAl-generated questions may be of limited value, with several flaws (e.g. inappropriate to students' level, inaccurate or irrelevant).

The solution is to create *custom GPT* [19]. Teachers can create their own question-generating custom GPT with specifications:

- Information sources: restricted to specific notes, articles, and websites.
- Language: tone, complexity, jargon.
- Type (e.g. single-answer MCQs with five distractors, scenario-based), and
- Level (e.g. using Bloom's Taxonomy).

Custom GPT *creation* requires a subscription license, but custom GPT *usage* does not, so your students can access them through a free OpenAl account. One such GPT is the *Case-Based MCQ generator* [20,21]. Google Gemini's equivalent is called Gems and Projects is the custom GPT for Anthropic's Claude.

### Tip 12: Adaptive teaching and learning for accurate assessments

Electronic Adaptive Learning grew from the potential of early 'hypermedia' [22] and evolved into Web-based environments [23]. Evolving into an Al-supported environment appears to be the next logical step.

Briefly put, Adaptive Teaching and Learning (ATL) is the education method that allows material to be presented in a range of formats, sizes and levels, the choice of which is dependent upon the mastery of previous material as afforded by Custom GPT. Another application of the iterative process of teaching and formative assessment, use the principles of Computer-Adaptive Testing [24], during which the student is tested based on their skill level, and their performance determines testing experience, until the final required level is reached.

As one can imagine, the resources required for material structuring and question creation and alignment are even greater than described in Tip 11. The material must be broken into logical sizes that can stand independently of each other, and can be interrogated by meaningful, formative assessment questions with diagnostic capabilities and branching scenarios. More focused materials allow for pointed questions, with greater value of ATL requiring more effort in construction. Although ChatGPT could be used, the repetitive and refining nature of the tasks would be better served by designing a custom GPT.

### Conclusions

Al has the potential to transform the entire milieu of HPE and scholarship. As a growing field, digital scholarship can be leveraged to enhance scholarship. There is a great need for clear guidelines on the use of Al for HPE and its ethical use [25]. Our learners will continue to use Al tools even if it is considered cheating to use them [3]. In addition, there are several concerns for limitations, inaccuracies and biases of Al [26,27]. Using Al tools in pedagogically informed ways can help HPE explore the advantages and disadvantages they may afford for efficiencies, creativity informed by large data analysis.

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#### References

- Lee J, Wu AS, Li D, et al. Artificial intelligence in undergraduate medical education: a scoping review. Acad Med. 2021;96(11S): S62–S70. doi: 10.1097/ACM.00000000004291
- Russell RG, Lovett Novak L, Patel M, et al. Competencies for the use of artificial intelligence–based tools by health care professionals. Acad Med. 2023;98(3):348–356. doi: 10.1097/ACM. 000000000004963
- Shoja MM, Van de Ridder JMM, Rajput V. The emerging role of generative artificial intelligence in medical education. Res Pract Cureus. 2023;15(6):e40883.
- Turner L, Hashimoto DA, Vasisht S, et al. Demystifying Al: current state and future role in medical education assessment. Acad Med. 2024;99(4S Suppl 1):S42–S47. doi: 10.1097/ACM. 000000000005598
- Cervantes J, Smith B, Ramadoss T, et al. Decoding medical educators' perceptions on generative artificial intelligence in medical education. J Invest Med. 2024;72(7):633–639. doi: 10.1177/ 10815589241257215
- Mehta N, Agrawal A, Benjamin J, et al. Pedagogy and generative artificial intelligence: applying the PICRAT model to Google NotebookLM. Med Teach. 2024;0(0):1–3. doi: 10.1080/0142159X. 2024.2418937
- Masters K. Medical teacher's first ChatGPT's referencing hallucinations: lessons for editors, reviewers, and teachers. Med Teach. 2023;45(7):673–675. doi: 10.1080/0142159X.2023.2208731
- Poston L, Boyer EL. Scholarship reconsidered: priorities of the professoriate. Academe. 1992;78(4):43. doi: 10.2307/40250362
- Almansour M, Alfhaid FM. Generative artificial intelligence and the personalization of health professional education: a narrative review. Medicine (Baltimore). 2024;103(31):e38955. doi: 10.1097/ MD.000000000038955
- Knopp MI, Warm EJ, Weber D, et al. Al-enabled medical education: threads of change, promising futures, and risky realities across four potential future worlds. JMIR Med Educ. 2023;9(1): e50373. doi: 10.2196/50373
- Kiester L, Turp C. Artificial intelligence behind the scenes: PubMed's best match algorithm. J Med Libr Assoc. 2022;110(1): 15–22. doi: 10.5195/jmla.2022.1236

- Nicholson JM, Mordaunt M, Lopez P, et al. scite: A smart citation index that displays the context of citations and classifies their intent using deep learning. Quant Sci Stud. 2021;2(3):882–898. doi: 10.1162/qss\_a\_00146
- Benjamin J, Pillow T, MacNeill H, et al. Reflections from the pandemic: is connectivism the panacea for clinicians? J Med Internet Res. 2024;26(1):e53344. doi: 10.2196/53344
- Nicholson JM, Uppala A, Sieber M, et al. Measuring the quality of scientific references in Wikipedia: an analysis of more than 115M citations to over 800 000 scientific articles. Febs J. 2021; 288(14):4242–4248. doi: 10.1111/febs.15608
- 15. Struggling Student. Available from: https://chatgpt.com/share/ 672391c1-1098-8004-b4f6-6bca31045c74.
- Lomis K, Jeffries P, Palatta A, et al. Artificial intelligence for health professions educators. NAM Perspect. 2021;Page 3-4 2021. https://nam.edu/artificial-intelligence-for-health-professions-educators/
- EDUCAUSE Review. A framework for Al literacy [Internet]. [cited 2024 Nov 9]. Available from: https://er.educause.edu/articles/ 2024/6/a-framework-for-ai-literacy.
- Fawns T. An entangled pedagogy: looking beyond the pedagogy—technology dichotomy. Postdigit Sci Educ. 2022;4(3):711– 728. doi: 10.1007/s42438-022-00302-7
- Masters K, Benjamin J, Agrawal A, et al. Twelve tips on creating and using custom GPTs to enhance health professions education. Med Teach. 2024;46(6):752–756 doi: 10.1080/0142159X. 2024.2305365
- Kıyak YS, Kononowicz AA. Case-based MCQ generator: a custom ChatGPT based on published prompts in the literature for automatic item generation. Med Teach. 2024;46(8):1018–1020. doi: 10.1080/0142159X.2024.2314723
- MCQ Generator. Available from: https://chat.openai.com/g/gvuyyH0jUp-case-based-mcq-generator.
- Brusilovsky P. Methods and techniques of adaptive hypermedia. User Model User-Adap Inter. 1996;6(2–3):87–129. doi: 10.1007/ BF00143964
- 23. Brusilovsky P, Peylo C. Adaptive and intelligent web-based educational systems.
- Schuwirth LWT, Van der Vleuten CPM. Programmatic assessment: from assessment of learning to assessment for learning. Med Teach. 2011;33(6):478–485. doi: 10.3109/0142159X.2011. 565828
- Masters K. Ethical use of artificial intelligence in health professions education: AMEE Guide No. 158. Med Teach. 2023;45(6): 574–584. [Internet]. https://www.tandfonline.com/doi/abs/10. 1080/0142159X.2023.2186203
- Baxter K, Schlesinger Y. Managing the risks of generative AI. Harvard Business Review [Internet]. 2023 [cited 2024 Sep 24]. Available from: https://hbr.org/2023/06/managing-the-risks-ofgenerative-ai.
- Currie GM, Hawk KE, Rohren EM. Generative artificial intelligence biases, limitations and risks in nuclear medicine: an argument for appropriate use framework and recommendations. Semin Nucl Med. 2024: page 10-11. https://www.sciencedirect.com/science/article/pii/S0001299824000461 doi: 10.1053/j.semnuclmed. 2024.05.005