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Promoting AI literacy through U.S. academic libraries: an analysis of LibGuides from ARL and Oberlin group libraries using the EDUCAUSE AI literacy framework

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Abstract

Introduction. As the integration of artificial intelligence (AI) rapidly advances, academic libraries are increasingly pivotal in supporting AI literacy among students and faculty.

Method. Through content analysis, the present study examines 70 newly developed generative AI LibGuides from academic libraries affiliated with the association of research libraries (ARL) and the Oberlin group, using the EDUCAUSE AI literacy framework.

Analysis. Through a detailed examination, the present research reorganizes and improves the EDUCAUSE AI literacy framework, proposing a more comprehensive version tailored to higher education needs. The adapted framework fills the gaps in the original model and offers a nuanced approach to AI literacy, reflecting the unique challenges faced by academic libraries.

Results. The findings reveal that most LibGuides emphasize foundational AI tools and responsible use, with less focus on advanced technical competencies related to AI creation. Significant differences were observed between ARL and Oberlin Group LibGuides, with ARL offering more comprehensive coverage. To address these differences, consistent training and knowledge sharing initiatives are recommended to ensure a common standard of AI literacy support across academic libraries.

Conclusion. This study provides insights into the role of libraries in promoting generative AI literacy and identifies areas for future strategic partnerships and improvement.

Introduction

As the integration of artificial intelligence (AI) rapidly advances, academic libraries are increasingly pivotal in supporting AI literacy among students and faculty (Mairn, 2024). This study provides a novel examination of how U.S. academic libraries, particularly those affiliated with the ARL and Oberlin Group, address generative AI through their library guides (hereafter referred to as LibGuides). Employing content analysis guided by the EDUCAUSE AI Literacy Framework, this study focuses on 70 recently created LibGuides dedicated to generative AI.

The originality of this study lies in the adaptation of the EDUCAUSE AI Literacy Framework, developed for Barnard College to guide AI literacy in educational settings (Hibbert et. al., 2024), within the context of academic library guides. This framework, which comprises four levels: *understanding* AI, *use and apply* AI, *analyse and evaluate* AI, and *create* AI, was reorganized to align more closely with the specific characteristics and objectives of LibGuides.

The present study holds strong implications for advancing AI literacy in higher education. By reorganizing and enhancing the EDUCAUSE AI literacy framework, it proposes a more comprehensive framework tailored specifically to the needs of higher education institutions. This adaptation addresses gaps identified in the original framework, offering a nuanced approach to AI literacy that reflects the unique challenges and opportunities faced by academic libraries.

Additionally, the study highlights on the evolving role of librarians in the higher education setting and their collaboration with faculty, AI experts, and other campus stakeholders in promoting AI literacy. Understanding how librarians and campus stakeholders may share responsibilities in disseminating AI knowledge provides valuable insights into how these roles can work together more effectively. This may pave the way for future research on optimizing collaboration between librarians' and other campus members' roles to address the broader impact of AI.

This study also identifies limitations in librarians' current approach, such as the often-limited technical depth in their guides. These findings highlight the need for further research into librarians' competencies and the future training required to meet the growing demands of AI literacy education. Addressing these limitations is crucial for enhancing the effectiveness of library resources and services while empowering librarians in their key role in advancing AI literacy.

Literature review

Generative artificial intelligence (AI) creates new images, text, and software by learning from existing data without directly replicating it. Although AI development has been ongoing for years, the launch of ChatGPT in November 2022 captured global attention due to its ease of use through natural language interaction. While generative AI offers considerable convenience, it also raises critical concerns, including issues of transparency, accuracy, bias, intellectual property disputes, cybersecurity risks, and sustainability challenges (Gartner, 2023). The rapid proliferation of AI tools for writing, coding, translation, information retrieval, illustration, and presentation creation also poses challenges in higher education. Not all campus stakeholders are familiar with or have access to these tools (Henke, 2024), potentially exacerbating disparities in learning opportunities. Furthermore, while it is recognized for enhancing productivity, concerns have surfaced regarding its effectiveness in creative and intellectually demanding fields, as well as its potential to facilitate plagiarism, which has heightened academic integrity concerns (Mogavi et al., 2024). According to EDUCAUSE's '*AI blueprint report*', a survey of 910 higher education professionals conducted in late 2023, 78% of respondents believe generative AI will impact academic integrity and the design of assignments, assessments, and curricula. Additionally, 73% reported that their institutions have already implemented related strategies, and over half have started offering education and guidance on the subject (Robert, 2024).

Libraries have long played a vital role in supporting teaching and research in higher education, serving as key partners in the adoption of technology and information literacy education. In '*Developing a library strategic response to artificial intelligence*,' Cox (2023) conducted a survey of 111 libraries in the UK and identified the perceived impacts of AI on various library functions. These include using AI to enhance metadata, improve discovery and retrieval processes, and implementing AI-driven tools, such as chatbots for user services. The paper outlines three key strategies for libraries:

> *using library AI capabilities to model responsible and explainable applications of descriptive AI, leveraging Librarians data competencies to enhance organizational AI capability, and promoting AI literacy to enhance organizational and societal AI capabilities.*

AI literacy is emerging as a critical area of focus for libraries around the world, driven by the increasing integration of AI technologies into information services and academic environments. Many information literacy instructors have begun exploring ways to transition into teaching AI literacy (Hervieux & Wheatley, 2024). Additionally, numerous librarians have designed AI literacy courses based on the core principles of information literacy and shared their approaches (ACRL, 2024).

An increasing number of academic librarians are developing library guides tailored to specific subjects or courses, assisting users with database searches, and recommending relevant resources. These guides serve as valuable tools for teaching information literacy and can, at times, have a greater impact than traditional classroom instruction (Duffy et al., 2021). Ko and Chiu (2024), in their analysis of 28 library guides using the ACRL framework, also found that librarians effectively applied the core concepts of information literacy to the introduction of AI. Currently, these guides present a timely opportunity to help build, promote, and advance AI literacy. By building on their foundation in information literacy, librarians can provide essential support for higher education institutions as they navigate broader AI policy development and respond to the growing demands of the AI era.

AI literacy framework

The concept of AI literacy was first introduced in 2015, and scholars from various fields have continued to explore its definition. At its core, AI literacy centres on equipping individuals with the ability to critically assess, engage with, and make use of AI technologies, even if they do not have the skills to develop AI models themselves (Chan, 2024). According to a review by Lintner (2024), although many AI literacy scales have been developed, their reliability and validity still require further verification. These scales share common elements, particularly in their emphasis on a basic technical understanding of AI, awareness of its societal implications, and a focus on AI ethics.

Meanwhile, Talagala (2021) introduced the concept of context of AI application, suggesting that individuals from different fields and with varying levels of prior knowledge will require different aspects of AI literacy. Pinski and Benlian (2024) provide an overarching conceptual framework for AI literacy, synthesising findings from 68 academic papers. Their work critically examines the specificity of AI literacy to different user groups and distinguishes it from other technology literacies. The conceptual framework is structured around the categories of '*Proficiency Dimensions*' and '*Subject Areas*', which encompasses the content areas relevant to AI literacy: AI models; data for AI; AI interfaces; AI tools; humans, organizations, and society; and cross-area. The cross area includes various literacy skills, including ethical literacy, critical literacy, meta-literacy, and future literacy.

Ng et al. (2021) explored the concept of AI literacy and provided a foundation for defining, teaching, and evaluating it in educational contexts. Through reviewing 18 peer-reviewed articles published

between 2016 and 2021, the authors identified four key aspects of AI literacy: '*know and understand* AI', '*apply* AI,' '*evaluate and create* AI,' and '*AI ethics*'. The first three of these components were aligned with Bloom's taxonomy. A few years later, Ng et al. (2024) developed an AI literacy questionnaire (AILQ) and proposed a model based on the ABCE (affective, behavioural, cognitive and ethical) to evaluate students' literacy development. The authors' framework lays the foundation for other frameworks, including the EDUCASE AI literacy framework, offering educators information on how to foster AI literacy in students.

In June 2024, EDUCAUSE published its AI literacy framework, offering a structured approach to understanding AI literacy in educational contexts. This framework is designed to guide institutions in developing AI education programs and is intended to meet individuals where they are scaffolding upon their current level of AI literacy. These levels are not strictly sequential; individuals can engage at any level based on their prior knowledge and goals (Hibbert et. al., 2024). The framework breaks down AI literacy into four levels:

Levels	Details
Level 1. Understand AI	Focuses on building a basic understanding of AI, including its definitions, history, and core technologies.
Level 2. Use and apply AI	Focuses on applying AI in practical contexts, such as using AI-powered software, services, or platforms.
Level 3. Analyse and evaluate AI	Focuses on developing critical thinking skills to analyse AI systems, evaluate their performance, and assess their societal and ethical impacts.
Level 4. Create AI	Focuses on advanced skills for creating AI models, such as developing custom machine learning models or AI-driven applications.

Table 1. EDUCAUSE AI literacy framework

Research questions

The following are the research questions our study is pursuing:

RQ1. For librarians developing AI literacy LibGuides, how could the EDUCAUSE AI Literacy framework be modified to be optimally suitable for libraries' user needs?

RQ2. To what extent are the Levels and Core Competencies (CCs) and Key Concepts (KCs) in the EDUCAUSE AI literacy framework addressed by the 70 ARL and Oberlin institutions' LibGuides? What levels and specific CCs/KCs are most commonly covered? What levels and specific CCs/KCs are the least frequently covered?

RQ3. What differences exist in terms of the coverage of EDUCAUSE AI literacy framework between Oberlin and ARL libraries and among the four levels?

Method

This study employs content analysis, guided by the EDUCAUSE AI literacy framework, to examine LibGuides created by academic libraries in the USA affiliated with the ARL and the Oberlin Group. The focus is exclusively on newly created guides specifically addressing generative AI. Guides in which librarians simply added information to existing content or those that are simply compilations of resources without explanatory text were excluded from the analysis, as they were deemed ineffective in conveying AI literacy. Furthermore, to avoid potential disciplinary biases, guides that introduced generative AI from a subject-specific angle were excluded.

By reviewing 114 ARL members in the United States and 83 members of the Oberlin group, the researchers identified 48 ARL libraries and 22 Oberlin libraries that created new LibGuides for AI, meeting the criteria for analysis. The content of these 70 guides was downloaded by the researchers, both having backgrounds in library and information science, between June 24 and June 30. The subsequent analysis was conducted between July and August 2024.

Among the 70 libraries analysed, several produced multiple guides addressing different aspects of AI, while others consolidated their information in a single guide. For this study, each library was treated as a unit of analysis to capture the overall message conveyed through its guides (details of the study samples are provided in Appendix 1).

The EDUCAUSE AI literacy framework consists of four levels, each linked to specific core competencies, key concepts, and reflection questions. However, the framework does not explain how these elements were developed. To address this limitation, the researchers reorganized the framework, elevating some key concepts and reflection questions to core competencies. Similar or overlapping concepts were consolidated, and multidimensional core competencies were split into sub-codes. Those not elevated or consolidated were categorized as sub-codes under their respective core competencies. Additionally, the researchers incorporated concepts from the LibGuides that were missing or underrepresented in the original framework, reflecting the LibGuides' unique perspective, and enriching the coding schema for a more comprehensive analysis. Tables 2, 3, 4, and 5 show the core competency, sub-code, description, and source for Level 1, Level 2, Level 3, and Level 4, respectively (examples of coding details are provided in Appendix 2).

To validate the coding scheme, a pre-test was conducted on a sample of 10% of the guides (seven guides) to ensure intercoder reliability, yielding an agreement ratio at 83.97%. Throughout this process, MAXQDA and Excel were used as coding tools, and consensus on newly emerging codes was achieved through discussion.

Core Competency	Sub-Code	Description	Source
L1 CC1 Be able to define AI-related terms	L1 CC1-1	Define the term '*Artificial Intelligence*'	EC-L1-KC1
	L1 CC1-2	Define the term '*Generative Artificial Intelligence*'	LG
	L1 CC1-3	Define the term '*Machine Learning*'	EC-L1-KC1
	L1 CC1-4	Define the term '*(Large) Language model*'	
	L1 CC1-5	Define the term '*Artificial Neural Network*'	
	L1 CC1-6	Define the term '*Diffusion Model*'	
	L1 CC1-7	Define the terms '*Artificial narrow intelligence*,' '*Artificial general intelligence*,' '*Artificial super intelligence*,' '*Reactive machines*,' '*Theory of mind*,' '*Self-awareness*'	EC-L1-KC2
	L1 CC1-8	Define technical frameworks related to AI (open source vs. closed models, APIs, etc.).	EC-L1-KC4
	L1 CC1-9	Recognize AI tool categories	EC-L1-KC3, RQ4
	L1 CC1-10	Define the term '*Prompt*'	LG
	L1 CC1-11	Other	

L1 CC2 Recognize the benefits and limitations of AI tools	L1 CC2-1	Identify technologies utilized by AI tools	EC-L1-RQ2
	L1 CC2-2	Understand the designed purpose of AI tools	EC-L1-RQ3
	L1 CC2-3	Assess what AI tools are particularly useful and what they are not	EC-L1-RQ4
	L1 CC2-4	Compare the benefits and limitations of AI tools to databases/search engines	LG
L1 CC3 Identify and explain the differences between various types of AI, as defined by their capabilities and computational mechanisms	L1 CC3-1	Identify the differences between various types of AI	EC-L1-CC
	L1 CC3-2	Explain the differences based on AI capabilities	
	L1 CC3-3	Describe the differences based on the AI computational mechanisms	
	L1 CC3-4	Explain the differences based on AI fees/access limits	LG
	L1 CC3-5	Use alternative methods to explain differences in AI types	
L1 CCP Additional competencies for understanding AI	L1 CCP-1	Track AI news or events	LG
	L1 CCP-2	Find AI resources	
	L1 CCP-3	Recognize AI working groups, associations, or institutions	
	L1 CCP-4	Understand the history of AI	
	L1 CCP-5	Recognize developments in AI-augmented tools	
	L1 CCP-6	Recognize AI literacy issues	

- EC-CC refers to the original core competencies outlined in the EDUCAUSE framework.
- EC-KC refers to the original key concepts outlined in the EDUCAUSE framework.
- EC-RQ refers to the original research questions outlined in the EDUCAUSE framework.
- LG refers to the librarian perspectives displayed in the LibGuides.
- Note. L1 CCP is the new competency identified in LibGuides.

Table 2. Level 1 '*identify* AI' coding scheme

Core Competency	Sub-Code	Description	Source
L2 CC1 Successfully utilize generative AI tools for desired responses	L2 CC1-1	Used solely to code AI usage methods beyond prompting.	EC-L2-CC
L2 CC2 Experiment with	L2 CC2-1	Apply '*Prompt Engineering*' or '*Context Windows*', '*Zero-Shot Prompting*', '*Few-Shot Prompting*'	EC-L2-KC1
	L2 CC2-2	Prompting technique- Add specificity	EC-L2-

prompting techniques to improve AI-generated output	L2 CC2-3	Prompting technique - Use context and details	KC2
	L2 CC2-4	Prompting technique - Ask the model to consider pros and cons	
	L2 CC2-5	Prompting technique - Ask the model to evaluate alternative positions	
	L2 CC2-6	Prompting techniques to reduce bias and hallucinations	EC-L2-KC1, RQ3
	L2 CC2-7	Prompting technique - Utilize iterative prompting	LG
	L2 CC2-8	Prompting technique -Task segmentation	
	L2 CC2-9	Prompting technique - Limit prompt word count or length	
	L2 CC2-10	Prompting technique - Use polite phrasing	
	L2 CC2-11	Prompting technique - Provide examples in prompts	
	L2 CC2-12	Other Prompting techniques	
	L2 CC2-13	Apply Prompting framework	
	L2 CC2-14	Apply Prompting template	
L2 CC3 Review AI-generated content	L2 CC3-1	Review content for hallucinations	EC-L2-KC1
	L2 CC3-2	Review content for fake citations	LG
	L2 CC3-3	Review content for potential reasoning errors	EC-L2-KC4
	L2 CC3-4	Review content for how prompts may affect outcomes	LG
	L2 CC3-5	Review content for potential bias	
	L2 CC3-6	Review content for reliability	
	L2 CC3-7	Review content for accuracy	
	L2 CC3-8	Review content for currency issue	
	L2 CC3-9	Strategies for reviewing AI-generated content	
	L2 CC3-10	Methods for detecting AI-generated content	
L2 CC4 Considerations for information fed into prompting tools	L2 CC4-1	Privacy consideration	EC-L2-KC3
	L2 CC4-2	Confidentiality consideration	
	L2 CC4-3	Copyright consideration	
L2 CCP Proper AI usage	L2 CCP-1	Apply institutional AI policy	LG
	L2 CCP-2	Disclose AI use in classroom work	
	L2 CCP-3	Apply publisher AI policy	

disclosure	L2 CCP-4	Disclose AI use in scholarly writing	
	L2 CCP-5	Cite AI-generated content in the APA, MLA, and Chicago style	
	L2 CCP-6	Keep a record of AI prompts for future verification	
	L2 CCP-7	Other ways to disclose AI usage	

- The same EC-CC, EC-KC, EC-RQ and LG notes as Table 2.
- Note. L2 CC4 is described as KC3 in the EDUCAUSE framework but is not explicitly listed as a Core Competency in the original framework. L2 CCP is the new competency identified in LibGuides.

Table 3. Level 2 '*use and apply AI*' coding scheme

Core Competency	Sub-Code	Description	Source
L3 CC1 Examine AI in a broader context, bringing in knowledge from one's discipline or interests	L3 CC1-1	Examine AI in a broader context	EC-L2-CC
	L3 CC1-2	Bring knowledge from specific disciplines or interests	
	L3 CC1-3	Framework for evaluating AI tools	LG
L3 CC2 Critique AI tools and offer arguments in support of or against their creation, use, and application	L3 CC2-1	Critical Perspective -Reliability	LG
	L3 CC2-2	Critical Perspective -Closed model or black box structure	
	L3 CC2-3	Critical Perspective -Overreliance and its effects on learning	
	L3 CC2-4	Evaluation of the designer's intentions versus actual usage of AI tools	
	L3 CC2-5	Strategies to prevent creators' work being used as AI training data	
	L3 CC2-6	Guidelines for developing AI policies in the classroom	
	L3 CC2-7	Other	
L3 CC3 Analyse ethical considerations in AI development and deployment	L3 CC3-1	Ethical Considerations -Environmental sustainability	EC-L3-KC1
	L3 CC3-2	Ethical Considerations -Labor	
	L3 CC3-3	Ethical Considerations -Privacy	
	L3 CC3-4	Ethical Considerations -Copyright	
	L3 CC3-5	Ethical Considerations -Biases (race, gender, class and other)	
	L3 CC3-6	Ethical Considerations -Misinformation	
	L3 CC3-7	Ethical Considerations -Academic integrity	LG
	L3 CC3-8	Ethical Considerations -Authorship concerns	
	L3 CC3-9	Ethical Considerations -Information Privilege/Digital Divide	
	L3 CC3-10	Other	
• The same EC-CC, EC-KC, EC-RQ and LG notes as Table 2.			

Table 4. Level 3 '*analyse and evaluate* AI' coding scheme

Core Competency	Sub-Code	Description	Source
L4 CC1 Synthesize learning to conceptualize or create new ideas, technologies, or structures that relate to AI	L4 CC1-1	Conceive of novel uses for AI	EC-L4-CC
	L4 CC1-2	Build software leveraging AI	
	L4 CC1-3	Propose theories about AI	
L4 CC2 Human-AI collaboration	L4 CC2-1	Examine how your ideas differ from AI-generated content	EC-L4-RQ1
	L4 CC2-2	Identify unique AI features that contribute to creativity	
L4 CCP Access resources to support AI creation	L4 CCP-1	Access resources for creating new AI-driven ideas or technologies	LG

- The same EC-CC, EC-KC, EC-RQ and LG notes as Table 2.
- Note. L4 CC2 is described as RQ1,2 in the EDUCAUSE framework, but it is not explicitly listed as a Core Competency in the original framework. L4 CCP is the new competency identified in LibGuides.

Table 5. Level 4 '*create* AI' coding scheme

Findings and discussion

In this section, we present the findings of our study based on the research questions outlined earlier.

Audience and professional background shape differences between the EDUCAUSE framework and LibGuides

Analysing library guides through the lens of the EDUCAUSE framework reveals two distinct approaches to AI literacy. While the EDUCAUSE framework is primarily designed for classroom instruction, librarians focus on curating and providing access to a diverse array of resources. Among the 70 library guides analysed, only two adopted a module format similar to online courses, incorporating unit activities or reflective exercises. Furthermore, many guides extend beyond student audiences, offering support to educators by helping them integrate AI into their teaching practices and adapt to advancements in AI. However, when presenting AI use cases, guides more frequently highlight applications for learning rather than specific support for teaching (see Table 6).

AI Use Situations	%
To assist learning	64.3
To assist teaching	47.1
To assist research	45.7
To assist search	24.3
To assist writing	22.9
To assist language translation	15.7
Other use case/situation	15.7

Table 6. AI use cases in library guides and their frequency of occurrence

Library guides prioritize the accessibility and diversity of resources, as reflected in the introduction of new core competencies at Level 1. For example, '*additional competencies for understanding* AI' encompass topics such as the history of AI, tracking AI news, recognizing key AI organizations, and locating AI resources (see Table 2). This resource-oriented approach underscores librarians' distinctive role to fostering AI literacy and meeting the evolving needs of higher education.

Beyond resource accessibility, librarians have introduced a critical Core Competency to Level 2 (Use and Apply AI): '*the proper disclosure of AI usage*' (see Table 3). Drawing on their expertise in citation practices, librarians emphasize this competency to ensure compliance to regulations such as copyright laws, publisher policies, institutional guidelines, citation standards, and AI privacy policies. This focus on AI disclosure addresses the academic integrity challenges posed by AI, which were not explicitly covered in the original EDUCAUSE framework.

Leveraging their deep foundation in information literacy, librarians underscore the differences between AI tools and their appropriate use, aligning with the ACRL information literacy framework's concept of '*information creation as a process*'. However, the primary focus remains on tools for text generation and research support (see Table 7), while fewer guides address AI-related media literacy topics, leaving a notable gap for future development.

AI tools categories	%
LLM or Chatbot, e.g. : ChatGPT, Gemini, Claude	61.4
Assisting research AI tools	51.4
Image generation AI tools	40
Search AI tools	30
Other types of AI tool, for example, Alexa, Deep Blue, and predictive text	28.6
Coding AI tools	27.1
Writing AI tools	24.3
Video generation AI tools	24.3
AI content detection tools	24.3
Text generation AI tools	21.4
Audio generation AI tools	20
Document analysis AI tools	10
Automatic creations of slides AI tools	8.6
Language translation or correction AI tools	7.1
Creating designs and mock-ups AI tools	4.3
Automatic transcription AI tools	1.4

Table 7. Categories of AI tools mentioned in library guides and their frequency of use

Librarians also highlight critical perspectives on information use, reflecting the ACRL Information Literacy Framework's principles of '*authority is constructed and contextual*' and '*Information Has Value.*' In the Level 2 section on reviewing AI-generated content, some LibGuides extend beyond basic concerns such as fake citations and outdated information by incorporating verification methods like the SIFT framework. These guides further enrich Level 3 (analyse and evaluate AI) by exploring essential topics, including information privilege, the digital divide, overreliance on AI tools, and the alignment of AI designers' intentions with actual use.

While these contributions reflect the depth of librarians' expertise, certain limitations remain evident. Frameworks such as CLEAR, ROBOT, and SIFT are frequently repeated across various guides, indicating a strong culture of shared learning within the library community. However, this repetition may also signal challenges in swiftly integrating AI-related frameworks from other disciplines.

Moreover, despite introducing numerous critical perspectives, notable gaps exist. For instance, issues such as the potential impact of AI on reducing interpersonal interactions and diminishing individual creativity are underexplored (Stahl, 2024). Additionally, most guides focus on understanding current AI issues and cautioning users about associated risks, rather than empowering them to actively shape AI-related policies. This gap underscores a potential area for growth in Level 4 (create AI).

Coverage of the EDUCAUSE framework

As shown in Table 8, the levels most frequently covered within the EDUCAUSE AI Literacy framework are Level 1 (understand AI) and Level 3 (analyse and evaluate AI). The top three Core Competencies with the highest occurrence rates among the 70 library guides are: '*L1 CC2: recognize the benefits and limitations of AI tools*' (41.1%), '*L1 CCP: additional competencies for understanding AI*' (35.7%), and '*L3 CC3: analyse ethical considerations in the development and deployment of AI*' (35.3%). These reflect the librarian's focus on foundational AI knowledge and ethical considerations.

In contrast, the least covered levels are Level 4 (Create AI) and parts of Level 2 (Use and Apply AI). The core competencies with the lowest occurrence rates are '*L4 CC1: synthesize learning to conceptualize or create new ideas, technologies, or structures related to AI*' (1.1%), '*L4 CC2: human-AI collaboration*' (2%), and '*L2 CC1: successfully utilize generative AI tools for desired responses*' (4.2%). This suggests that librarians may have limited expertise in these areas or may not fully recognize their importance as integral components of AI literacy.

Core Competencies by Levels	%
L1 CC2 Recognize the benefits and limitations of AI tools	41.1
L1 CCP Additional competencies for understanding AI	35.7
L3 CC3 Analyse ethical considerations in the development and deployment of AI	35.3
L3 CC1 Examine AI in a broader context, bringing in knowledge from one's discipline or interests	35.1
L1 CC1 Be able to define the AI related terms	28.6
L2 CC3 Review AI-generated content	28
L2 CCP Proper AI usage disclosure	27.9
L2 CC4 Considerations for information fed into prompting tools	17.8
L1 CC3 Identify and explain the differences between various types of AI, as defined by their capabilities and computational mechanisms	15.2
L2 CC2 Experiment with prompting techniques to improve AI-generated output	14.9
L4 CCP Access resources to support AI creation	13.2
L3 CC2 Critique AI tools and offer arguments in support of or against their creation, use, and application	12.8
L2 CC1 Successfully utilize generative AI tools for desired responses	4.2
L4 CC2 Human-AI collaboration	2
L4 CC1 Synthesize learning to conceptualize or create new ideas, technologies, or structures that relate to AI.	1.1

Table 8. Frequency of core competencies by levels in library guides

A detailed analysis of the sub-codes provides additional insight. Among the 70 library guides, 13 key concepts were mentioned in more than half of them. As shown in Table 9, the most frequently addressed were: '*L1 CC1-9: recognize AI tool categories*' (85.7%), '*L1 CCP-2: find AI resources*' (77.1%),

and '*L2 CCP-5: cite AI-generated content in APA, MLA, and Chicago styles*' (74.3%). In contrast, 19 key concepts appeared in fewer than 10% of the guides. The concepts least frequently introduced in the library guides are: '*L4 CC1: synthesize learning to conceptualize or create new ideas, technologies, or structures that relate to AI*' (1.1%), '*L4 CC2: human-AI collaboration*' (2%), and '*L2 CC1: successfully utilize generative AI tools for desired responses*' (4.2%) (See Table 10).

Key concepts mentioned in more than half of the guides	%
L1 CC1-9 Recognize AI tool categories	85.7
L1 CCP-2 Find AI resources	77.1
L2 CCP-5 Cite AI-generated content in APA, MLA, and Chicago style	74.3
L3 CC3-5 Ethical Considerations -Biases (race, gender, class and other)	65.7
L1 CC2-3 Assess what AI tools are particularly useful for and what they are not	62.9
L2 CC3-1 Review content for hallucinations	62.9
L1 CC1-2 Define the term "Generative Artificial Intelligence"	55.7
L2 CCP-2 Disclose AI use in classroom work	55.7
L3 CC3-7 Ethical Considerations -Academic Integrity	55.7
L2 CC3-7 Review content for accuracy	51.4
L2 CCP-1 Apply institutional AI policy	51.4
L3 CC3-4 Ethical Considerations -Copyright	51.4
L1 CCP-3 Recognize AI working groups, associations, or institutions	50

Table 9. Frequency of key concepts mentioned in more than half of the library guides

Key concepts mentioned in fewer than 10% of the guides	%
L1 CC1-7 Define the term '*Artificial narrow intelligence*,' '*Artificial general intelligence*,' '*Artificial super intelligence*,' '*Reactive machines*,' '*Theory of mind*,' or '*Self-awareness*'	8.6
L1 CC3-5 Use alternative methods to explain differences in AI types	8.6
L2 CC2-9 Prompting technique - Limit prompt word count or length	8.6
L3 CC2-5 Strategies to prevent creators' work being used as AI training data	8.6
L1 CCP-5 Recognize developments in AI-augmented tools	7.1
L1 CC1-8 Define technical frameworks related to AI (open-source vs. closed models, APIs, etc.).	5.7
L2 CC1 Successfully utilize generative AI tools for desired responses	5.7
L2 CC2-6 Prompting techniques to reduce bias and hallucinations	5.7
L3 CC2-4 Evaluation of designers' intentions versus actual usage of AI tools	5.7
L2 CC2-4 Prompting technique - Ask the model to consider pros and cons	2.9
L2 CC2-10 Prompting technique - Use polite phrasing	2.9
L4 CC2-1 Examine how your ideas differ from AI-generated content	2.9
L2 CC2-5 Prompting technique - Ask the model to evaluate alternative positions	1.4
L2 CC3-3 Review content for potential reasoning errors	1.4
L4 CC1-2 Build software leveraging AI	1.4
L1 CC1-6 Define the term "Diffusion Model"	0
L4 CC1-1 Conceive of novel uses for AI	0
L4 CC1-3 Propose theories about AI	0
L4 CC2-2 Identify unique AI features that contribute to creativity	0

Table 10. Frequency of key concepts mentioned in less than 10% of the library guides

Overall, the analysis reveals that LibGuides tend to focus on building a foundational understanding of AI tools and encouraging responsible use of AI, while dedicating less attention to the technical aspects and competencies in Level 4, which involve AI creation. These trends suggest that the guides prioritize helping users discover additional resources for continued learning and upholding academic integrity standards, rather than training them in advanced AI creation, programming, or operational skills (detailed coding concept distribution and applications across four AI literacy levels are provided in Appendix 3).

Statistical differences

The descriptive statistics of AI-related LibGuides' coverage for both Oberlin group (OBL) libraries and association of research libraries (ARL) were analysed based on the four levels of core competencies from the EDUCAUSE AI literacy framework (see Table 11).

Levels	Library Group	Mean	SD	Median	Min	Max
Level 1: Understand AI	OBL	0.248	0.213	0.205	0.000	0.773
	ARL	0.333	0.219	0.323	0.000	0.896
Level 2: Use and Apply AI	OBL	0.174	0.138	0.182	0.000	0.500
	ARL	0.216	0.177	0.157	0.000	0.688
Level 3: Analyse and Evaluate AI	OBL	0.209	0.172	0.159	0.000	0.636
	ARL	0.303	0.178	0.240	0.083	0.667
Level 4: Create AI	OBL	0.000	0.000	0.000	0.000	0.000
	ARL	0.013	0.019	0.000	0.000	0.042

Table 11. Library guides' coverage measured by EDUCASE AI literacy framework levels

For OBL, the mean coverage for Level 1 was 0.248 (SD = 0.213). For ARL, the mean coverage for Level 1 was higher at 0.333 (SD = 0.219). For OBL, the mean coverage for Level 2 was 0.174 (SD = 0.138). Whereas for ARL, the mean coverage for Level 2 was 0.216 (SD = 0.177).

For Level 3, analyse and evaluate AI, the mean coverage of OBL was 0.209 (SD = 0.172). In comparison, ARL libraries' mean coverage for Level 3 was higher at 0.303 (SD = 0.178). For Level 4, the numbers are different: while OBL libraries had no coverage for this level, with a mean of 0.000 (SD = 0.000), whereas ARL libraries had a low mean coverage at 0.013 (SD = 0.019).

Differences between OBL and ARL libraries

A paired samples t-test was conducted to compare the percentage coverage of EDUCAUSE AI literacy framework components between Oberlin and ARL libraries. The results showed that the mean percentage coverage for OBL (M = 0.192, SD = 0.175) was significantly lower than that of the ARL libraries (M = 0.258, SD = 0.199), with paired differences as ($t(72) = -4.861$, $p < .001$). The effect size ranged from moderate to large ($d = -0.569$), indicating a significant difference in the AI literacy coverage between the two library groups. The mean difference in coverage was -0.066 (SD = 0.117), suggesting that the ARL libraries' LibGuides generally covered more components of the AI literacy framework than the LibGuides developed by libraries of the Oberlin group.

Differences among AI literacy levels

The average proportion of coverage was obtained by averaging OBL and ARL's proportion of coverage of various core competencies and key concepts. The mean proportion of coverage was highest for Level 1 (M = 0.291, SD = 0.206), followed by Level 3 (M = 0.256, SD = 0.163), Level 2 (M = 0.195, SD = 0.149), and the lowest for Level 4 (M = 0.006, SD = 0.009).

A one-way ANOVA was conducted to examine the effect of different levels on the average proportion of LibGuides' coverage of the EDUCAUSE AI literacy framework competency components. One-way ANOVA revealed a statistically significant difference in the average proportion of LibGuides coverage across the different levels ($F(3, 69) = 4.436$, $p = .007$). The effect size was small to moderate, as indicated by eta-squared ($\eta^2 = 0.162$), suggesting that approximately 16.2% of the coverage variance can be attributed to the level differences.

Post hoc tests using Tukey's HSD indicated that the mean coverage for Level 4 was significantly lower than for Level 1 (mean difference = -0.284, $p = .006$) and Level 3 (mean difference = -0.250, $p = .019$). No other comparisons were statistically significant.

Conclusions

This study examines 70 newly developed generative AI LibGuides from libraries affiliated with ARL and Oberlin group, analysed through the lens of the EDUCAUSE AI literacy framework. Our findings align with Talagala's (2021) assertion that AI literacy must adapt to individuals' roles and task contexts. Similarly, those responsible for providing AI literacy adapt their focus based on their training, background, and tasks. LibGuides include content absent from the EDUCAUSE framework, such as proper disclosure of AI usage, highlighting academic integrity concerns. Furthermore, LibGuides emphasize Level 1 (understand AI) and Level 3 (analyse and evaluate AI), focusing on helping users critically evaluate AI tools' strengths and limitations.

However, many technical concepts featured in the EDUCAUSE framework, such as '*diffusion models*' and '*few-shot prompting*', were underrepresented in the LibGuides. Furthermore, prompt techniques and operational instructions for AI tools at Level 2 (use and apply AI) were less frequently addressed. The near absence of Level 4 (create AI) was particularly striking, suggesting that libraries focus more on resource discovery and ethical AI use, rather than advanced AI creation and programming.

These findings underscore the need for collaboration across higher education to foster comprehensive AI literacy, with various roles contributing their unique expertise. Hervieux and Wheatley's (2024) AI literacy framework, grounded in Bloom's taxonomy and shaped by a library science perspective, provides a concise alternative to the EDUCAUSE framework. By integrating their approach with the detailed competencies identified in this study, institutions could develop a more actionable and inclusive AI literacy framework that better addresses diverse user needs. Moreover, the detailed coding scheme from this study offers libraries a valuable tool for identifying underrepresented areas and fostering partnerships with other campus units to bridge these gaps effectively.

Our analysis also revealed that ARL libraries generally cover more components of the AI literacy framework than Oberlin group libraries, which may reflect differences in resources, institutional priorities, and librarian training. Addressing these disparities through more consistent training and knowledge-sharing initiatives could ensure a common standard of AI literacy support across academic libraries.

Lastly, this study excludes discipline-specific generative AI guides, which could offer valuable insights into discipline-based AI literacy needs. Friesen et al. (2023) examined publications by librarians across various disciplines and found that legal and health sciences librarians had the highest number of AI-related articles, with different disciplines focusing on distinct AI-related topics. Future research should explore whether different disciplines prioritize unique AI literacy competencies and how librarians in specific fields can better support those needs.

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Appendix