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## AI-powered Literature Review with Notebook LM: Implications for Educational Technology and Older Adults

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# AI-powered Literature Review with Notebook LM: Implications for Educational Technology and Older Adults

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## Abstract

With the rapid expansion of research on educational technology for older adults, conducting comprehensive literature reviews has become increasingly complex. Artificial Intelligence (AI) tools such as Google's NotebookLM offer the potential to streamline this process by enabling researchers to interactively query and summarize large document collections. This study presents a methodological evaluation of NotebookLM as an AI-assisted literature review tool and explores its implications for research in educational technology targeting older adult learners. A critical, tool-focused evaluation of NotebookLM's interaction with a curated corpus assesses its research value for age-sensitive educational technologies. The tool was applied to a curated corpus of 20 academic sources, revealing its strengths in automation, speed, and thematic synthesis. A SWOT analysis was employed to assess its capabilities, highlighting strengths (e.g., efficiency, breadth), opportunities (e.g., mapping emerging trends), but also weaknesses such as occasional hallucinated references and limited capacity for critical appraisal. To address these limitations, we applied a human-in-the-loop approach, including manual verification of sources, prompt refinement, and triangulation with traditional review methods, ensuring reliability and scholarly rigor. Ethical considerations, especially the need for human oversight, were emphasized due to the potential for misinformation and bias in AI-generated outputs. Findings suggest that while NotebookLM can accelerate the process of identifying key themes (e.g., digital inclusion, lifelong learning, assistive technologies), it cannot substitute for rigorous, human-led analysis. Instead, a human-AI partnership is recommended, where AI performs the labor-intensive groundwork and researchers ensure the quality and validity of results. This work contributes to the growing body of scholarship on integrating AI into academic research workflows and highlights the importance of transparency and ethical responsibility in the use of AI in literature reviews.

**Keywords:** Artificial Intelligence, digital inclusion, educational technology, ethical AI use, literature review, NotebookLM, older adults

## Introduction

Population aging and the digital revolution are converging to create new opportunities and challenges for education in later life. By mid-century, the global population of adults over 60 is projected to exceed 2 billion (United Nations, 2023), leading to increasing interest in how technology can support older adults' learning, social participation, and independent living. Researchers are exploring a wide range of educational and assistive technologies for seniors – for example, voice-activated virtual assistants for medication adherence (Chen et al., 2023), smart home systems for independent living (Papadopoulos et al., 2022), and digital platforms for lifelong learning and cognitive engagement (Sharpe & Elwood, 2024).

Technology-enhanced learning has been shown to yield cognitive and social benefits for older adults (Formosa & Noguera, 2023). However, age-related barriers such as limited digital literacy, usability issues, and age-biased design persist (Seifert et al., 2021). These challenges

underscore the need for inclusive and evidence-based approaches to educational technology that address the diverse needs of aging populations.

As scholarly interest in this interdisciplinary domain grows, conducting comprehensive literature reviews becomes more demanding. The volume of publications spanning gerontology, education, and human-computer interaction has expanded rapidly (Yang et al., 2023). Traditional review methods are time-consuming and risk being overwhelmed by the sheer quantity of information. In response, researchers have begun experimenting with AI-driven tools, particularly large language models (LLMs), to accelerate systematic literature reviews (Castillo-Segura et al., 2023). These tools can rapidly extract, summarize, and synthesize information, potentially uncovering patterns and insights that manual reviews may overlook.

Among such tools, NotebookLM, introduced by Google in 2023, allows users to upload source documents and interact with a conversational AI model grounded in those texts. It combines the generative abilities of LLMs with document-specific reasoning and memory, offering a potentially valuable assistant for scholars conducting literature reviews (Google, 2023; Steal These Thoughts, 2024).

Despite these promises, limitations remain: AI systems are prone to hallucinations, lack critical reasoning, and require careful oversight to avoid misinterpretation or misinformation (Chelli et al., 2024). These concerns raise important ethical and methodological questions about the reliability of AI-assisted reviews, especially in fields affecting vulnerable populations.

In this context, the present study evaluates the use of NotebookLM as a literature review tool in the domain of educational technology for older adults. The research addresses three guiding questions:

- (1) How effectively can NotebookLM assist in mapping and summarizing the literature?
- (2) What are the methodological strengths and limitations of using such AI tools?
- (3) What are the ethical implications and best practices for integrating AI into scholarly workflows?

Through a critical, practice-based approach, we aim to assess the potential of NotebookLM to support academic research while ensuring rigorous human oversight and ethical responsibility.

## **Methodology**

### ***Theoretical framing***

This study is informed by key concepts from the field of adult education and lifelong learning. The andragogical model (Knowles, 1984) emphasizes self-directed learning and relevance to learners' life experiences – principles particularly relevant for older adults navigating digital environments. Freire's (1970) critical pedagogy further underlines the role of education in promoting empowerment and critical consciousness, highlighting the importance of inclusive and equitable access to knowledge. These theoretical perspectives frame our evaluation of NotebookLM not merely as a technological artifact, but as a pedagogical tool that mediates access, agency, and epistemic inclusion for older learners.

### ***Overall approach***

This study followed a methodological design focused on evaluating NotebookLM, an AI-based tool developed by Google, as a research assistant in the literature review process. Rather than engaging in empirical data collection from participants, our approach emphasized a tool-

focused evaluation within a real research scenario in the field of educational technology and aging. The methodology combined hands-on experimentation with NotebookLM, using a curated literature corpus, and a critical synthesis of existing secondary literature on AI-assisted reviewing (Castillo-Segura et al., 2023; Yang et al., 2023), allowing for triangulated insights into the tool's strengths and limitations.

### ***Literature corpus selection***

A representative sample of twenty scholarly publications was selected, covering topics related to digital education, assistive technology, and digital inclusion for older adults. The corpus included recent peer-reviewed articles and systematic reviews published between 2018 and 2024, sourced from databases such as PubMed, Scopus, and ResearchGate. The selected works addressed diverse themes including technology-mediated learning, smart home systems, AI-based healthcare aids, and social or cognitive inclusion for older populations. Notable sources included Chen et al. (2023) on voice assistants for medication adherence, Papadopoulos et al. (2022) on smart technologies in aging, and Seifert et al. (2021) on the digital divide.

### ***Use of NotebookLM***

The documents were uploaded into a dedicated notebook within NotebookLM, which allowed for conversational queries grounded in the user-provided corpus. We simulated the workflow of a researcher conducting a literature review by submitting prompts such as: "What are the primary themes in these studies?", "What challenges do older adults face in using digital learning technologies?", and "Are any ethical concerns discussed in the literature?". The AI model responded with summaries, topic clusters, and at times, direct references to authors or studies. To assess the reliability and completeness of these outputs, one of the authors conducted a parallel manual mini review of the same corpus. This involved reviewing abstracts and conclusions, extracting major findings, and comparing these with the AI-generated summaries. The results from both processes were then compared to evaluate the consistency, accuracy, and coverage of NotebookLM.

### ***Evaluation strategy***

The evaluation was structured around three main criteria: thematic accuracy (i.e., whether the AI captured the main research themes present in the documents), factual precision (i.e., whether cited references or claims were accurate), and methodological depth (i.e., whether the AI demonstrated capacity for critical synthesis or merely surface-level aggregation). Any factual assertions made by the AI were systematically checked against the source material. When hallucinations or incorrect attributions were detected – such as referencing a study that was not part of the uploaded corpus – these instances were documented and treated as performance limitations. The manual and AI-assisted reviews were then comparatively analyzed to assess alignment in the identified topics, and to detect whether the AI missed any critical themes or introduced unsupported claims. Notably, NotebookLM was generally successful in capturing dominant trends such as digital inclusion, cognitive engagement, and usability challenges, though some minor misrepresentations were noted.

### ***SWOT analysis of NotebookLM***

A formal SWOT analysis was conducted to systematically identify the Strengths, Weaknesses, Opportunities, and Threats associated with NotebookLM as an AI literature review assistant.

This assessment was based on our own observations during the tool's use, as well as insights from recent evaluations of AI in academic workflows (Chelli et al., 2024; Susnjak et al., 2025).

Strengths included the speed of information synthesis, the ability to maintain persistent context across documents, and the organization of large amounts of data into thematic clusters. The system was able to retrieve relevant information quickly, allowed iterative exploration of the content, and supported the detection of emerging research trends.

Weaknesses emerged in areas such as citation accuracy, coverage limitations, and critical appraisal. Specifically, NotebookLM occasionally produced inaccurate or nonexistent references and misattributed findings. Moreover, because it relies solely on the uploaded documents, it may overlook significant literature outside the corpus provided. It also lacks the capacity to assess methodological rigor or the reliability of included studies—an essential component in systematic reviews. Furthermore, it sometimes generalized complex findings, omitting nuances unless explicitly prompted.

Opportunities lie in the integration of NotebookLM into academic research workflows to support rapid scoping and the development of living systematic reviews. As AI capabilities advance, future iterations may support multilingual corpora, recognize quality indicators, and provide better source attribution. The tool also holds promise in educational settings, helping students or early-career researchers scaffold their review process while learning critical evaluation skills.

Threats, however, must be carefully considered. There is a risk of overreliance on AI-generated summaries, leading to diminished researcher engagement and potential propagation of misinformation. The possibility of confirmation bias, bias in training data, or exclusion of minority perspectives remains. Furthermore, if AI-generated content is used uncritically, issues of academic integrity, including improper attribution or plagiarism, may arise. These risks underline the necessity of rigorous human validation and transparency in AI use.

### ***Evaluation of NotebookLM's performance***

To evaluate the performance of NotebookLM, we compared the AI-generated summaries against the manual review across three main dimensions: thematic coverage, factual accuracy, and depth of interpretation.

In terms of thematic coverage, NotebookLM effectively identified dominant themes in literature, including digital inclusion, lifelong learning, usability issues, and assistive technologies. The AI was able to synthesize findings across multiple sources and surface recurring concerns such as age-friendly design and technology-mediated social participation. In most cases, the summaries produced were consistent with those identified through manual thematic coding, demonstrating strong pattern recognition capabilities.

Regarding factual accuracy, the system performed reasonably well when referencing specific papers that were included in the uploaded corpus. It occasionally cited studies by name and provided paraphrased or quoted content that matched the original documents. However, there were instances of minor hallucinations, for example, attributing a concept to the wrong author or referring to a publication year that did not match any source in the corpus. These inaccuracies did not dominate the output but highlighted the need for careful source validation.

In terms of interpretive depth, NotebookLM tended to produce broad summaries unless prompted with more targeted questions. It could identify key findings and trends but lacked the ability to critically evaluate the methodological quality of the studies or to detect contradictions across the literature. For example, when two studies presented conflicting

evidence regarding the effectiveness of a digital learning intervention, the AI did not comment on this discrepancy unless explicitly asked to compare the results.

Overall, the AI tool proved useful for accelerating the synthesis of large volumes of information and for generating an initial overview of the research landscape. However, its outputs required human refinement to reach the level of nuance and critical engagement expected in scholarly literature reviews.

### ***Quality control and ethical considerations***

Throughout this evaluation, we followed a human-in-the-loop model to ensure academic rigor. All outputs from NotebookLM were treated as drafts requiring verification. Citations, claims, and interpretations were only accepted if they could be directly confirmed in the source texts. We also refined our prompts over multiple sessions to improve the precision of AI responses, helping to mitigate superficial or ambiguous outputs.

Ethical practices were upheld in all phases. We made explicit the role of NotebookLM in methodology, avoided allowing the AI to generate novel interpretations, and clearly attributed all content to the respective human or AI contributor. No personal or sensitive data were involved. The use of the tool was strictly limited to analysis and summarization of publicly available academic literature.

## **Results**

### ***AI-assisted literature mapping***

Using NotebookLM, we were able to rapidly generate an organized synthesis of the literature on educational and assistive technologies for older adults. The AI successfully identified recurring themes across the uploaded corpus and provided cohesive summaries that aligned with those obtained through manual review.

A key thematic finding was the emphasis on digital inclusion and autonomy. Several studies in the corpus examined how technology can support older adults' independence and social connectedness. NotebookLM accurately summarized the role of smart home technologies and digital assistants in promoting safety, medication management, and virtual communication. For example, it referenced Chen et al. (2023) in relation to voice-based assistants for daily routines and Papadopoulos et al. (2022) regarding sensor-based wellness monitoring systems. The AI noted that such technologies are designed not only to assist with health-related tasks but also to reduce social isolation by enabling digital participation.

Another prominent theme was lifelong learning and cognitive engagement. The AI highlighted the benefits of e-learning platforms tailored for older adults, citing evidence that participation in digital learning can improve cognitive performance and quality of life (Sharpe & Elwood, 2024). It correctly identified the growing interest in intergenerational learning programs and digital literacy training, particularly following the COVID-19 pandemic (Seifert et al., 2021). This matched the manual analysis, which found that recent studies increasingly focus on older adults' self-directed learning and the social benefits of online education.

NotebookLM also captured critical concerns around design and usability. It noted that many educational technologies are not age-inclusive, with common barriers including complex interfaces, small fonts, and unintuitive navigation. The AI referred to studies emphasizing the importance of user-centered and co-designed solutions, reflecting the literature's call for technologies that accommodate sensory and cognitive changes in older age.

A less frequent but still noteworthy topic addressed by the AI was ethics and data privacy. It synthesized discussions from several sources regarding the potential surveillance risks of home monitoring technologies, the importance of informed consent, and the need for transparent data governance. These points were corroborated by our manual review, though the AI required targeted prompts to extract such ethical considerations.

### ***Consistency and comparison with manual review***

The comparison between NotebookLM and the human-led review showed a high degree of thematic overlap. No major topic present in the manual review was entirely missed by the AI. For example, both processes identified digital literacy as a critical enabler of technology adoption, and both recognized the challenge of exclusion due to affordability or lack of training.

In terms of specificity, NotebookLM generally provided accurate but general summaries. However, when prompted, it was capable of naming authors and years and giving more detailed insights. In one instance, it correctly attributed findings to Chen et al. (2023) regarding the acceptability of voice assistants, which we verified in the source text. Yet, it also showed occasional inaccuracies—for example, referencing a study by Zhang et al. (2020) that was not present in our corpus. This was likely a misattribution or confusion with another source, highlighting the need for human validation.

While outright fabrications were rare, there were instances of overgeneralization or misinterpretation. For example, one study reporting mixed results about a training program was paraphrased by the AI as "extremely effective." Such discrepancies underscore the importance of close reading and cross-checking when using AI tools in scholarly contexts.

Despite these limitations, the efficiency gains were substantial. Producing an initial synthesis of twenty documents through NotebookLM took only a few hours, compared to the days required for manual review. The system retained contextual memory, enabling follow-up questions such as "Which studies mentioned intergenerational learning?" and generating specific responses linked to uploaded texts. This functionality mimicked the behavior of an intelligent assistant, guiding the researcher through the document set.

Moreover, NotebookLM demonstrated the capacity to identify temporal patterns, noting, for instance, that the focus on distance learning for seniors surged in publications from 2020 onward, corresponding with the global shift to remote interaction during the pandemic. This form of embedded bibliometric insight added value to the thematic synthesis and helped contextualize the evolution of research in the field.

### ***SWOT analysis of NotebookLM as a literature review tool***

To systematically evaluate the applicability of NotebookLM in academic research, a SWOT analysis was conducted. This framework allowed us to assess not only its functional capacity but also its broader implications for scholarly work.

Strengths include the tool's ability to rapidly synthesize large volumes of uploaded academic texts, maintain contextual memory across sources, and support iterative querying (Castillo-Segura et al., 2023; Yang et al., 2023). It also proved useful for detecting recurring themes and producing citation-ready summaries, which can save time and support early-stage exploration.

Weaknesses relate to factual reliability, limited scope, and lack of methodological discernment. The tool occasionally hallucinates references (Chelli et al., 2024), misattributes findings, and offers no capacity for assessing the quality of evidence. Moreover, it is limited

to the uploaded corpus and cannot suggest missing but relevant literature (Susnjak et al., 2025).

Opportunities include the integration of such tools in teaching academic synthesis and in supporting students or early-career researchers. As generative AI improves, NotebookLM may enable multilingual review workflows, dynamic literature maps, and more equitable access to academic content (Formosa & Noguera, 2023; Seifert et al., 2021).

Threats concern overreliance on AI, potential reinforcement of bias, and issues of academic integrity. Without human oversight, there is risk of misinformation or shallow engagement with literature. Furthermore, repeated use of similar AI tools could lead to homogenization of review processes across disciplines (Yang et al., 2023).

To systematically assess the functionality of NotebookLM in the context of literature reviews, we conducted a SWOT analysis focusing on its strengths, weaknesses, opportunities, and threats. This analysis drew on our direct interaction with the tool, as well as on findings from recent evaluations of AI-supported academic tools (Castillo-Segura et al., 2023; Chelli et al., 2024; Susnjak et al., 2025).

**Table 1. Swot Analysis of NotebookLM as an AI Literature Review Tool**

<b>Strengths</b>	<b>Weaknesses</b>
Fast synthesis of uploaded documents	Occasional hallucinations and citation errors (Chelli et al., 2024)
Maintains contextual memory across sources (Castillo-Segura et al., 2023)	Limited to uploaded corpus; cannot retrieve new sources (Susnjak et al., 2025)
Supports thematic clustering and trend detection (Yang et al., 2023)	No capacity to assess methodological quality or credibility
Useful for early-stage review and citation generation	Generalizes complex findings unless prompted specifically
<b>Opportunities</b>	<b>Threats</b>
Supports academic training and scaffolding of novice researchers (Formosa & Noguera, 2023)	Risk of diminished researcher engagement with source material (Susnjak et al., 2025)
Potential integration of multilingual and inclusive corpora	Biases if input corpus lacks representational diversity (Seifert et al., 2021)
Enables dynamic "living" reviews and fast updates	Ethical risks: plagiarism, improper attribution, misuse (Chelli et al., 2024)
Increases accessibility for time-constrained or under-resourced researchers	Review standardization and homogenization of academic synthesis (Yang et al., 2023)

## Discussion

The results of this study underscore both the promise and the current limitations of integrating AI tools such as NotebookLM into the research workflow, particularly for the synthesis of literature in interdisciplinary fields like educational gerontechnology. The tool demonstrated considerable utility in accelerating information retrieval and organizing conceptual themes, confirming earlier findings regarding the time-saving potential of large language models in systematic reviews (Castillo-Segura et al., 2023; Chelli et al., 2024).

Thematic congruence between the AI-assisted and human-conducted reviews was strong, with NotebookLM effectively identifying recurring patterns such as digital inclusion, lifelong learning, and age-sensitive design. Its capacity to support iterative inquiry, by allowing researchers to refine questions and build upon prior outputs, provided a more exploratory and conversational model of literature engagement (Yang et al., 2023).

Nevertheless, the tool's weaknesses, especially its occasional hallucinations, dependence on user-provided materials, and lack of critical appraisal, highlight the necessity of human oversight. While the AI could recognize trends, it lacked the epistemic judgment to weigh the quality of evidence or to detect methodological flaws. This limitation aligns with concerns raised in recent literature about the superficiality of LLM outputs in academic contexts (Formosa & Noguera, 2023; Susnjak et al., 2025).

Importantly, the evaluation showed that AI can be a valuable collaborator rather than a replacement for the researcher. By outsourcing repetitive and time-consuming tasks such as thematic clustering and reference mapping, researchers are free to focus on interpretation, critique, and synthesis. This model aligns with the concept of a "human-in-the-loop" approach to AI, where technology amplifies human capacities without substituting for critical thinking (Yang et al., 2023).

The potential educational benefits of such tools also merit consideration. For novice researchers and students, AI systems like NotebookLM can serve as scaffolding devices, helping to visualize knowledge structures and practice academic synthesis. However, this pedagogical promise must be tempered with clear guidance about the limitations of AI output, especially in relation to source verification and ethical use.

From an ethical standpoint, our findings support current recommendations for transparent disclosure of AI use, manual validation of AI-generated content, and critical awareness of bias and representational imbalance in training data (Chelli et al., 2024). Without these safeguards, there is a risk of introducing inaccuracies into the academic record or reinforcing dominant narratives at the expense of marginalized voices (Seifert et al., 2021).

Overall, NotebookLM can be seen as a productive yet partial solution to the challenges of navigating large scholarly literatures. When embedded within a reflective, ethically grounded research process, it has the potential to enhance efficiency and accessibility in academic knowledge production.

From an educational perspective, the use of AI tools in literature review processes should be critically examined through the lens of adult learning theory. The interaction between older adult learners and AI-powered platforms like NotebookLM reveals both affordances and barriers related to accessibility, digital confidence, and epistemic agency. Without critical framing, these tools risk reinforcing digital divides. Therefore, embedding AI technologies within the values of inclusive adult education is essential to ensure meaningful participation and knowledge equity.

## Conclusion

This study explored the application of NotebookLM, a generative AI tool developed by Google, as a support mechanism for conducting literature reviews in the field of educational technologies for older adults. Our aim was to assess how effectively such tools can assist in synthesizing research, identify their limitations, and reflect on the ethical and methodological implications of their use in academic settings.

The findings suggest that NotebookLM offers significant potential for accelerating the early stages of literature analysis. It efficiently identified recurring themes, supported iterative exploration of sources, and provided useful summaries that aligned with human-coded findings. These features make it a promising assistant for researchers managing large volumes of interdisciplinary literature, particularly when time or resources are limited.

However, the study also revealed critical limitations. NotebookLM occasionally produced hallucinated or inaccurate references, and its inability to assess the quality or credibility of individual studies remained a significant constraint. These findings reinforce the necessity of

human validation, not only to check facts but also to interpret and critique the literature in a meaningful way. AI, in this context, must be seen as a facilitator—not a substitute—for scholarly judgment.

From an educational perspective, the tool presents valuable opportunities for fostering digital research skills and scaffolding the literature review process for students and early-career scholars. Yet such use requires structured guidance to ensure ethical and effective practice. Transparency about the use of AI, critical engagement with its outputs, and inclusive corpus design are essential for responsible implementation.

Future research should investigate how NotebookLM performs across different academic disciplines and with more diverse data types, including multilingual or multimodal sources. Further evaluation is also needed on how such tools affect researchers' cognitive engagement with literature and whether they promote or hinder critical thinking over time.

In conclusion, while NotebookLM is not a replacement for traditional scholarly review, it holds considerable value as a cognitive and organizational aid—one that, when embedded within reflective academic practice, can contribute meaningfully to the evolving landscape of digital research. By highlighting the interplay between human oversight, ethical responsibility, and inclusive design, the study emphasizes that AI tools like NotebookLM should be evaluated not only for efficiency but also for their alignment with the pedagogical values of lifelong learning, accessibility, and critical engagement.

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