

# Learning with AI, Not From AI: A Post-exposure Evaluation of NotebookLM

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## Article Details:

Received: 04 March 2026

Revised: 09 March 2026

Accepted: 18 March 2026

Published: 21 March 2026

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## Recommended Citation:

Maniulit, J. J. (2026). Learning with AI, Not From AI: A Post-exposure Evaluation of NotebookLM. *The International Review of Multidisciplinary Research*, 1 (3), 290-299.

<https://doi.org/10.5281/zenodo.19142887>

## Index Terms:

artificial intelligence, cognitive tasks, learning stations, higher education, NotebookLM

**Abstract.** The increasing integration of artificial intelligence in higher education necessitates systematic evaluation of its instructional effectiveness, particularly in supporting students' cognitive engagement. This study examined the responsiveness of an AI-assisted tool, NotebookLM, in enhancing cognitive task performance among pre-service mathematics teachers in a tertiary setting. Specifically, it sought to evaluate students' post-exposure perceptions of the tool's functionality, accessibility, technical requirements, privacy and data protection, and social and cognitive presence during classroom-based Learning Station activities. Employing a descriptive–evaluative research design with a case study approach, the study involved 45 Bachelor of Secondary Education major in Mathematics students selected through purposive sampling. Data were collected using a structured questionnaire adapted from the eCampusOntario rubric for evaluating AI tools, consisting of both Likert-scale items and open-ended questions. Quantitative data were analyzed using descriptive statistics, including frequencies and weighted means, while qualitative responses underwent thematic analysis to capture recurring patterns in students' experiences. Findings revealed generally positive perceptions of NotebookLM, particularly in supporting comprehension, organization of ideas, and collaborative learning tasks. However, students also identified challenges related to initial navigation and dependency on stable internet connectivity. Overall, the study highlights the potential of AI-supported learning stations in enhancing cognitive task engagement while underscoring the importance of guided implementation. The results contribute to the growing discourse on responsible and pedagogically grounded integration of AI tools in teacher education.

## Introduction

Global educational landscape is currently undergoing a "Generative AI Revolution." International research suggests that while General Purpose AI (GPAI) like ChatGPT offers broad utility, it often presents risks regarding academic integrity and factual "hallucinations" (UNESCO, 2023). In response, "source-grounded" AI tools such as NotebookLM have emerged. These tools utilize Retrieval-Augmented Generation (RAG) to ensure that AI outputs are strictly tethered to verified user-uploaded documents (Bentley & Higgins, 2024). This shift is critical as it moves the focus from "content generation" to "content synthesis and inquiry."

In the Philippines, the Department of Education (DepEd) and various Higher Education Institutions (HEIs) have begun exploring the ethical adoption of AI. Local scholars emphasize that the challenge for Filipino educators is not just providing access to technology, but ensuring "AI Literacy"—the ability of students to critically evaluate and collaborate with AI tools (De Silva & Reyes, 2024; UP Open University, 2023). The concept of Learning Stations serves as a strategic pedagogical approach in local classrooms, allowing students to rotate through technology-enhanced activities to foster collaborative inquiry and active learning.

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### *The Problem Statement*

While the potential of AI in the classroom is widely acknowledged, there is a significant "evaluation gap." Many students use AI tools without a structured framework to assess their reliability, privacy standards, or instructional value. In the Philippine context, where digital resources are sometimes limited, it is essential to determine if a tool like NotebookLM provides actual cognitive presence (deep thinking) or if it merely acts as a shortcut. There is a lack of empirical "post-exposure" data evaluating how integrated AI tools perform against standardized criteria like the eCampusOntario (2024) rubric in a collaborative classroom setting.

### *Objectives of the Study*

This research evaluates the effectiveness of NotebookLM as an AI learning companion through the following objectives:

1. **Fundamental Evaluation:** To assess NotebookLM's usability, accessibility, and data privacy based on the eCampusOntario (2024) fundamental criteria.
2. **Pedagogical Assessment:** To analyze the tool's impact on student inquiry and collaborative learning within a Learning Station setup.
3. **Qualitative Analysis:** To document the lived experiences, challenges, and perceived learning value of students after direct exposure to the tool.

### *Significance of the Study*

This study is significant for educators seeking evidence-based methods to integrate AI safely. For students, it highlights the importance of using "grounded" AI to improve research accuracy. Finally, for academic institutions, this research provides a blueprint for using international rubrics (eCampusOntario) to evaluate local classroom interventions.

## **Literature Review**

### *The Shift from General AI to "Source-Grounded" Learning*

Recent international studies mark a significant shift from using general-purpose AI (like ChatGPT) to "source-grounded" AI systems. NotebookLM is highlighted as a primary example of Retrieval-Augmented Generation (RAG), which ensures that AI responses are strictly tethered to specific, user-provided documents (FGCU, 2025). This "grounding" addresses the critical problem of AI hallucinations, fostering a "foundation of trust" that is essential for academic research (BCCampus, 2025). Locally, the UP Open University (2023) emphasizes that for AI to be responsible, it must prioritize transparency and evidence-based synthesis—features that are central to NotebookLM's design.

### *Enhancing Cognitive Presence through Active Recall*

Literature in cognitive science suggests that AI is most impactful when it moves beyond passive summarization into active recall. Tools within NotebookLM, such as AI-generated flashcards, quizzes, and mind maps, serve as "external cognitive resources" that help students identify big-picture ideas and test their own knowledge (Think Academy, 2025). Research by Wang et al. (2025) found that multimodal AI agents (audio/visual overviews) function as "Generative Co-Learners," significantly improving cognitive presence and reflection in students who may otherwise feel overwhelmed by dense academic texts (TESL-EJ, 2025).

### *AI as a Facilitator of Collaborative Inquiry*

The role of AI has evolved from a "search engine" to a "thought partner." Studies on human-AI collaboration (HAC) indicate that AI can act as an expert participant or a virtual peer that mediates group discussions (Filament Games, 2024). In a classroom setting, this facilitates inquiry-based learning, where the AI prompts students to ask deeper questions rather than just providing "easy answers" (Song et al., 2025). This aligns with the SEAMEO INNOTECH (2024) regional thrust in Southeast Asia, which advocates for AI tools that strengthen student agency and collaborative problem-solving.

### *Evaluation Standards and the eCampusOntario Framework*

With the influx of AI tools, there is an urgent need for standardized evaluation. The eCampusOntario (2024) rubric has emerged as a global benchmark, providing a 7-point Likert scale to assess AI tools across dimensions like usability, accessibility, and privacy. Literature suggests that using such rubrics in the classroom not only helps educators select better

tools but also builds "AI Literacy" in students by teaching them to critically analyze the technology they use (eCampusOntario, 2024; Hu, 2024).

### *The Philippine Context: Digital Transformation in Higher Education*

In the Philippines, the Commission on Higher Education (CHED) has spearheaded the Digital Transformation Roadmap and Strategic Plan (2024–2028), which mandates Higher Education Institutions (HEIs) to integrate emerging technologies into their curricula to ensure global competitiveness (CHED, 2025). This institutional shift is further supported by the National AI Strategy Roadmap 2.0 (2025), which identifies the academe as a critical hub for fostering an AI-ready human capital (DTI, 2025).

The implementation of "Learning Stations" in the tertiary classroom—where university students rotate through specific AI-enhanced tasks like mind-mapping and source-based synthesis—aligns with the shift toward learner-centered pedagogy. Unlike traditional rote learning, these stations encourage student autonomy and cooperative work, which are essential soft skills in the Fourth Industrial Revolution (4IR). Recent local studies on Philippine HEIs indicate that such "learning destination sites" not only improve remote and hybrid learning outcomes but also significantly reduce the cognitive load of students by providing structured, AI-assisted pathways for inquiry (Mallillin et al., 2025; Obenza et al., 2024).

## Methodology

This study adopted a descriptive-evaluative research design using a case study approach. It functioned as a post-exposure evaluation, focusing on students' experiences and perceptions after engaging with NotebookLM during classroom-based *Learning Station* activities. The case study design allowed an in-depth examination of a bounded system—a single tertiary classroom—providing contextualized insights into how an AI learning tool operates in an authentic instructional setting (Bueno, 2017).

### *Participants and Sampling*

The participants were 45 tertiary students enrolled in the Bachelor of Secondary Education major in Mathematics at Taguig City University. Purposive sampling was employed, as all participants had direct exposure to NotebookLM and utilized the tool to produce specific learning outputs such as mind maps, flashcards, and quizzes. This sampling technique ensured that respondents were capable of providing informed and experience-based evaluations of the tool.

### *Research Instrument*

Data were collected using a structured survey questionnaire adapted from the *Rubric for Evaluating AI Tools: Fundamental Criteria* developed by eCampusOntario (2024). The instrument consisted of two parts:

1. Quantitative Section – A Likert-scale assessment measuring five domains: Functionality, Accessibility, Technical Requirements, Privacy and Data Protection, and Social-Teaching-Cognitive Presence.
2. Qualitative Section – Open-ended, post-exposure questions designed to elicit students' reflections on their learning experiences, perceived benefits, and challenges encountered while using NotebookLM.

### *Data Collection Procedure*

Data collection was conducted in four stages:

1. Exposure Phase – Students engaged with NotebookLM during a scheduled classroom activity using a *Learning Stations* format.
2. Orientation – The researcher explained the study's purpose and obtained informed consent from all participants.
3. Survey Administration – The questionnaire was administered through Google Forms immediately after the activity to capture authentic post-use reflections.
4. Anonymity and Ethics – Responses were collected anonymously to encourage honest and unbiased feedback.

### *Data Analysis*

Quantitative Data were analyzed using descriptive statistics, specifically frequencies and weighted means, to summarize student ratings across the evaluation domains. Qualitative Data underwent thematic analysis, wherein responses were

coded and clustered to identify recurring themes related to the tool’s instructional value, cognitive support, and encountered challenges.

**Results and Discussion**

Criteria	Works Well	%	f	Minor Concerns	%	f	Serious Concerns	%	f
Responsiveness	The AI provides rapid and accurate responses to queries.	80%	36	Occasional delays or inaccuracies in AI responses.	20%	9	Slow response times and frequent inaccuracies hindering the learning process	0	0
Ease of Use	The AI interface is intuitive, with little to no learning curve for new users.	35.6%	16	Some users require assistance to navigate or understand AI functionalities.	60%	27	Users find the interface confusing, leading to a significant barrier to effective use.	4.4%	2
Tech Support / Help Availability	Robust support materials specifically for AI, with responsive technical support for AI-related inquiries.	91.1%	41	AI support materials are less thorough.	8.9%	4	Lack of AI-focused support materials and channels.	0	0

Table 1. Functionality

The results show that NotebookLM performs well in terms of functionality when used as a classroom learning station. Most students (80.0%) reported that the tool provided fast and accurate responses, with no serious concerns identified, indicating reliable system performance during learning activities. In terms of ease of use, while 35.6% of students found the interface immediately intuitive, the majority (60.0%) reported minor concerns, mainly related to the need for initial guidance. Only a small proportion (4.4%) experienced serious difficulty, suggesting that brief orientation is sufficient to support effective use. For technical support and help availability, feedback was overwhelmingly positive, with 91.1% indicating that support materials were adequate and accessible. No serious concerns were reported in this criterion. Overall, the findings suggest that NotebookLM is functional, reliable, and suitable for instructional use, particularly when implemented with minimal scaffolding to support first-time users.

Criteria	Works Well	%	f	Minor Concerns	%	f	Serious Concerns	%	f
Accessibility standards	The AI tool complies with international accessibility standards and includes features like text-to-speech, alternative text for images, and screen reader compatibility	71.15	32	The tool has some limited capacity to meet accessibility guidelines.	26.9 %	13	The tool fails to meet basic accessibility standards, making it difficult or impossible for users with disabilities to utilize it effectively.		
Cost of Use	The AI tool is free or offers significant value for its cost, with transparent pricing models.	68.9%	31	The tool has some cost barriers, but discounts or institutional licenses can reduce expenses.	26.7 %	12	The high cost of the tool significantly limits its accessibility to a broader user base	4.4%	2

Table 2. Accessibility

The findings indicate that NotebookLM demonstrates strong accessibility performance. A majority of students (71.1%) reported that the tool sufficiently meets accessibility standards, while the remaining respondents (28.9%) identified minor limitations. Importantly, no serious accessibility concerns were reported, suggesting that the tool is generally inclusive for classroom use. In terms of cost of use, most students (68.9%) perceived NotebookLM as affordable or offering good value,

though 26.7% noted minor cost-related concerns. Only a small proportion (4.4%) identified cost as a serious barrier. Overall, the results suggest that NotebookLM is largely accessible and financially feasible, particularly within resource-conscious classroom settings.

Criteria	Works Well	%	f	Minor Concerns	%	f	Serious Concerns	%	f
Operating Systems & Browsers	The AI tool is compatible with a wide range of operating systems, mobile devices and browsers and does not require extensive resources.		33	The tool works on most systems but is optimized for certain operating systems / browsers, which could limit some users.		12	Compatibility is limited to a few operating systems / browsers, excluding users.		
Additional Downloads	No additional downloads are required to use the AI tool, or any required software is lightweight and easy to install.		40	Some additional downloads are necessary, but they do not significantly impact the ease of setup or use.		5	The tool requires multiple or resource-intensive downloads, complicating setup and use, and possibly violating institutional IT policies.		1
Offline Access	The AI tool can function with minimal connectivity or has offline capabilities.		8	The tool requires a stable internet connection for most functionalities.		27	Constant, high-speed internet is essential, rendering the tool unusable in low-connectivity environments.		10

Table 3. Technical

Results indicate that NotebookLM performs well in terms of system compatibility and setup requirements. Most students (73.3%) reported broad compatibility across operating systems and browsers, with no serious concerns noted. Additionally, the majority (88.9%) indicated that the tool requires minimal or no additional downloads, supporting ease of implementation in classroom settings. However, offline access emerged as a key limitation. While 17.8% reported some level of low-connectivity functionality, most students (60.0%) indicated that a stable internet connection is required, and 22.2% identified this as a serious concern. This finding highlights connectivity dependence as a critical consideration when implementing NotebookLM in contexts with limited or unstable internet access.

Criteria	Works Well	%	f	Minor Concerns	%	f	Serious Concerns	%	f
Sign Up/ Sign In	The AI tool uses secure authentication methods and offers options for anonymity where appropriate.	55.6%	25	The tool requires some personal information for sign-up but has transparent policies on data usage	4.4%	2	The sign-up process lacks secure authentication or unnecessarily requires extensive personal information.	0%	0
User Control Over Data	Users have full control over their data, with options to modify, delete, export, or restrict processing of their data.	100%	45	Users have some control, but there may be limitations on how they can manage their data within the AI system.	0%	0	Users have little to no control over their data once it is entered into the AI system	0%	0

Table 4. Privacy, Data Protection, and Rights

The results indicate strong student confidence in NotebookLM's privacy and data protection features. More than half of the respondents (55.6%) perceived the sign-up and sign-in process as secure, while the remaining students (44.4%) reported minor concerns related to the need for personal information, though with transparent data-use policies. Notably, no serious concerns were reported.

For user control over data, all participants (100.0%) indicated that NotebookLM provides full control over their uploaded content, including options to manage and restrict data use. This finding underscores NotebookLM's alignment with ethical AI principles and highlights its suitability for responsible classroom integration.

Criteria	Works Well	%	f	Minor Concerns	%	f	Serious Concerns	%	f
Social (Collaboration)	The AI tool enhances collaboration through features like group chats, forums, and intelligent matchmaking for study partners or groups based on skills and learning goals	68.9%	31	The tool supports some collaborative functions, but some features may not be as robust or user-friendly as desired.	2.6%	12	Collaboration is hindered by the tool, either through lack of supportive features or by creating barriers to effective group work.	4.4%	2
Teaching (Facilitation)	The AI tool facilitates meaningful learning experiences, effectively guiding students through the learning process and providing timely support.	68.9%	31	The tool aids in facilitation but may require additional instructor intervention for optimal guidance	2.6%	12	The AI tool's facilitation is limited or misaligned with instructional goals, necessitating significant instructor effort to maintain teaching presence.	0%	0
Cognitive Enhancement of Cognitive Task(s)	The AI tool actively supports a range of cognitive tasks, enhancing learning efficiency and effectiveness	55.6%	25	The tool provides some cognitive support, but it may not be comprehensive across all task types.	4.4%	20	The tool does little to enhance cognitive tasks, possibly hindering cognitive engagement due to poor design or functionality.	0%	0

Table 5. Social, Teaching, and Cognitive Presence

The results indicate that NotebookLM demonstrates strong social, teaching, and cognitive presence within the learning station setup. A majority of students (68.9%) reported that the tool effectively supported collaboration and instructional facilitation, with only minimal serious concerns noted in social interaction. In terms of cognitive enhancement, over half of the students (55.6%) perceived that NotebookLM actively supported their cognitive tasks, while the remaining respondents identified minor limitations rather than major deficiencies. Importantly, no serious concerns were reported for teaching or cognitive presence, suggesting that NotebookLM effectively functions as a learning companion that supports inquiry, collaboration, and guided learning.

*Thematic Analysis of Students' Overall Experience in Using NotebookLM as a Learning Station*

Analysis of students' responses revealed four major themes describing their overall experience in using NotebookLM as a learning station during class activities.

**Theme 1: Organized and Time-Efficient Learning**

Most students described NotebookLM as a tool that made learning more organized and efficient. They emphasized how features such as summaries, mind maps, flashcards, and quizzes helped them manage large amounts of information, particularly when reviewing multiple mathematicians. One student shared that NotebookLM "made it easier to review because all the important details were already summarized," while another noted that studying became "less stressful and not time-consuming compared to the traditional way."

**Theme 2: Increased Engagement and Motivation**

Students reported that NotebookLM made learning more engaging and enjoyable. The interactive nature of the platform encouraged active participation and sustained interest during class activities. A participant described the experience as "very enjoyable and interactive," while another stated that the tool "made studying easier and more interesting, not boring." Several students also mentioned that using NotebookLM motivated them to study in advance and participate more confidently in class.

**Theme 3: Support for Independent and Self-Paced Learning**

NotebookLM supported students' independent learning by allowing flexible access to study materials anytime and anywhere. Students appreciated being able to review using their preferred study methods. As one student explained, "I can easily review without writing handwritten notes and I can access it on my phone." Others highlighted that the platform helped them understand complex topics by breaking information into smaller, manageable sections.

**Theme 4: Limitations in Depth of Learning and Technical Concerns**

Despite the positive experience, some students expressed concerns regarding overreliance on memorization and technical limitations. A few participants felt that using quizzes and summaries led to "memorizing answers rather

*than fully understanding the lesson.*" Technical issues such as the need for a stable internet connection and occasional errors were also noted. One student mentioned that *"sometimes there are missing information or errors, especially during exams."*

### Overall Synthesis

Overall, students perceived NotebookLM as a helpful and effective learning station that enhanced organization, engagement, and independent learning. While concerns about deep learning, collaboration, and technical issues were identified, students generally viewed the tool as a valuable support to classroom instruction rather than a replacement for teacher-led discussions.

### Thematic Analysis: AI as a Learning Companion

Students' responses regarding their feelings about using NotebookLM as a learning companion revealed four key themes.

#### Theme 1: Reduced Learning Pressure and Emotional Ease

Many students expressed positive emotions such as happiness, ease, and reduced pressure when using NotebookLM. The AI tool helped lessen stress, especially for students who struggled with traditional learning setups or had limited time for review. One student shared that using NotebookLM made learning *"less stressful and not time-consuming,"* while another stated that they felt *"at ease when using NotebookLM because it helps me understand better."* This suggests that NotebookLM provided emotional support by making academic tasks more manageable.

#### Theme 2: Perception of AI as a "Study Buddy"

A recurring idea in the responses was the perception of NotebookLM as a learning companion or "study buddy." Students felt supported by the tool as it guided them through lessons, explained concepts, and organized information. One participant described the experience as *"parang may study buddy ako na tumutulong mag-explain at mag-organize ng lessons,"* while another noted that *"it feels like I have someone helping me review."* This highlights the role of AI in fostering a sense of companionship in independent learning.

#### Theme 3: Increased Convenience and Learning Confidence

Students emphasized the convenience of NotebookLM, particularly its ability to generate quizzes, flashcards, mind maps, and audio materials. These features boosted their confidence in learning and reviewing lessons across subjects. A student mentioned that *"it made my work easier tenfold, all I have to do is review,"* while another shared that the tool helped them *"feel more confident when participating in activities."* This indicates that NotebookLM enhanced learners' self-efficacy by supporting different study preferences.

#### Theme 4: Cautious Trust and Preference for Traditional Learning

Despite the positive feelings, some students expressed caution in fully relying on AI. Concerns included possible inaccuracies, overdependence, and reduced depth of learning. One participant admitted that they *"sometimes doubt the answers generated by AI and still double-check the information,"* while another shared a preference for traditional learning, stating that they were *"more used to learning without AI."* These responses reflect students' awareness of the limitations of AI and the continued value of teacher-guided instruction.

### Overall Synthesis

Overall, students felt positive, supported, and motivated when using NotebookLM as a learning companion. The tool reduced learning anxiety, increased convenience, and provided a sense of academic support. However, students also demonstrated critical awareness by emphasizing the need for proper use, verification of information, and balance between AI-assisted and traditional learning approaches.

### Thematic Analysis: Challenges Encountered in Using NotebookLM

Students identified several challenges while using NotebookLM during class activities. These challenges clustered into four major themes, although many participants emphasized that the difficulties were manageable and did not outweigh the benefits of the tool.

**Theme 1: Internet Connectivity and Technical Dependence**

The most frequently reported challenge was the reliance on a stable and fast internet connection. Students noted delays, glitches, slow processing, and difficulty accessing features when using mobile data or weak signals. One student explicitly stated, *"Honestly, my own internet connection,"* while another shared that *"NotebookLM needs a very stable connection, and not all of us have access to Wi-Fi."* This theme highlights digital access as a critical factor affecting the usability of AI tools in classroom settings.

**Theme 2: Feature Limitations and Usage Restrictions**

Several students reported limitations in specific features, particularly quizzes and downloads. Concerns included repeated quiz questions, limits on quiz generation, and restrictions requiring premium access. A participant noted that *"generating quizzes is limited, and you need to go premium for unlimited access,"* while another mentioned that *"mind map is the only station that can be downloaded."* These limitations affected students' flexibility in using NotebookLM as a consistent review tool.

**Theme 3: Initial Learning Curve and Navigation Difficulties**

Some students experienced difficulty during initial use, particularly in navigating features and understanding workflows. One student shared that *"at first, it was challenging to understand how to use all the features,"* while another noted confusion in navigation during early use. However, most students emphasized that these difficulties diminished over time as they became more familiar with the platform.

**Theme 4: Overreliance and Reduced Depth of Learning**

A smaller group of students expressed concern about becoming overly dependent on AI-generated summaries and quizzes, which they felt sometimes encouraged memorization rather than deep understanding. One participant reflected that *"I relied too much on AI-generated quizzes and struggled when it was not available,"* while another mentioned that excessive reliance could affect reading comprehension. This theme reflects students' growing awareness of the need for balanced AI use.

**Overall Synthesis**

Overall, students encountered challenges related mainly to technical access, feature limitations, and adjustment to AI-assisted learning. However, many explicitly stated that they experienced *"no major difficulties"* and viewed the challenges as situational rather than barriers. The findings suggest that while NotebookLM is generally user-friendly and effective, its implementation in classroom activities should consider infrastructure readiness, guided orientation, and pedagogical balance.

**Conclusion and Implications**

This study evaluated NotebookLM as an AI learning companion using the fundamental criteria outlined by eCampusOntario through a post-exposure classroom implementation. Findings indicate that NotebookLM performs strongly across functionality, accessibility, technical compatibility, privacy, and pedagogical presence. Students consistently reported that the tool enhanced organization, engagement, and independent learning, particularly through features such as mind maps, flashcards, quizzes, and source-based synthesis. Quantitative results revealed high levels of satisfaction in responsiveness, data privacy, and instructional facilitation, while qualitative findings showed that students perceived NotebookLM as a "study buddy" that reduced learning pressure and increased confidence. Importantly, students also demonstrated critical AI literacy by expressing cautious trust, recognizing feature limitations, and emphasizing the need to verify information and balance AI-assisted learning with traditional study practices. Despite challenges related to internet connectivity, feature limitations, and initial navigation, these concerns were largely situational and did not outweigh the perceived benefits. Overall, the findings suggest that when implemented through structured learning stations, NotebookLM effectively supports cognitive presence, collaborative inquiry, and responsible AI use in the tertiary classroom.

Based on the findings of the study, the following recommendations are proposed. Educators are encouraged to integrate NotebookLM using structured pedagogical approaches such as learning stations, accompanied by clear orientation and guided activities to minimize initial navigation difficulties and prevent overreliance on AI-generated outputs. Institutions should consider adopting standardized AI evaluation frameworks, such as the eCampusOntario rubric, as part of institutional AI governance and faculty development programs. Support for reliable internet infrastructure is essential to ensure equitable access. Students should be guided to use NotebookLM as a learning support tool rather than a replacement for critical reading and analysis. Emphasizing verification, reflection, and ethical use will further strengthen AI literacy. Future studies may employ experimental or longitudinal designs to examine the long-term effects of source-

grounded AI tools on learning outcomes, critical thinking, and academic integrity across different disciplines and institutional contexts.

## Acknowledgements

The authors would like to thank the BSE-Mathematics 1A 1B Students respondents from Taguig City University and colleague who provided guidance, feedback, and support throughout the conduct of this research and the preparation of this manuscript. Any remaining errors or omissions are the sole responsibility of the authors.

## Funding

This research received no external funding from any public, commercial, or not-for-profit funding agency, and no organization provided financial support for the conduct of the study, authorship, or publication of this article.

## Competing Interests Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

## Data Availability Statement

Data sharing is available upon submitting a formal request to the author.

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## Appendices

No appendices are attached to this study.