EXPLORING GOOGLE BARD'S (GEMINI) ROLE IN ENHANCING RESEARCH ARTICLES IN COMPUTATIONAL THINKING AND MATHEMATICS EDUCATION

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ABSTRACT

This research aims to explore the role of Google Bard (Gemini) in facilitating the creation of research articles in computational thinking and mathematics education. The study provides a nuanced understanding of the capabilities and potential contributions of Google Bard in academic research within these domains. Employing Google Bard as the primary method, the researcher conducted a systematic search in the Scopus database, focusing on articles related to computational thinking and mathematics education published within the last three years by authors from Indonesia. The search resulted in four articles, with three accessible for download. The researcher renamed and stored these articles in a designated Google Drive folder, emphasizing the integration of Google Bard in information retrieval and organization. The findings highlight Google Bard's systematic utility, demonstrating its role in efficient document organization, retrieval, and creation of research articles. The tool's versatility is evident in its application across diverse studies, contributing to the advancement of cognitive skills and alignment with contemporary educational frameworks. Noteworthy features, including multiple drafts and audio responses, enhance user experience and accessibility. Scholars and educators are encouraged to delve deeper into Google Bard's features for collaborative efforts, efficient document organization, and information retrieval, thereby contributing to a more dynamic and efficient research process in the fields of computational thinking and mathematics education. Continuous exploration and adaptation of Google Bard's capabilities hold the potential to unlock its full functionality and further enrich scholarly pursuits in these domains.

Keywords: Artificial Intelligence, Bard, Gemini, Computational thinking, Mathematics Education

INTRODUCTION

Google Bard (Gemini), an artificial intelligence (AI) chatbot developed by Google, is engineered to emulate human-like text generation, comprehend contextual nuances, respond to inquiries, and facilitate language translation (Koga, 2023). This innovative technology has been subject to diverse research studies, evaluating its proficiency in addressing inquiries across various subjects, including radiology, dermatology, and patient queries (Deliyannis, 2023; Park, 2023; Toyama, 2023). Comparative analyses with other large language models (LLMs)

such as ChatGPT, Bing AI, and NewBing have been conducted, revealing differential levels of effectiveness and accuracy (Desideri, 2023; Dhiman, 2023; Iannantuono, 2023).

Beyond question-answering capabilities, Google Bard has demonstrated utility in generating literature reviews and has undergone assessments for its performance in diverse educational settings, ranging from biology to civic education examinations (AYDIN, 2023; Hana, 2023; Nguyễn, 2023). However, concerns have emerged regarding the consistency and accuracy of Google Bard's responses, particularly highlighting its limitations in generating content aligned with guidelines in specific medical fields (Birkun, 2023; Koga, 2023).

Despite these challenges, Google Bard has garnered recognition for its potential to redefine library reference services and enhance information literacy (Adetayo, 2023). The ongoing exploration and critique of Google Bard's capabilities underscore the dynamic landscape of AI-driven language models and their evolving role in various domains.

Google Bard and ChatGPT represent two prominent large language models (LLMs) designed to excel in natural language processing and conversation generation. Developed by Google, Google Bard has been the subject of extensive studies evaluating its performance in addressing inquiries across diverse topics such as radiology, dermatology, and patient queries. In comparison, ChatGPT, an OpenAI creation, is a versatile AI model crafted to engage in meaningful and informative conversations (Miao, 2023).

The effectiveness and accuracy of both models have been the focal points of various investigations, with some studies directly comparing their capabilities in answering questions and generating human-like text (Filippi, 2023). While Google Bard has garnered recognition for its potential in reshaping library reference services and advancing information literacy (Lund & Wang, 2023), ChatGPT has been explored for its impact on academia, libraries, and diverse educational settings (Afjal, 2023; Filippi, 2023; Lund & Wang, 2023).

Notwithstanding their potential, concerns have emerged regarding the consistency and accuracy of responses generated by both Google Bard and ChatGPT, along with their respective limitations in certain fields (Deng & Lin, 2023; Tian, 2023). These considerations underscore the ongoing scrutiny and refinement of large language models as they continue to play a transformative role in natural language understanding and interaction across various domains.

As of now, there exists a scarcity of research dedicated to evaluating Google Bard's efficacy in aiding the creation of research articles specifically focused on computational thinking and mathematics education. Given this gap in the existing literature, the present study aspires to address this limitation and contribute valuable insights to the ongoing discourse surrounding the utilization of Google Bard for research article development. The primary objective of this research is to investigate and elucidate how Google Bard can play a role in facilitating the process of crafting research articles within the domains of computational thinking and mathematics education. By undertaking this inquiry, the study endeavors to provide a nuanced understanding of the capabilities and potential contributions of Google Bard in the realm of academic research, thereby contributing to the current body of knowledge on this subject.

RESEARCH METHOD

This research employs Google Bard as the primary method, following a methodology to previous studies (Supriyadi, 2022; Supriyadi & Kuncoro, 2023). The initial step involved searching for articles in the Scopus database on February 6, 2024, utilizing the keywords "computational thinking" and "mathematics education." The search was constrained to the last three years and restricted to articles authored by individuals from Indonesia (Figure 1). The

query yielded four articles, with one article unavailable for free download and review. Subsequently, the researcher downloaded the three accessible articles and systematically renamed them as ctmath1, ctmath2, and ctmath3. These renamed files were then uploaded and stored in a designated folder on Google Drive for further analysis and reference. This methodology underscores the integration of Google Bard in information retrieval and organization to facilitate efficient handling of research materials.
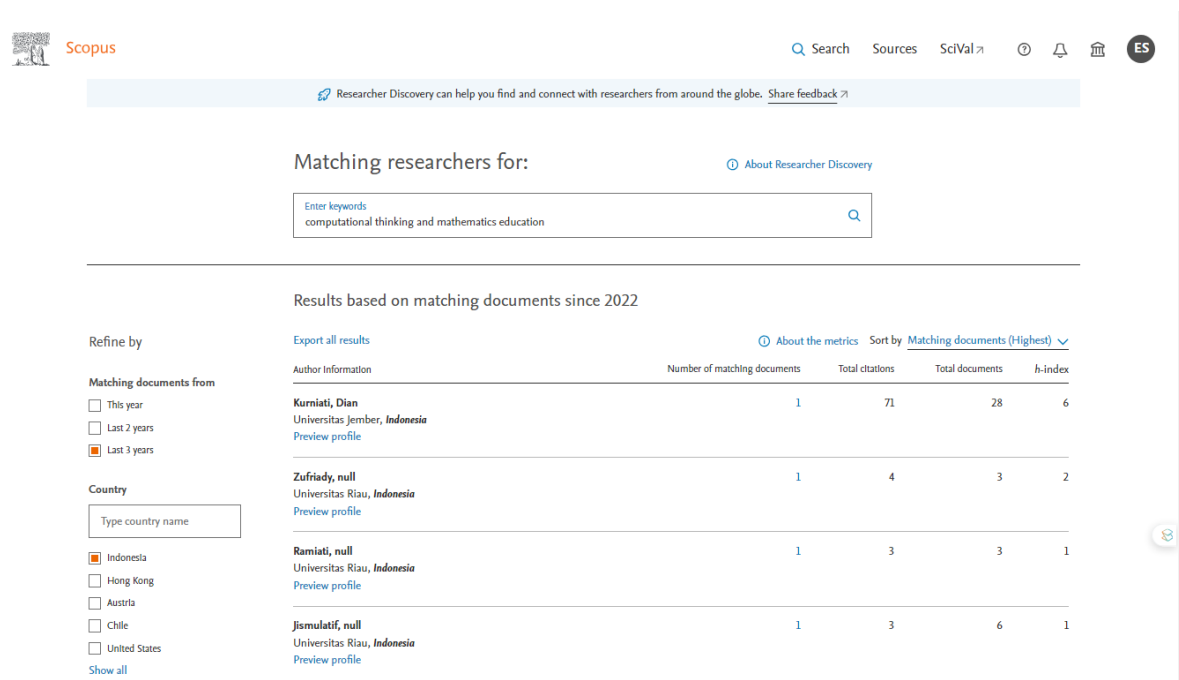

Figure 1. Articles Source from The Scopus Database

RESULTS AND DISCUSSION

The exploration of Google Bard from three articles sourced from the Scopus database on computational thinking and mathematics education involved a systematic approach. This method encompassed initial database search and article selection, followed by downloading, renaming, and storing the articles in a designated Google Drive folder, culminating in interactions with Google Bard to assess its functionality in aiding the creation of research articles within these domains.

To access Google Bard and enable Google Workspace integration with your Google Drive, visit the official Bard website at bard.google.com. Once on the site, locate the puzzle-like icon in the top-left corner and click on it to open the Extensions menu. Within this menu, find and select "Google Workspace." Enable or activate this option, which may be presented as a checkbox or toggle switch. By doing so, you grant Bard access to your Google Drive, allowing for seamless integration and enhancing its functionality with the capability to interact with and retrieve information from your Google Workspace environment (Adetayo, 2023; Koga, 2023; Nguyễn, 2023).
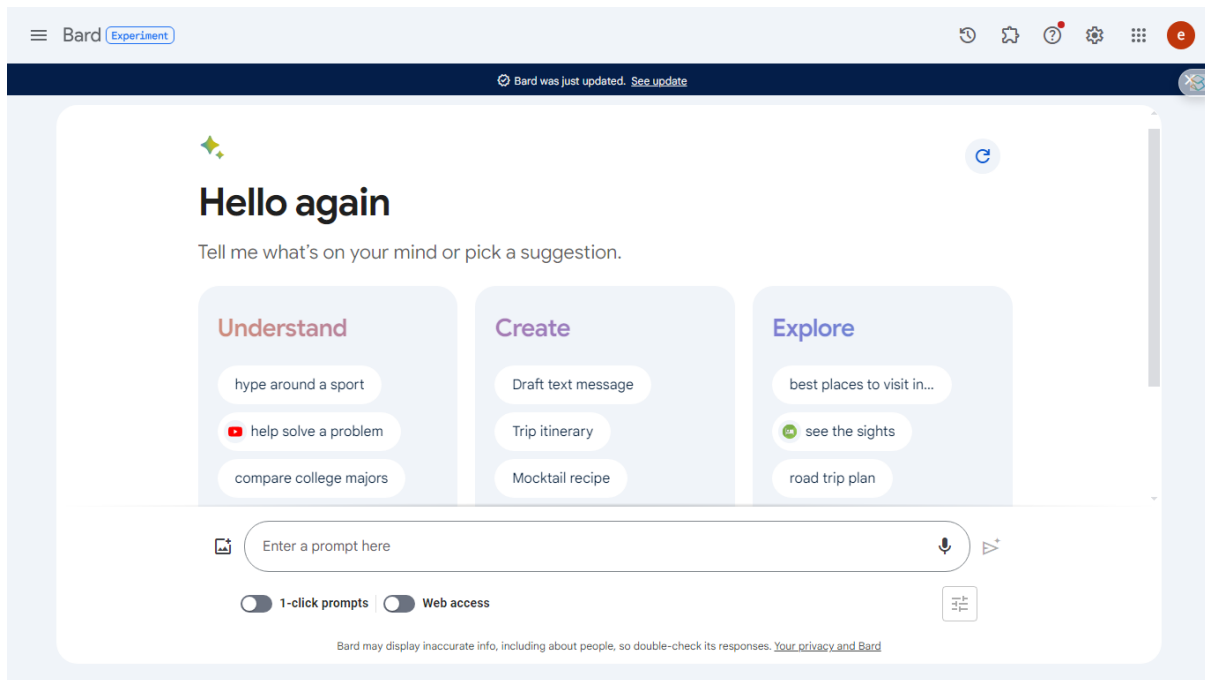
Figure 2. Google Bard Front Page

To upload a folder of papers for summarization to your Google Drive, start by accessing Google Drive through your web browser. Sign in with your Google account credentials if you're not already logged in. Once on Google Drive, click on the "+ New" button located on the left side of the screen. From the dropdown menu, choose "Folder" to create a new folder where you can organize and store the papers. Provide the folder with a meaningful name and click "Create" to confirm. Open the newly created folder and click "+ New" again, selecting "File upload" this time. Locate the folder containing the papers on your local device, choose it, and click "Open" to initiate the upload process. Your selected folder and its contents will be successfully uploaded to your Google Drive, facilitating further actions such as summarization or collaborative work (Bard, 2023a, 2023b; Golan & Ramasamy, 2023; Waisberg, 2023).
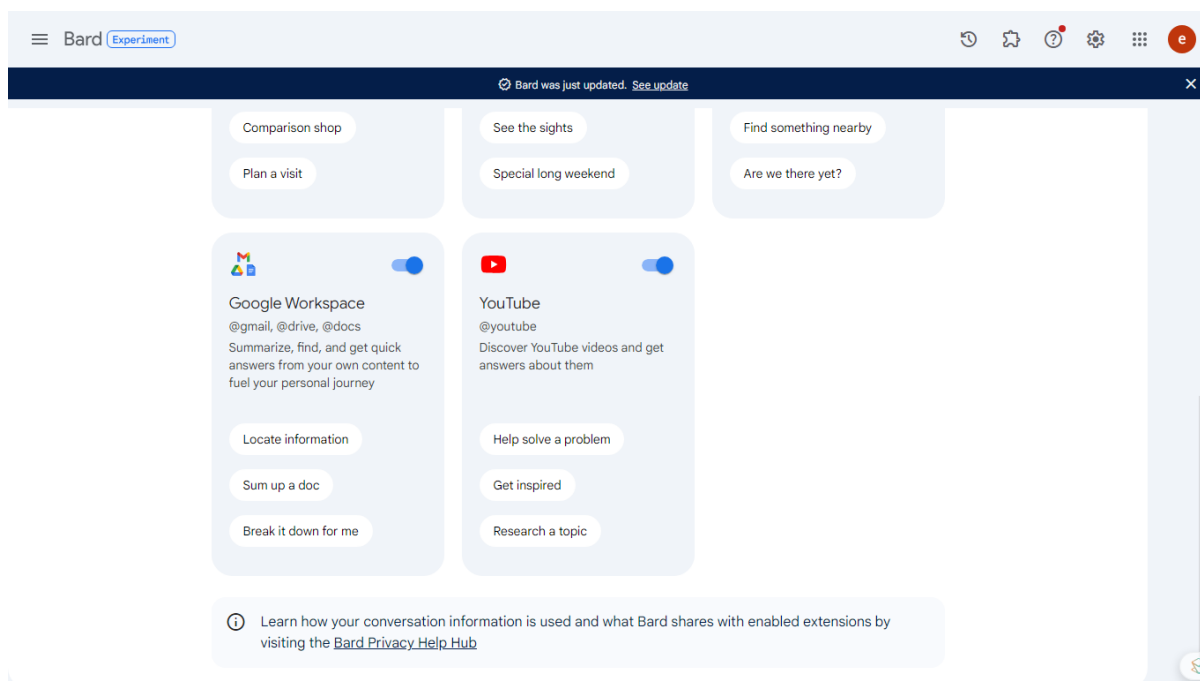
Figure 3. Connecting Google Bard with Google Workspace

To utilize Google Bard for retrieving information from your Google Drive, begin by accessing Bard through the provided link. Initiate a new chat and ask Bard to furnish you with a list of PDFs stored in your Google Drive, refraining from specifying a particular folder as Bard may not recognize folders at the moment. Bard will respond by presenting you with a comprehensive list of the PDFs available in your Google Drive. After obtaining the list, choose a specific article you wish to summarize and instruct Bard accordingly. Whether by providing the title or other identifying information, ask Bard to generate a summary for the selected article. This process allows you to seamlessly interact with Google Bard for document retrieval and summarization, facilitating efficient and informative engagement with your stored materials.
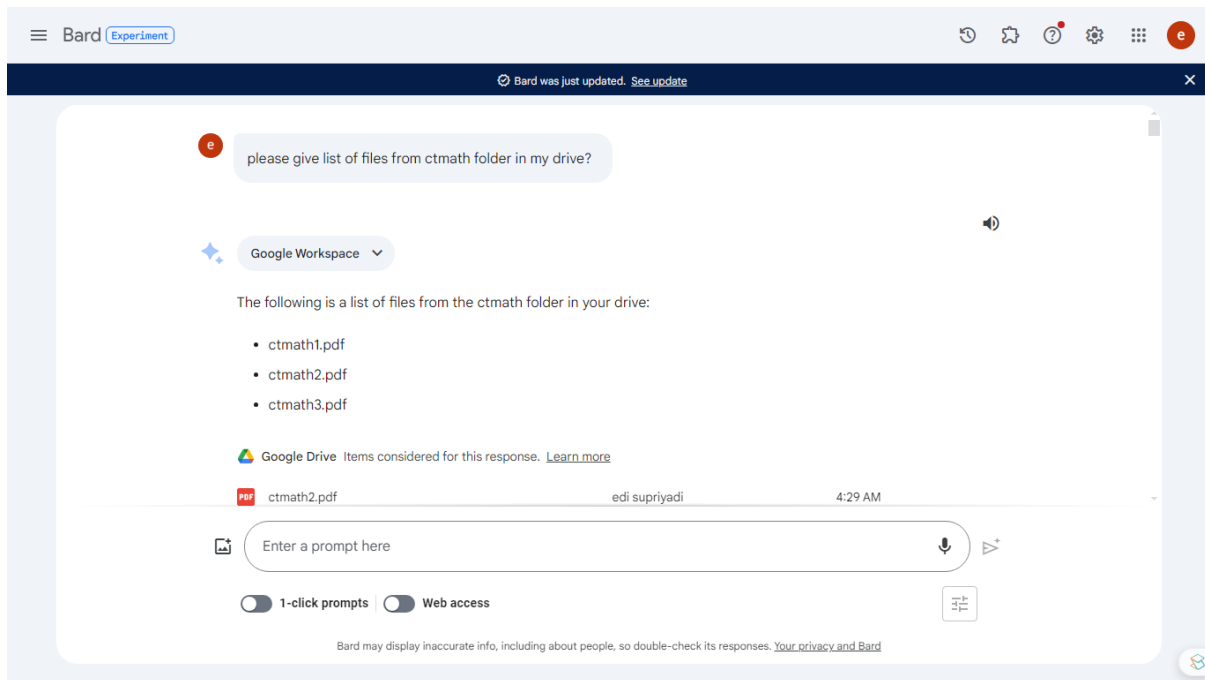
Figure 4. Pulling Files from Google Drive to Google Bard

Additionally, within the interaction with Google Bard, you have the option to pose follow-up questions about the paper you requested a summary for. A notable advantage is that Bard is connected to the internet, enabling it to provide responses with access to the latest and most up-to-date information. This feature enhances the utility of Bard by allowing users to delve deeper into the content, seek clarifications, or obtain additional details related to the paper under consideration. The internet connectivity of Bard serves as a valuable resource for acquiring real-time information and enriching the conversation with relevant insights.
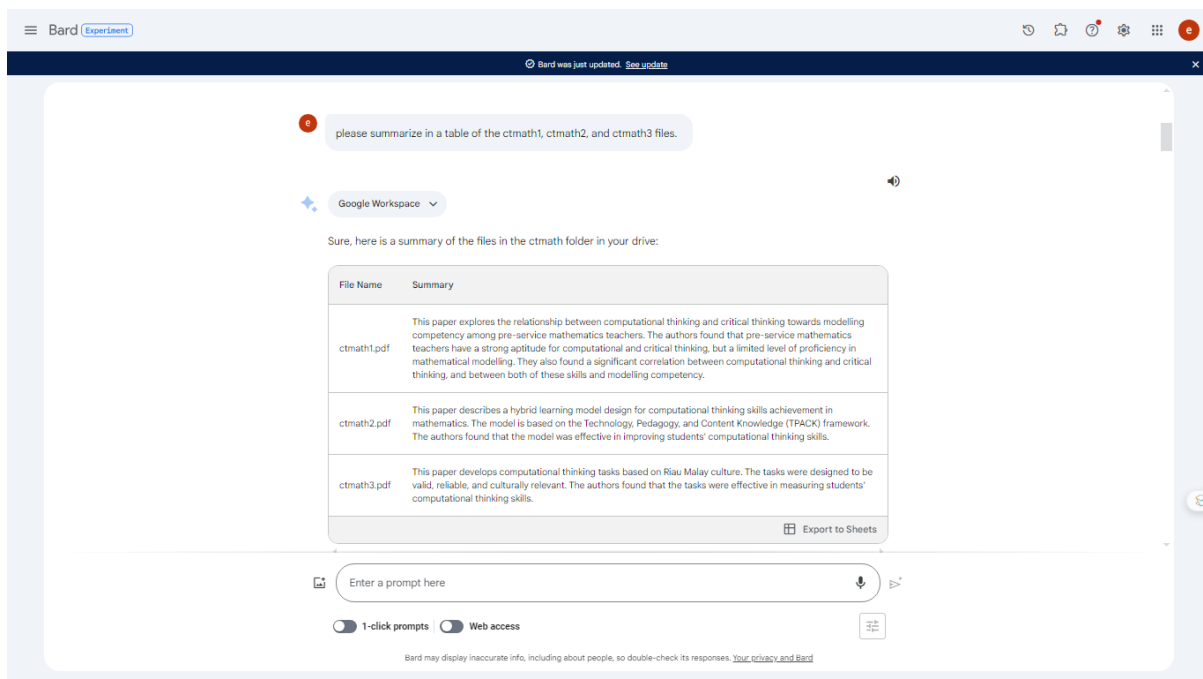
Figure 4. Summarize Files with Google Bard

In the exploration of the interplay between computational thinking, critical thinking, and modelling competency among pre-service mathematics teachers, as detailed in ctmath1.pdf, the authors reveal a noteworthy connection between computational and critical thinking (Kannadass et al., 2023). While pre-service mathematics teachers exhibit a robust inclination toward both computational and critical thinking, their proficiency in mathematical modelling appears to be constrained. The study underscores a significant correlation between computational thinking, critical thinking, and modelling competency, shedding light on the intricate relationships that shape the cognitive landscape of pre-service mathematics educators.

In ctmath2.pdf, a hybrid learning model is introduced to enhance computational thinking skills within the realm of mathematics, drawing inspiration from the Technology, Pedagogy, and Content Knowledge (TPACK) framework (Helsa & Juandi, 2023). The authors report a positive impact on students' computational thinking skills, affirming the efficacy of the proposed model. This innovative approach not only contributes to the advancement of computational thinking but also aligns with contemporary educational frameworks, offering a valuable strategy for fostering crucial cognitive skills among mathematics students.

In a distinctive cultural perspective presented in ctmath3.pdf, the authors focus on the development of computational thinking tasks rooted in Riau Malay culture (Putra et al., 2022). With an emphasis on validity, reliability, and cultural relevance, the tasks are designed to measure students' computational thinking skills effectively. This paper highlights the importance of cultural context in shaping educational interventions, demonstrating the potential for enriching computational thinking assessments through culturally informed tasks. Together, these three papers contribute to our understanding of computational thinking's multifaceted nature and its implications for mathematics education.

Google Bard may generate multiple drafts of an answer. Users can access these drafts by selecting "View other drafts," providing insight into the evolution and refinement of the response. Additionally, for a more immersive experience, users have the option to listen to Bard's answers by clicking on the speaker icon. This audio feature enhances accessibility,

allowing users to engage with Bard's responses through auditory means, providing an alternative and potentially more convenient way to consume information. These functionalities contribute to a versatile and user-friendly interaction with Google Bard, accommodating diverse preferences and accessibility needs.
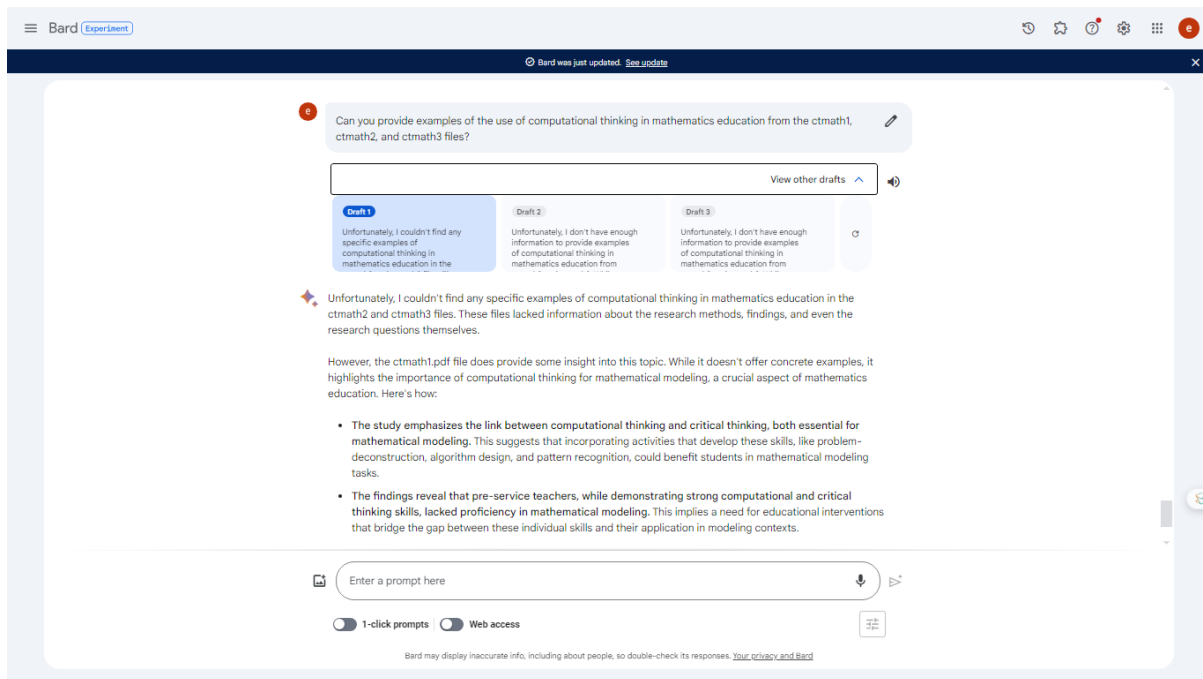

Figure 4. Alternative Draft View Provided by Google Bard

CONCLUSION

The examination of Google Bard emerges as an insightful exploration into a versatile tool with the potential to streamline various tasks. Demonstrating its systematic utility, the tool facilitates the creation of research articles and ensures efficient document organization and retrieval through seamless integration with Google Drive. Its versatility becomes apparent in diverse studies, emphasizing its role in advancing cognitive skills and aligning with contemporary educational frameworks. Noteworthy features, such as the ability to create multiple drafts and provide audio responses, significantly enhance the user experience and accessibility. Google Bard stands out as a promising and user-friendly platform, offering researchers and educators an efficient and interactive means of engaging with research materials in the fields of computational thinking and mathematics education.

SUGGESTION

For scholars and instructors incorporating Google Bard into their academic practices, it is advisable to delve deeper into the tool's features to enhance collaborative efforts and information retrieval. Given its seamless integration with Google Drive, users are prompted to utilize the tool for streamlined document organization and cooperative endeavors. The exploitation of Bard's internet connectivity for real-time information retrieval, along with the practice of posing follow-up questions, is suggested to deepen the quality of interactions. Exploring features like the alternative draft view and audio functionality can further enrich the user experience for a comprehensive and accessible engagement. A continuous exploration and

adaptation of Google Bard's capabilities in scholarly pursuits hold the potential to unlock its full functionality, thereby contributing to a more dynamic and efficient research process within the domains of computational thinking and mathematics education.

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