Socratic AI Against Disinformation

Improving Critical Thinking to Recognize Disinformation Using Socratic AI

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ABSTRACT

This paper explores how the Socratic method, implemented in an AI-chatbot, can be used to stimulate citizens' critical thinking, and consequently fight disinformation. In the Horizon Europe project TITAN, we are scrutinizing this opportunity. A prototype of the Socratic AI-chatbot was tested in four Co-Creation Labs with citizens. The findings presented in this paper indicate that there is potential and provide guidance to improve the effectiveness of the Socratic AI-chatbot in stimulating critical thinking and recognizing disinformation.

CCS CONCEPTS

• **Human-centered computing** → Human computer interaction (HCI); HCI design and evaluation methods; User studies; Interaction design; Interaction design process and methods; User centered design; • **Computing methodologies** → Artificial intelligence; Knowledge representation and reasoning; Reasoning about belief and knowledge.

KEYWORDS

AI, Socratic Method, Critical Thinking, Disinformation, Living Lab Approach

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1 INTRODUCTION

Disinformation is a recurring topic of interest in today's democracies. Recent societal events have contributed to this. The COVID-19 pandemic, Brexit, 2016 US elections, and war in Ukraine are examples of the potential influence of false information on society [1]. Online platforms have facilitated the spread of online news and have boosted the velocity and quantity of communication distribution [2]. This makes it difficult for citizens to distinguish trustworthy information from false or misleading content. Taking these societal developments into account, the necessity of citizens being able to critically assess the credibility of online news increased [3].

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AI can be used to create disinformation, but equally entails societal benefits [4]. Within the Horizon Europe project TITAN, we are exploring the latter by developing an AI-chatbot, fueled by the Socratic method (i.e., a conversation technique to challenge existing beliefs and come to logical conclusions through probing questions [5]), to combat disinformation by stimulating critical thinking. Therefore, the central question in this paper is how citizens evaluate the effectiveness of the Socratic AI-prototype in guiding the critical assessment of online news. This research focusses on the interplay between disinformation, critical thinking, the Socratic method, and AI.

To develop a trustworthy and socially accepted tool, a three-phased, participative methodology is implemented, consisting of 1/ co-creation workshops, 2/ living labs, and 3/ use case pilots. In this paper we will present the preliminary results of the second methodological phase, in which a prototype of the Socratic AI-chatbot was tested during Living Labs with 65 citizens in Belgium, Denmark, Italy, and Bulgaria.

2 ONLINE DISINFORMATION AND AI

Disinformation is information that is intentionally spread to mislead its reader [6], and to possibly harm a certain person, group, or institution [7]. It forms a threat to society and democracy as it influences sincere journalism and freedom of speech [8], it undermines trust and inflicts harm [7]. The concept of disinformation is nothing new [9], but its ubiquity flourished since the facilitation of information and news dissemination through online platforms [2]. The content production process was simplified [6], more actors became able to produce content [10], and users were confronted with an excessive amount of available online information and news [11]. This resulted in a general decline of information quality and an increase of false and misleading information [6].

2.1 The Dual Character of AI

In recent years, more initiatives were started, and tools were developed to combat this disinformation problem [12]. Amongst them are AI technologies. AI technology both provides new opportunities to benefit society [13] and comes with new legal and ethical challenges [14]. In particular, AI can now automate content generation and can be used to create false information and news while making it look reliable [15]. In this way, AI contributes to the disinformation problem. However, it can equally be used to combat disinformation through automated deception detection [14].

3 THE IMPORTANCE OF CRITICAL THINKING

Considering the increase in easily available false information and news [11], the dual character of AI [14], and the complexity of the

disinformation problem, the necessity to look beyond automatic detection mechanisms grew [4]. Citizens need to be able to critically assess the veracity of online news and information [3] and to autonomously evaluate news through their own decision-making process [15]. A critical thinking state-of-mind is necessary for citizens to be able to recognize disinformation signals and tactics while stepping away from their own biases and opinions [16]. In doing so, they can contribute to the fight against disinformation [4].

3.1 The Socratic Method as a Solution

The Socratic method is a well-established method within psychotherapy [17]. The method originated from Plato's books that captured Socrates' dialogues [18]. It exists of three main components: inductive reasoning, universal definitions, and systematic questioning [5]. Inductive reasoning aims to reach logical conclusions by presenting specific examples [19]. Secondly, "universal definitions describe the properties that are sufficient to capture the essence of a concept" [20]. Lastly, the most commonly used tactic is systematic questioning as it aims to go beyond the 'interviewee's' existing beliefs and pushes them to rethink the subject [18]. The Socratic method is used as a teaching method in which the teacher acts as a guide rather than a purveyor of knowledge [21]. Consequently, the Socratic method is a widely accepted approach to stimulate critical thinking [18].

4 TITAN'S SOCRATIC AI-CHATBOT

Central in the TITAN Socratic AI-chatbot is the aim to stimulate citizens' critical thinking, to guide them in the evaluation of news and in learning to recognize disinformation. The AI and machine learning (ML) model tracks signals for disinformation in online news. Subsequently, the chatbot implements Socratic systematic questioning to stimulate the users' critical reflection about the specific found disinformation signal, without explicitly mentioning it. In this way, the TITAN chatbot differs from other existing chatbots. Its goal is not to answer users' questions or to give them a conclusive answer on whether an article is disinformation or not, but rather and only to enhance their critical thinking process. Specifically, a dialogue with the chatbot consists of six Socratic question classes and, therefore, six steps that the user will go through, i.e., clarification, challenging assumptions, evidence and reasoning, alternative

Table 1: Examples of Socratic questions for the 6 question classes

Question class	Related Socratic questions examples
Clarification	*"What prompted you to read this article?"* *"Having read the article, what would you say the main topic is?"* *"Do you consider yourself well-acquainted with the topic of the article?"* *"What are the claims that are being made in the article?"*
Challenging assumptions	*"Can you identify any claims, that support the author's opinion or interpretation?"* *"What are your thoughts regarding the assumptions made by the author?"*
Evidence and reasoning	*"Is this evidence verified?"* *"Does the article cite any sources for that claim?"* *"Would you be able to identify the emotion that the evidence provokes?"*
Alternative viewpoints	*"Regardless of the appeal an explanation might have, it is always important to think/ search for alternative viewpoints. Are you able to think of an alternative way of approaching the subject in question? Can you try giving me an example?"* *"Can you think of any potential strengths a different approach might have in this case?"*
Implications and consequences	*"After carefully considering the assumptions made by the author and the overall content of the article, can you think of any consequences this text might have to a potential reader?"* *"Do you believe that the assumptions/ claims of the article are consistent with your own personal experience on the subject?"*
Challenging the question	*"After this discussion, how do you feel about this article?"* *"Do you feel that you've grasped the reasoning of the author?"* *"Are you in a position to identify any potential disinformation signals included in the text?"* *"What would be a recommended course of action once the disinformation signal has been identified?"*

Figure 1: The TITAN Socratic AI-prototype

viewpoints, implications and consequences, and challenging the question, based on the Paul-Elder Socratic approach [22]. Table 1 shows examples of Socratic questions for each question class.

Figure 1 shows the current state, i.e., prototype, of the TITAN Socratic AI chatbot. Currently, the chatbot is in a rule-based state. The questions are predefined and the chatbot offers a list of ten proposed articles that users can choose from. The goal is to evolve to a large language model (LLM) that can assist the users' article evaluation for online available articles as well, i.e., by copying the URL or content of the article.

5 A THREE-PHASED METHODOLOGY

Throughout the project, a methodological approach in three phases is applied. Central to this is a strong focus on a citizen- and user-centric approach to tap into the societal opportunities of AI, to constrain the disadvantages and ethical challenges within the context of disinformation [15], and to develop a socially accepted and trustworthy Socratic AI-chatbot [23]. The tool will thus be developed using a co-creation methodology in three phases that will shape the tool through iterative testing with citizens. Figure 2 shows the different steps in this methodological approach, as well as the focus, status, and aim of each phase. Phase one aimed at gathering insights into citizens' news and information consumption habits as well as their current view and knowledge on disinformation. The results from phase one were used as input for the development of the prototype of the TITAN Socratic AI-chatbot. As mentioned above, this is a static prototype. Phase two was intended to test this prototype with citizens to gather qualitative user feedback and to implement this feedback, translated into user requirements and important technical features, for the first release of the tool in phase three. Consequently, this first release will be iteratively tested with citizens in the third phase to further ensure a citizen-

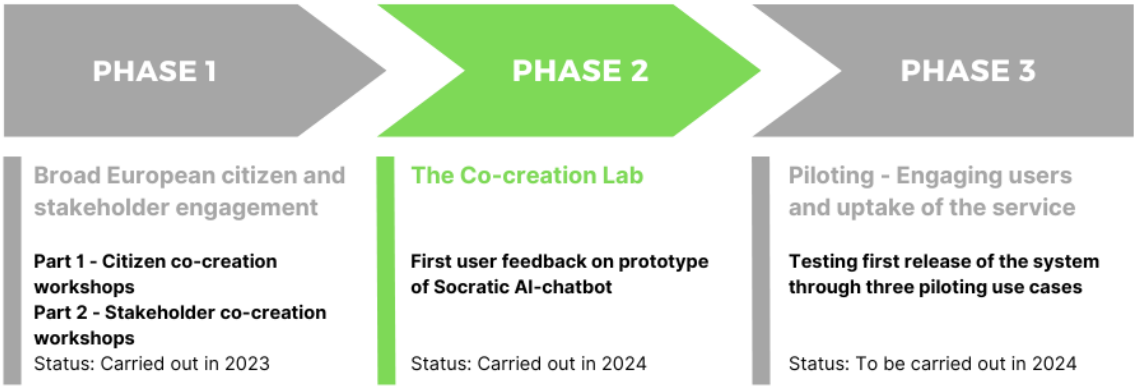

Figure 2: Overview of the Three-Phased Methodology

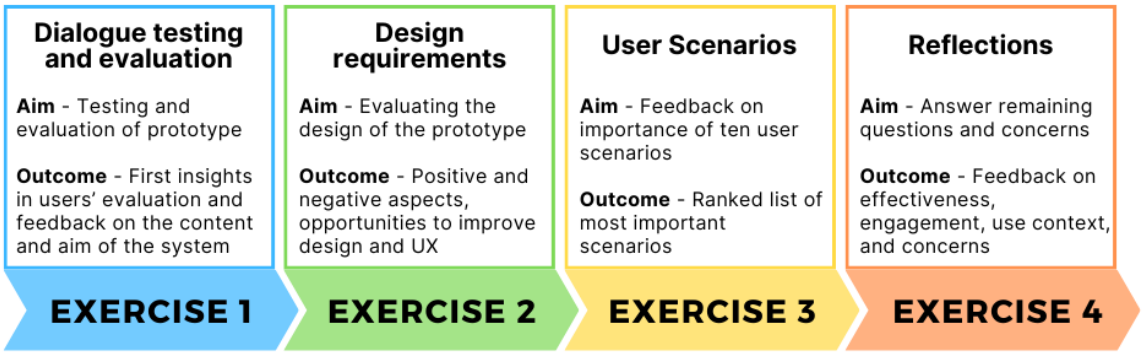

Figure 3: Overview of the Four Exercises in the Co-Creation Lab

and user-centric development of the next and final releases of the tool at the end of the project. In this way, the design process of the TITAN Socratic AI-chatbot is strongly influenced by the central co-creational approach. In this paper we will only consider this second phase, carried out between January and March 2024. Below, we specify the type of feedback we gathered, and the methods used to do so.

5.1 The Co-Creation Lab

The aim of phase two was to get an insight into the first user feedback on the user experience, usability, and effectiveness of the Socratic AI-chatbot. In this paper, we will solely focus on the users' perceived effectiveness of the system in stimulating critical thinking through Socratic systematic questioning. Moreover, the aim of the co-creation labs was to scrutinize why citizens evaluated the effectiveness of the chatbot the way they did. This, to be able to construct accurate and relevant user requirements for the next stages of the technological development. The prototype of the chatbot was tested while implementing a living lab methodology. With this, an open innovation approach was applied to further develop, test, co-create, and validate our prototype with users in an early stage of the technological shaping process [24].

Four co-creation labs with citizens were conducted in Belgium, Denmark, Italy, and Bulgaria. Each country targeted a specific citizen group. In Belgium, students were targeted, Italy focused on migrants and Bulgaria worked with NGO members and active citizens. Lastly, Denmark targeted citizenship at large. Each country had a target of 20 participants, resulting in a total of 80 participants for all the workshops.

The co-creation labs lasted five hours. This, to fully immerse the participants in the testing and context of the chatbot and to gather enough valuable insights for the further valorization and development of the first release of the Socratic AI-chatbot. The workshop was divided into four different exercises, each with its own focus (see Figure 3). During all the exercises, participants were divided into smaller table groups of five to seven people, each guided by a table moderator, to ensure fruitful discussions. A main moderator presented the overall workshop, explained the different exercises, and acted as timekeeper.

5.1.1 Exercise 1 – Dialogue Testing and Evaluation. In exercise one, the participants got an introduction about the aim and reasoning behind the chatbot, as well as a short explanation of what the Socratic method entails. Subsequently, they were asked to test the chatbot. Every participant had a conversation with the tool about a specific news article that included signals for disinformation. After the testing, all participants completed a brief online questionnaire to get some quantitative insights into the effectiveness of the chatbot. They were presented with some multiple-choice questions about the User Interface (UI), User Experience, (UX), usability, and duration as well as statements on the effectiveness of the chatbot in stimulating their critical thinking, using a five-point Likert scale ranging from strongly disagree to strongly agree. Then, in the smaller groups, the participants discussed their initial thoughts about the chatbot.

5.1.2 Exercise 2 - Design Requirements. During the second exercise, the central focus was evaluating the design and establishing requirements for improving the UI and UX. For this, we used the Rose, Thorn, Bud method [25]. Each table group received a template of a rose printed on an A3 sheet of paper, each participant individually got a pile of post-it notes in three colours: red, green, and yellow. The red post-it notes represented the flower of the rose and stood for positive aspects of the design, yellow post-it notes visualized the thorns and stood for negative aspects. Lastly, the green post-it notes symbolized the stem and stood for opportunities to improve the design. Each participant got 10 minutes to individually complete the post-it notes with their feedback and comments. After this, the group presented their post-it notes to each other and had

Figure 4: Execution of the Rose, Thorn, Bud Method [25] during the Belgian Co-Creation Lab

a 30-minute discussion while placing the presented post-it notes on the visual and clustering similar comments (see Figure 4).

5.1.3 Exercise 3 – User Scenarios. In exercise three, the aim was to get user feedback on the importance of ten specific user scenarios and rank them[1]. We applied The Island Approach [26] and each table group received a printed A3 island template (see Figure 5). Besides that, the groups got all 10 user scenarios printed on cards (see Figure 6) and were asked to divide the different scenarios over the designated spots on the island. The beach chair signified the most important scenario, the palm trees the second most important, and the 'exposed' spot the third most important scenario. The other seven scenarios were divided over the lifebuoy and crocodiles, which respectively represented 'interesting but not necessary' and 'least crucial' scenarios.

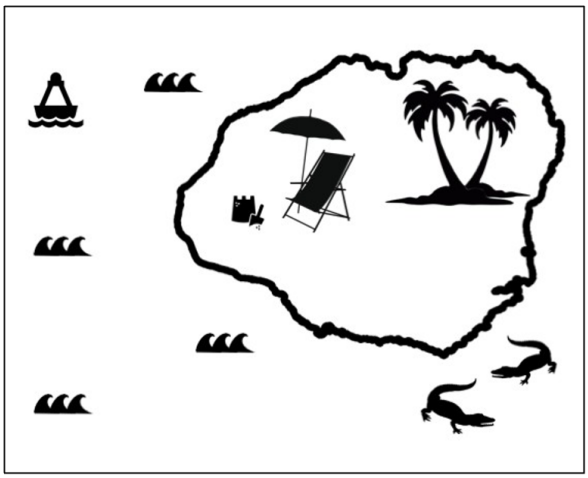

Figure 5: The Island Template [26]

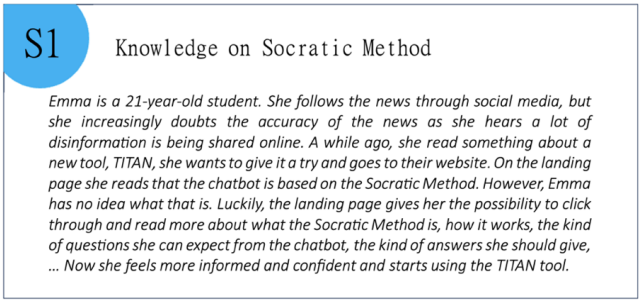

Figure 6: Example of the User Scenario Cards Used during Exercise 3

[1]In phase one of the user centric approach, user requirements were constructed based on a literature review and co-creation sessions. We selected 21 user requirements that needed validation and clustered and transformed them into 10 user scenarios. For more information on the methodology and results of phase one, please consult Duelen et al. (2023).

5.1.4 Exercise 4 – Reflections. The purpose of the last exercise was to delve into some questions and concerns that we, within the project, have. The aim was to gather insights from the citizens on four topics: the **effectiveness** of the chatbot in stimulating critical thinking and fighting disinformation, the level of **engagement** that the tool offers users, the **context** in which our tool would and should be used, and **concerns** on privacy, personalization, trustworthy AI, and trust in news. For this, the groups got a printed A3 template (see Figure 7) which included these four topics. The table moderators received a list of questions to guide the 40-minute discussion. The groups wrote down keywords that were brought up on the template around the related topic.

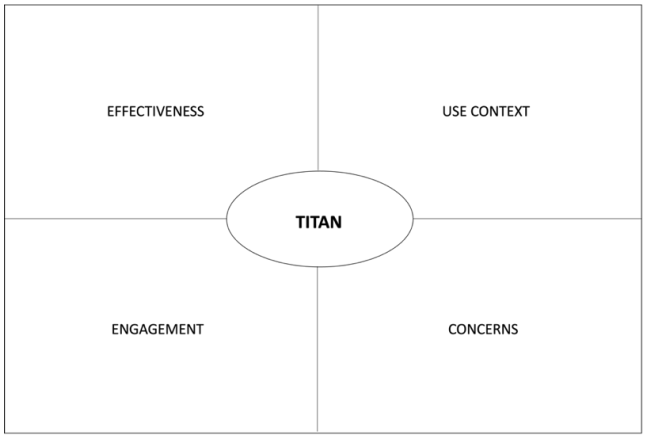

Figure 7: Reflections Template

5.2 Data-Analysis

The workshops, except the one in Denmark due to the organizations' GDPR rules, were recorded and transcribed in English. Furthermore, separate templates for results gathering were provided for each exercise. To get an insight into patterns and recurring topics of feedback, experiences, and opinions, a thematic analysis of the results is being carried out [27]. Moreover, to demonstrate the validity of the research, participants' quotes are added as part of the thick descriptions [28]. We use aliases to anonymize the participants. As the analysis is still ongoing, for this work-in-progress paper we will focus on the results of the Belgian Co-creation Lab[2].

6 PRELIMINARY RESULTS

The central question of this paper is how citizens evaluate the effectiveness of the Socratic AI-prototype in guiding the critical assessment of online news and information, this to get an insight in how Socratic AI can help to fight disinformation.

6.1 The Participants – Students

The target group of the Belgian Co-creation Lab were students. 22 students participated (see Figure 8). 13 were female, 8 were male, and one was non-binary. 21 of the students were between 18

[2]During the conference, we will be able to present additional findings from the other Co-creation Labs as well.

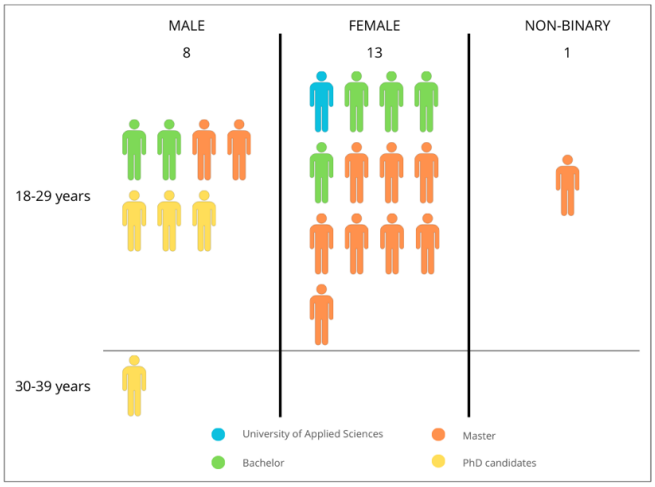

Figure 8: Socio-Demographic Data of the Participating Students

and 29 years old, one participant was between 30 and 39 years old. One student was studying at a university of applied sciences, six students were in their bachelor, 11 in their master and four were PhD candidates. Within these, students from different disciplines participated; communication sciences, chemistry, psychology, criminology, industrial engineering, law, economic sciences, computer sciences, and social sciences.

6.2 Stimulating Critical Thinking and Recognizing Disinformation

Looking at the results from the online questionnaire, presented in Table 2, we found that, on average, the chatbot was able to guide the students through both their critical thinking process and the evaluation of a news article's credibility. In addition, half of the students will reflect more critically when reading online information. However, aside from the overall positive response to the statements, there is room for improvement on the chatbot's effectiveness in stimulating critical thinking, i.e., students indicating 'neutral' or 'disagree' to the statements.

During the discussions, participants confirmed the results from the questionnaire. They agreed that the chatbot was able to stimulate their critical thinking. As stated by one participant, the chatbot "*pushed me to read the article in depth, rather than doing a superficial or quick reading which I would normally do*" (Simon, male, 18-29 years old). The questions were of good quality and the Socratic systematic questioning stimulated reflection without pushing them to the right answer. Nonetheless, the discussions equally confirmed the remaining room for improvement. Below, we address the participants' suggestions to enhance the dialogues and system.

6.3 The Socratic AI-Chatbot

During the exercises, we gathered concrete findings to further improve the Socratic AI-chatbot. The most recurring feedback on the chatbot was a lack of interaction, structure, and language options.

6.3.1 Interaction. As the Socratic questioning is predefined in this stage of the technological development, the questions the participants received did not respond to their answers. Sophie (female, 18-29 years old) said that "*it felt more like a script or completing a questionnaire rather than having a conversation*". Participants felt the need for a more human-like feeling while chatting as well as more support and guidance, by replying to users' difficulties and insecurities.

6.3.2 Structure. Besides that, the dialogues needed more structure. The chatbot should put more explicit emphasis on disinformation signals during the dialogues. Suggestions, such as an infographic about disinformation signals before or after the dialogue and a summary of learned lessons after the chat, were provided by the participants. Axel (male, 18-29 years old), for example, stated that "*it would be nice if we could get an overview or a summary of the disinformation signals found in the article, this would make it easier to draw lessons for the future*".

6.3.3 Language. Lastly, the language of the chatbot was an obstacle for some students. The prototype was in English, and the word use was in some cases indicated as too difficult. This had an influence on their interpretation of some of the Socratic questions. We found that "*the chatbot needs to be available in multiple languages, this could otherwise be a big threshold for people to use it*" (Louise, female, 18-29 years old).

The students argued that improving these aspects, i.e., the chatbot's interaction, language, and structure, would improve the effectiveness of the Socratic AI-chatbot. Lastly, the overall idea behind the chatbot was evaluated positively. They were enthusiastic about the development of a tool with the aim of stimulating critical thinking. "*A chatbot is something that we all know, everyone today uses Messenger, WhatsApp, and ChatGPT. This makes the interface familiar and user friendly and could encourage more people to try it out*" (Laura, female, 18-29 years old).

Table 2: Significant Results from the Online Questionnaire

Statement	Agreed	Neutral	Disagreed
"The chatbot guided me to think critically about the information in the article"	14	7	1
"The chatbot gave me good guidance in the evaluation of the article"	14	8	0
"In the future, I will reflect more critically when reading online news and information"	11	11	0

7 CONCLUSION

We can conclude that there is potential in using the Socratic method to stimulate critical thinking [18] and recognize disinformation [16] through an AI-chatbot. However, there is room for improvement. The results from all Co-Creation Labs will be used as input for the development of the first release of the Socratic AI-chatbot. The results from the second methodological phase will be translated into specific user requirements and important features that must be implemented in the chatbot, according to the participating citizens. The need for a human-like and interactive feeling while performing a dialogue, more guidance and background information during the chat, a structured overview and summary of learned lessons after completing a dialogue, being presented with an infographic about disinformation, and lastly, easier and clearer Socratic questions in other languages besides only English will be communicated to the technical partners in the project and taken into account as requirements for the first release of the tool. Subsequently, this release will be iteratively tested during the third methodological phase, the pilots. In addition, the gathered dialogues will be used as training datasets for Machine Learning (ML) methods that will enhance the system's functionalities and effectiveness. Other opportunities to deploy Socratic AI in the fight against disinformation, by focusing on enhancing citizens' critical thinking skills, should be scrutinized further in future research.

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