

Exploring Large Language Models in Collaboration:
AI Agent in Meeting Organization, Brainstorming
and Conflict Mediation

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March 14, 2024

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Department of Information and Computing Sciences

Human-Computer Interaction

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Abstract

This study explores the application of Large Language Models (LLM) in collaborative environments, emphasizing the integration of prompt engineering and the "Chain of Thought" method to mitigate hallucination in text generation, and highlighting the importance of cross-cultural collaboration. Introducing an AI agent that provides meeting summaries, guides thought, resolves conflicts, and evaluates its impact on collaboration efficiency, personalized interpretation, and conflict mediation.

Users can interact indirectly with this AI agent by creating a website with a user interface. Through this UI, users can intuitively evaluate the AI agent's performance in collaboration. The presence of this UI provides users with a channel to comprehensively understand the AI agent's functionality and effectively evaluate its collaborative performance. Experimental results demonstrate the AI agent's success in streamlining meeting processes, fostering deeper discussions, and excelling at challenges such as reducing the number of conflicts over time and team collaboration. Specifically, the AI agent effectively minimizes errors, meaningless content, or situations divorced from reality, thereby improving the quality of the generated text. In addition, the AI agent's guidance and conflict mediation capabilities contribute to smoother and more efficient meetings. However, areas for improvement in conflict resolution and bias reduction are identified, with the AI agent's performance in these aspects rated as moderate, indicating potential avenues for further optimization.

In summary, the experiment results support the value of prompt engineering in collaborative scenarios and underscore the potential benefits of AI agents in enhancing collaboration efficiency and quality. Future research directions include further optimization of conflict resolution capabilities and reduction of potential biases. Recognizing the challenges of computational resources and runtime, future efforts should prioritize reducing computational costs, optimizing runtime, and expanding the system's input methods to include speech input, thereby increasing user diversity and convenience.

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Introduction

Self-attention is a deep learning technique that has revolutionized traditional neural networks, particularly benefiting natural language processing tasks. It has been successfully applied in machine translation and text generation, changing the way models are designed.[Vas+17].

OpenAI has proposed a significant research initiative involving LLM (Large Language Models). They utilize the GPT structure based on the Transformer architecture and employ numerous decoder modules for pre-training. These models are renowned for their exceptional generalization ability, enabling them to learn new tasks with minimal examples. This achievement has sparked pioneering research in the fields of zero-sample learning and few-sample learning.[Bro+20]. These two studies have made substantial contributions to deep learning theory and have significantly aided the practical applications of natural language processing.

On the contrary, teamwork is vital for success in today's globalized and diverse learning and working environments. Nevertheless, team members from different cultural backgrounds and personalities often encounter various difficulties and challenges when they collaborate with each other[Sta+10][CS84], including diverse role expectations, problems in task allocation, and inconsistencies in communication styles. Such challenges finally lead to conflict and reduced collaboration efficiency. In such complicated collaborative situations, generative AI can not only assist human team members to better understand problems and solutions[Bou+23], but can also be applied to a variety of team tasks, including stimulating creative thinking[DH23], project management[Wen23], and summarisation[GLD22].

With the breakthrough in generative models, many solutions have emerged to assist human teams in understanding problems. Therefore, current AI research concentrates on the utilization of AI in team decision-making, with little attention being given to the collaborative aspects of teams and AI functionality. There are significant research gaps that need to be considered. First of all, limited sample sizes and biases can cause an incomplete understanding of AI teamwork in diverse cultural and industry settings [Mil+23]. Subsequently, a lack of research on user acceptance poses a significant threat to the success of AI in teams. Additionally,

research on sustainability, reliability, and long-term AI robot teammate performance is scarce[FC20][Dal21][ZL21]. Finally, there is a need for an in-depth study into the adaptability and effectiveness of AI to support **cross-cultural**[Cao+23a], **cross-personality** [Ari+23], and **cross-disciplinary** [Dwi+23] teamwork either per individual axes or across all three axes simultaneously. In summary, more extensive research is required to comprehend the role and challenges of AI in team collaboration to enhance effective collaboration between AI and human teams.

1.1 Research Question and Contributions

Although LLMs are powerful, it has oftentimes been found to generate text that is erroneous, nonsensical, biased, and stereotyping.[Gro23] [Cao+23b]At the same time, LLMs do show promise in helping individuals and teams tackle different tasks, once bias errors are removed, for example using prompt engineering combined with the "chain-of-thought" method.

Our research question therefore becomes:

- Research question: Can prompt engineering, providing LLMs with theoretically grounded knowledge regarding the influence of personality and culture on collaboration, combined with the Chain-of-Thought method, allow agents to decompose processing steps, assist teams in overcoming conflicts, and enhance collaboration?

This study comprehensively evaluates the success of AI agents in team collaboration by considering conflict mediation, and collaboration quality. Our contributions are primarily reflected in the following areas:

- **UI interface design and LLM system construction** : We designed and implemented a user interface (UI) that enables users to interact with AI agents indirectly. Through this interface, the user can effectively evaluate the performance of the AI agent during the collaboration process.
- **Time efficiency and deeper discussions**: Our tool streamlines meetings by reducing summarize time. Moreover, it assists the team in facilitating deeper discussions and brainstorming.

- **Personalized interpretation and targeted feedback:** The AI agent provides personalized advice based on team and individuals. Assist team members know each other better when they have conflicts during the discussion.

The rest of this thesis is organized as follows. Section 2 presents the related work, the research gaps, and the revised research question based on these gaps. Section 3 presents the methodology, including the participants, the used research methods, and the structuring of the gathered data. Section 6 presents the experiment design. Section 4 shows the results with a focus on the feedback that emerged from the interviews with AI agents. Section 5 discusses these findings in a synthetic format, and presents limitations and opportunities for future work. Finally, section 6 concludes with the key findings of this work.

Related Work

In this chapter, we explored various research domains through a systematic literature review, employing rigorous inclusion and exclusion criteria. Following multiple rounds of screening, we ultimately selected 27 papers to form the foundation of our related work.

Our literature review encompasses several key areas, including the phenomenon of globalization, team diversity, conflict management, the application of AI in creative education, and the advantages and application potential of AI agents.

The trends of globalization are evident in the increasing collaboration of transnational teams and the growing mobility of international students. Research on team diversity reveals potential advantages but also highlights challenges, particularly in conflicts arising from diverse cultural backgrounds and personality traits, leading to communication barriers. The application of AI in creative education is noted for inspiring flexible thinking and promoting human-AI collaboration. Additionally, we explore the role of AI in conflict resolution, expectations, implementation methods, and existing research. Lastly, we delve into the enhancing effects of Chain-of-Thought Prompting on multi-step reasoning, and the unified framework and multi-level capabilities of Agent.

2.1 The phenomenon of globalization

Participating in global teamwork is becoming the norm rather than the exception, and transnational teams of all shapes and sizes are seen as a major driver of globalization[Sno+96]. Furthermore, the mobility of international students is rising globally, leading to increased interaction between them [Pra13]. Team tasks become more and more complex and thus more interdisciplinary, intercultural, and interpersonal.

2.2 Myers-Briggs Type Indicator (MBTI) personality

An individual's personality can greatly influence their perception of the team environment, interactions within the team, and adaptation to team culture in a collaborative setting. Additionally, personality plays a crucial role in team dynamics, particularly during the conflict phase. For example, a team that avoids conflict may handle the conflict stage differently than a team that is accustomed to confrontation. Social identity theory proposes that individuals tend to prefer collaborating with others who share similar characteristics. However, it is important to note that teams dominated by a single personality type may not achieve optimal performance. Researchers have extensively explored personality types and their impact on team collaboration, including the Myers-Briggs Type Indicator (MBTI) test, which is a widely used tool for understanding individuals' personality preferences in various settings.

The Myers-Briggs Type Indicator (MBTI) is a commonly used tool for comprehending an individual's cognitive processes, decision-making styles, and behavioral tendencies. It classifies individuals into one of sixteen personality types based on four psychological functions: Extraversion (E) or Introversion (I), Sensing (S) or Intuition (N), Thinking (T) or Feeling (F), and Judging (J) or Perceiving (P). Recognizing the different MBTI types in a team can facilitate effective communication, cooperation, and problem-solving in team dynamics. Research by Chen and Lin [CL04] and Silva et al. [Sil+20] explored the impact of MBTI on team building, highlighting the correlation between specific personality traits and team roles. By utilizing the insights of the MBTI, team leaders can adapt their communication, conflict resolution, and decision-making methods to promote a more cohesive and productive team environment. However, it is important to acknowledge the criticisms surrounding the MBTI, including concerns about its reliability and validity. Despite these criticisms, some organizations have found value in using the MBTI as a tool to enhance team dynamics and personal development. (Figure 2.1).[Wik24]

2.3 Navigating Challenges and Conflict Management

Team diversity initially presents several potential advantages, such as enhanced innovation, broader perspectives, and improved problem-solving abilities. However, research in this field also reveals potential challenges, including conflicts and coordination difficulties[KHB09].

What's Your Personality Type?

Use the questions on the outside of the chart to determine the four letters of your Myers-Briggs type. For each pair of letters, choose the side that seems most natural to you, even if you don't agree with every description.



Fig. 2.1.: Myers-Briggs Type Indicator (MBTI) personality: In this research, the AI agent used MBTI personality to explain individual interpretations when the conflict happens during the discussion. Assist people in understanding why conflict happens due to their different personalities.

2.4 Sources of Conflict and its Occurrence Orientation

Specifically, team members from diverse cultural backgrounds hold varying degrees of importance and selectivity in the information they share, significantly impacting conflicts at both individual and group levels [Tri00][Shu07]. Moreover, there is a notable correlation between specific personality traits of team members and their adopted approach to conflict management [AN14]. On the contrary, communication barriers often arise in team discussions due to diverse professional backgrounds [KHH15]. The significance of how teams effectively manage conflict in their work is further underscored by the combined impact of these factors, consequently enhancing decision-making process satisfaction, decision quality, and team participation [Pau+04].

2.5 Geert Hofstede's cultural dimensions theory

In cross-cultural environments, cultural differences often lead to misunderstandings and conflicts between teams. In areas such as international business and cooperation, these differences can lead to miscommunication, conflicting values, and a lack of harmonization of work processes. In this situation, Geert Hofstede's theory of cultural dimensions provides a valuable analytical tool to help interpret and understand

the root causes of these cultural differences, thereby facilitating cooperation and coordination between teams.

Geert Hofstede's cultural dimensions theory [Hof03] provides a comprehensive framework for understanding and comparing differences between cultures. The theory breaks down culture into several key dimensions, including individualism versus collectivism, power distance, uncertainty avoidance, and masculinity versus femininity. Each dimension reflects the core values and behavioral patterns of different cultures. The Individualism vs. Collectivism dimension explores the relationship between the individual and the group, distinguishing between cultures that emphasize individual independence and freedom (individualism) and cultures that prioritize group cooperation and benefits (collectivism). The power distance dimension analyzes the distribution of power across cultures, from high power distance cultures that emphasize hierarchy and authority to low power distance cultures that prioritize equality and democracy. The Uncertainty Avoidance dimension examines the attitudes of different cultures towards future uncertainty, ranging from cultures that favor stable systems and rule-following (high Uncertainty Avoidance) to cultures that are more willing to accept uncertainty (low Uncertainty Avoidance). Finally, the "masculinity" versus "femininity" dimensions contrast perceptions of gender roles and values, ranging from cultures that emphasize emotional expression, empathy, and cooperation (femininity) to those that prioritize competition, decisiveness, and achievement (masculinity) [Nic23] (Figure 2.2)

Overall, these dimensions contribute to a comprehensive understanding of values, behavioral patterns, and organizational culture across cultures. By understanding and dealing with cultural differences, effective cross-cultural communication, international business and management practices can be implemented. This contributes to smooth international cooperation and exchange.

2.6 Exploring the Impact of AI in Creative Education: From Flexible Thinking to Collaborative Brainstorming

The exploration of AI in creative education is becoming increasingly profound. Research indicates that AI has the potential to inspire students' flexible thinking. While emphasizing the cautious integration of AI, the literature also points out that AI contributes to providing new perspectives, enriching the learning experience [Hab+23].

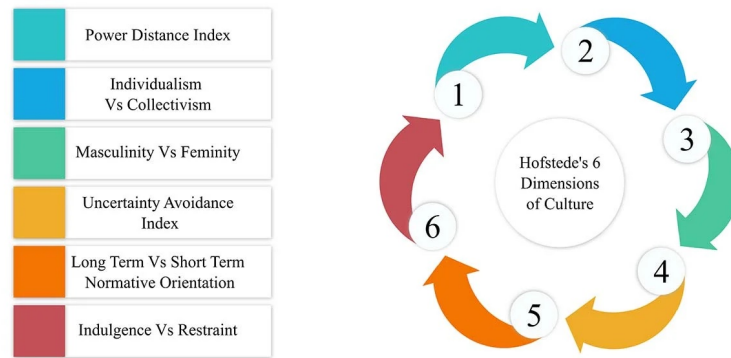


Fig. 2.2.: Geert Hofstede’s cultural dimensions theory: In this research, the AI agent adopts Geert Hofstede’s cultural dimensions theory to detect the conflict points during the discussion. And used this theory to provide further explanation to people about why the conflict happened.

Recent studies on AI’s role in brainstorming have grown, particularly focusing on the collaborative work of generative large language models (LLM), revealing the effects of generative AI in human-AI collaboration and the potential risks it may bring, offering crucial insights for future research in related fields [MT23]. In addition, another study examines the application of virtual reality (VR) and artificial intelligence (AI) technologies in product ideation. Through bibliographic analysis, it explores the relationships in the relevant field, enhancing creativity in engineering scenarios through smart team coordination, communication technologies, and multisensory stimulation [GMW23]. Furthermore, the collaboration between artificial intelligence (AI) and humans in co-creation emphasizes interactive dynamics such as rotation, contribution, and communication. This collaborative creativity extends brainstorming, with AI and humans actively participating and jointly generating creative ideas. The literature highlights the shortcomings in the interaction design of existing collaborative creation systems and proposes the "Collaborative Creation Framework for Interaction Design (COFI)" to facilitate more effective human-AI cooperation. This model not only expands and improves brainstorming but also deepens the understanding of interactive models in collaborative creativity [RM23].

2.7 AI-Assisted Conflict Resolution: Anticipations, Implementation, and Existing Approaches

Furthermore, because the newer generation has displayed heightened flexibility in their interaction with AI technologies, there is greater anticipation for optimally uti-

lizing these technologies in the resolution of conflicts and issues[Lar10]. Intelligent machines have agency because they can act on perceptions aided by computation [BT19]. In aiding conflict resolution, mediators typically rely on reason and logic to persuade parties to reach a mutually acceptable resolution [WS14]. Recent research has employed artificial intelligence (AI) to automatically identify and signal users to unsuitable, combative language. Furthermore, to enhance their communication abilities and prevent potential conflicts, AI has provided conflict resolution exercises in real-life scenarios. However, this paper focuses specifically on the wording that triggers conflict and does not delve into the specific reasons why team members clash due to personality, cultural background, and academic differences.[HC23]. In addition, conflict mediators use machine learning tools to assist in collating and analyzing data from complex and dynamic conflict situations to enhance efficiency, promote consensus, identify potential conflicts, and challenge biases to manage complex and long-term conflict mediation more effectively[AVP21]. Furthermore, effectively dealing with interpersonal conflicts is a crucial skill often lacking in adequate training. In practical system design, rehearsal systems allow the simulation of conflict scenarios, utilizing Interest-Rights-Power (IRP) generation based on conflict resolution theory by language models. Participants who undergo rehearsal experience significant improvement in real-life conflict situations, underscoring the practical value of language models in training interpersonal skills [Sha+23]. These findings provide valuable insights and inspiration for improving team diversity management and conflict resolution and provide the basis and direction for improvement in this project.

2.8 Enhancing Multi-Step Reasoning through Chain-of-Thought Prompting

In addition, the introduction of Chain-of-thought (COT) prompting addresses the challenges posed by multi-step reasoning problems. It achieves this by allowing the model to decompose the problem into intermediate steps, thereby enhancing the efficiency of computational resource utilization. Furthermore, this method provides interpretability of the reasoning path, facilitating the analysis and debugging of the model's decisions. The widespread applicability of COT prompting enables it to handle various tasks, such as mathematical applications and common-sense reasoning, providing robust support for language models in tackling complex problems. By integrating it into few-shot prompt examples, this approach guides the model to

adapt to new tasks rapidly, overcoming the challenges associated with multi-step reasoning problems [Wei+22].

Moreover, by diversely selecting representative problems, for each sampled question, we concatenate it with a phrase similar to Zero-Shot-CoT's "Let's think step by step" and input it into the language model. In this manner, the language model generates intermediate reasoning steps and answers. Subsequently, all sampled questions, along with the intermediate reasoning steps and answers generated by the language model, are concatenated to form examples for few-shot learning. Finally, the questions that need to be addressed, along with this information, are input into the language model for continuation, enabling the model to generate intermediate reasoning steps and answers [Zha+22].

2.9 Powerful Advantages and Potential Application of AI Agent

The prowess of AI agents is manifested in their unified framework and multi-level capabilities. The framework encompasses modules such as Profile, Memory, Planning, and Action, endowing the agent with a high degree of autonomy. Methods like model fine-tuning, prompt engineering, and mechanical engineering confer diverse and effective task execution capabilities upon the agent. This enables the AI agent not only to flexibly adapt to various scenarios but also to demonstrate robust adaptability and intelligence across different task executions [Wan+23]. The development of AI agents presents several advantages. Firstly, these agents can autonomously handle everyday tasks, assisting users in alleviating repetitive work, reducing work-related stress, and enhancing task-solving efficiency. Secondly, AI agents no longer require explicit low-level instructions but possess the ability to independently analyze, plan, and solve problems. This autonomy makes the agents more flexible and intelligent. Additionally, AI agents find applications in scenarios involving single-agent performance, multi-agent interactions, and human-agent interactions. Single agents exhibit excellent performance, while multi-agents achieve more efficient task execution through cooperative or adversarial interactions. Furthermore, AI agents excel in understanding natural language and executing daily tasks, making them potential intelligent assistants for users. Overall, these characteristics endow AI agents with potential practical applications in addressing various challenges in real-life situations, and they are poised to become the foundation for future advanced intelligent agent systems [Xi+23].

Methodology

In this chapter, we have extensively discussed the research methodology employed in our study. Firstly, we focused on the recruitment of participants and the interview process, conducting experiments in pairs. To document the entire conversation, we utilized Microsoft Teams for real-time recording and employed an agent to save all information for subsequent in-depth analysis. During the data organization phase, we employed a comprehensive approach involving both qualitative and quantitative analyses to gain insights into users' perspectives and feedback on the agent's impact on improving discussion outcomes and facilitating understanding among team members.

On one hand, we emphasized the recruitment of participants, the experimental process, and the organized and detailed analysis of the data. On the other hand, we delved into the role of generative AI in diverse team collaboration. By integrating OpenAI API with Langchain, we developed an agent designed to assist teams in resolving potential conflicts and building consensus, especially when team members possess different personality traits and cultural backgrounds [Yao+22]. This agent automatically analyzed conversations among team members, capturing disagreements and potential conflicts, and assisted in summarizing discussions at each stage, posing extended questions to facilitate team brainstorming.

The implementation of this approach not only enhanced collaboration efficiency but also reduced conflict during the collaborative process. Overall, our research has opened up new opportunities for intercultural, and different personality team collaboration. Through the use of LLM models and prompts, we not only fostered mutual understanding but also expedited the consensus-building process, enabling teams to achieve common goals more efficiently.

3.1 Research Design

3.1.1 Experimental Objectives

The purpose of this experiment is to conduct an in-depth exploration of the role of agents within LLM model frameworks. Specifically, our focus will center on the functions of the agent in team communication, including providing communication suggestions, facilitating thought stimulation to enhance dialogue content, and mediating conflicts when they arise.

3.1.2 Task Topics and Process

In this experiment, participants will engage in two rounds of discussions, delving into controversial topics that currently spark widespread discourse in society. To ensure objectivity and fairness in the discussions, the order of topics and the timing of Agent participation (first or second round) will be randomly assigned within each discussion group, mitigating potential biases. The design and development of the experimental questions revolved around a recent controversial issue in the Netherlands, focusing on the following two topics:

- First topic: The Dutch government is reviewing its policy on international student enrollment in universities, which has led to heated debates. Some people are concerned that the increase in international students will affect the resources and quality of teaching, and have raised the question of whether or not there should be a limit on the enrollment of international students.
- Second topic: Dutch universities are debating whether the Dutch language requirement should be strengthened. Some argue that this will help integrate international students and improve their opportunities, while others fear that it will make universities less attractive, lower their quality, and even lead to a loss of talent and financial resources.

Both issues are related to university development and the impact of international students on the learning environment. The community needs to consider how to balance the growth of international students with the needs of local students, and how to develop language requirements to facilitate cross-cultural exchange. For detailed information on each topic, please refer to the appendix. (see the appendix 12.2)

Additionally, the task process is as follows, as previously described. The sequence of discussions on the two topics and the timing of Agent involvement will be randomized to ensure fairness and prevent biases.

- **First Round of Discussion**

1. Participants will have 5 minutes to answer questions related to Topic 1.
2. Participants will engage in a 15-minute intra-group discussion with another member to delve deeper into Topic 1. Each round will last for 5 minutes, with a total of 3 rounds.
3. Participants will again answer questions related to Topic 1 and fill out a questionnaire; this step will take 10 minutes.

- **Second Round of Discussion**

1. Participants will have 5 minutes to answer questions related to Topic 2
2. Participants will engage in an intra-group discussion with another member, and an AI Agent will participate throughout the entire discussion. Each round will last for 5 minutes, with a total of 3 rounds. The AI agent will summarize their discussion and detect if any conflicts occur in each round. Moreover, the Ai agent will assist in summarizing the meeting minutes at the end of the meeting.
3. Participants will again answer questions related to Topic 2 and fill out a questionnaire; this step will take 10 minutes.

Timing of AI Involvement

The Agent will be involved in a discussion every 5 minutes, providing summaries and posing additional questions in each round. In the event of conflicts, the mediation feature will be activated. The AI Agent will perform the following actions:

- **Summarize the discussion:** Based on the team members' conversations, summarize the core points of the current discussion, while ensuring that the discussion stays on topic and utilizes time effectively.
- **List subtopics related to the original theme, fostering brainstorming:** Based on the content of the discussion, propose relevant subtopics to promote brainstorming among team members. During the discussion, even when there are no ideas, creativity can still be inspired.

- Identify points of conflict and provide actionable suggestions for resolution: Ai agent used Geert Hofstede’s Cultural Dimensions Theory to identify points of conflict and provide actionable suggestions for resolution when conflict or disagreement arises in a discussion.
- Offer personalized suggestions for each participant to aid in better mutual understanding: Based on the causes of conflict and each participant’s MBTI personality traits, provide personalized suggestions to aid in better mutual understanding and communication.

3.2 Data Collection Methods

3.2.1 Experimental Design

This study employs a Within-subject experimental approach, emphasizing the collaboration of the same group of participants to engage in discussions on different topics within the experiment. The advantage of this method lies in reducing variability among participants, allowing for a more specific observation of participant reactions in different contexts.

3.2.2 Discussion Phase

Each pair of participants will engage in discussions on two topics. In the discussion phase, the role of the AI agent will be introduced in one of the rounds, facilitating dialogue by providing summaries and posing expanded questions. This design is conducive to exploring the impact of the agent in different discussion contexts and capturing more detailed perspectives and opinions through textual interactions.

3.2.3 Questionnaire Survey

After the discussion phase, participants will be asked to fill out a questionnaire. This questionnaire includes various aspects, such as the impact of AI agent on team collaboration, feature usefulness, comparison of teams with and without AI agent, and subjective feelings regarding the overall user experience. The purpose of the questionnaire is to collect comprehensive feedback from participants on the experiment, further understanding their perspectives and actual experiences.

3.2.4 Data Analysis

Employ a mixed-methods approach for data analysis. Firstly, textual data from the discussion process will be analyzed to explore interactions and viewpoints relevant to the topics. Secondly, the results of the questionnaire survey will undergo statistical analysis to quantitatively assess participant satisfaction and experiences. Finally, qualitative methods will be employed to gain a deeper understanding of participant perspectives and experiences, ensuring a more comprehensive data analysis.

3.2.5 Overall workflow for Agent

Before the discussion starts, the team members need to provide their profile information to let the AI agent. The purpose of this step is for the AI agent to be able to provide individual interpretations based on the participant's profile. This profile information includes the participant's: MBTI personality, nationality, and how they process conflict. Next, the team members will be assigned by the researcher to discuss a specific topic, and then choose the topic for the AI agent. Moreover, after choosing the specific topic, the AI agent will show what people need to discuss, and the direction they can follow. (See Figure 3.1 for an illustration)

Subsequently, team members will provide their initial ideas about the specific topic, and provide them with the AI agent. At the same time, the agent will summarise and provide extended questions Team members will then consider the chosen inquiries and continue iterating through successive rounds until the discussion is finished. In the event of a conflict, an agent will be triggered to provide the reason for the conflict, as well as offer individual and team insights. In addition, the agent will provide a detailed explanation of the conflict's causes, such as cultural backgrounds, personality traits, and other factors to let people understand why the conflict arises, and how to understand each other better.

Following several rounds of iteration, the team members will come to a consensus and state "We are done." The agent will then review the summary to ensure it aligns with the meeting's objectives. If the summary is consistent with the goals, the meeting comes to a close. On the contrary, if the summary does not align with the objective, the agent will initiate further discussion to clarify or adjust the information to ensure that the intended outcome is attained. This collaborative decision-making process maximizes the use of agent technology and agent intervention to aid teams in collaborating and making decisions efficiently, ensuring that consensus and agreement on objectives are ultimately reached. This approach is applicable in

diverse team collaboration scenarios, particularly those involving complex problem discussions.

3.2.6 Agent prompt design

The Agent utilizes the OpenAI LLM ChatGPT 3.5 version, with the backend primarily developed in Python, leveraging Langchain and OpenAI's packages, along with additional custom functions. The front end is presented using Streamlit.

This agent includes four prompts: cold start, summary, extended question, and mediation prompt. To begin, the agent promptly triggers the cold start, with the main idea being to designate the agent as a meeting assistant and specify the main task of the meeting. Additionally, for the summary and extended question prompts, the agent invites members to provide initial ideas on the specific topic, summarizes what people discuss, and provides extended questions.

Regarding the mediation prompt, if the discussion becomes conflicted, the mediation prompt will trigger the conflict mediation mechanism and provide team and personalized suggestions. Finally, when members have completed their discussion, the researcher is asked to click the "We are done" button. At this point, the finishing prompt will summarize the overall discussion and provide the meeting minutes to team members. (Figure 3.2)

3.2.7 AI Agent Website Design and Function

Throughout the entire process, the AI agent plays a pivotal role, providing support for team collaboration. Firstly, assists thought summarization, it drives brainstorming by providing extended questions, ensuring that the team has a full discussion on ideas and creativity. In conflict identification and resolution, the AI agent captures potential conflict points and different opinions in team discussions objectively. Personalized explanations facilitate better understanding and help resolve potential conflicts, especially when there are differences in personality and cultural background. Simultaneously, the personalized analysis by the AI agent provides each team member with valuable explanations, fostering mutual understanding. Additionally, the AI agent takes responsibility for generating detailed meeting minutes, highlighting key points, and laying the foundation for team review and summarization. Finally, when evaluating options, the AI agent assesses the need for further

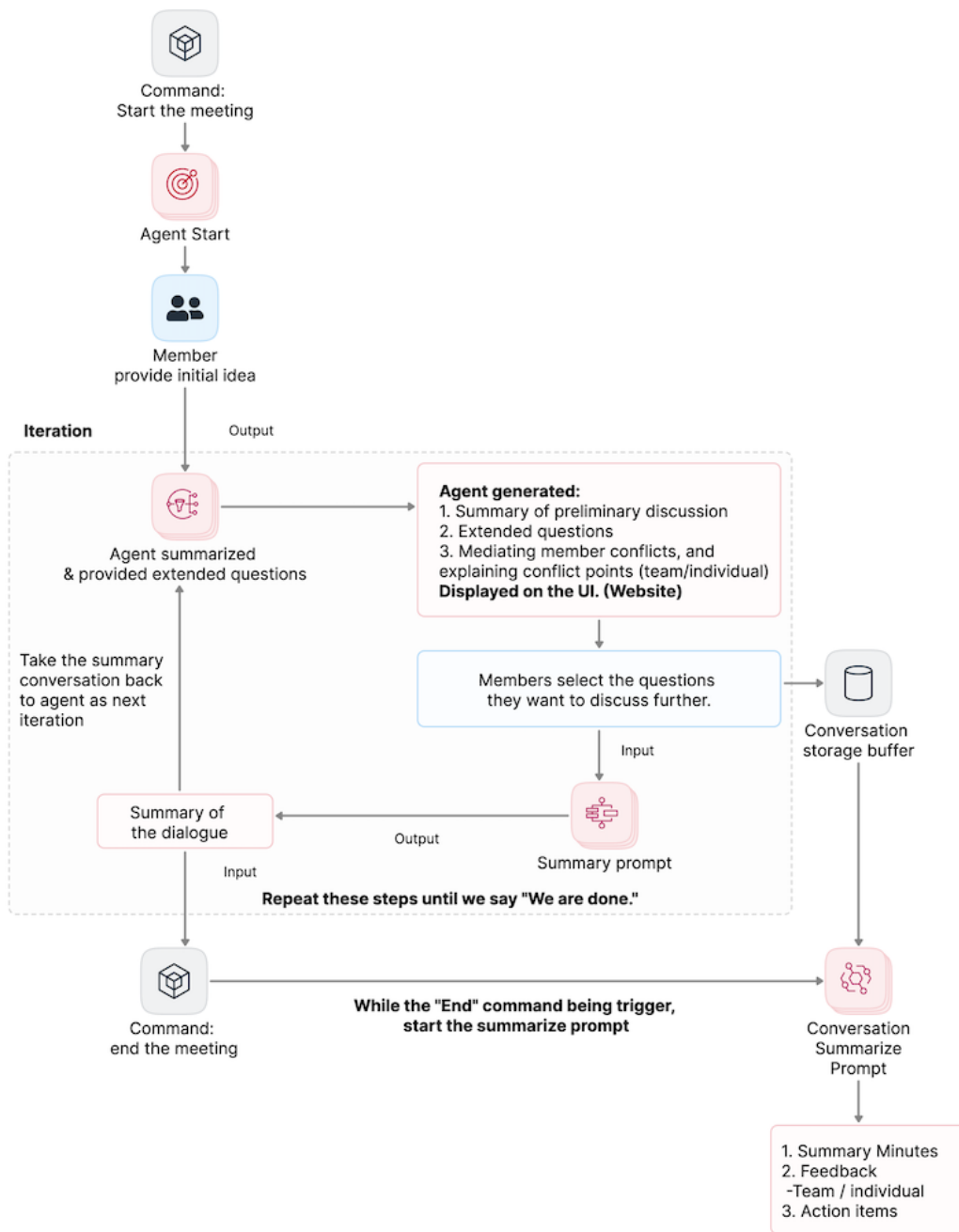


Fig. 3.1.: Workflow for AI to interact with the teams as an agent: The flowcharts illustrate the end-to-end process of the AI agent’s interaction. The flow is divided into three sections. Firstly, the agent prompt initiates the meeting, and team members share their initial ideas with the AI agent. Secondly, the agent summarizes the team members’ discussion and offers extended questions to facilitate brainstorming. Additionally, the agent assists in conflict detection during the discussion. This section is iterated until members indicate they are done. Finally, the agent summarizes the discussion and provides meeting minutes, conclusions, and highlights.

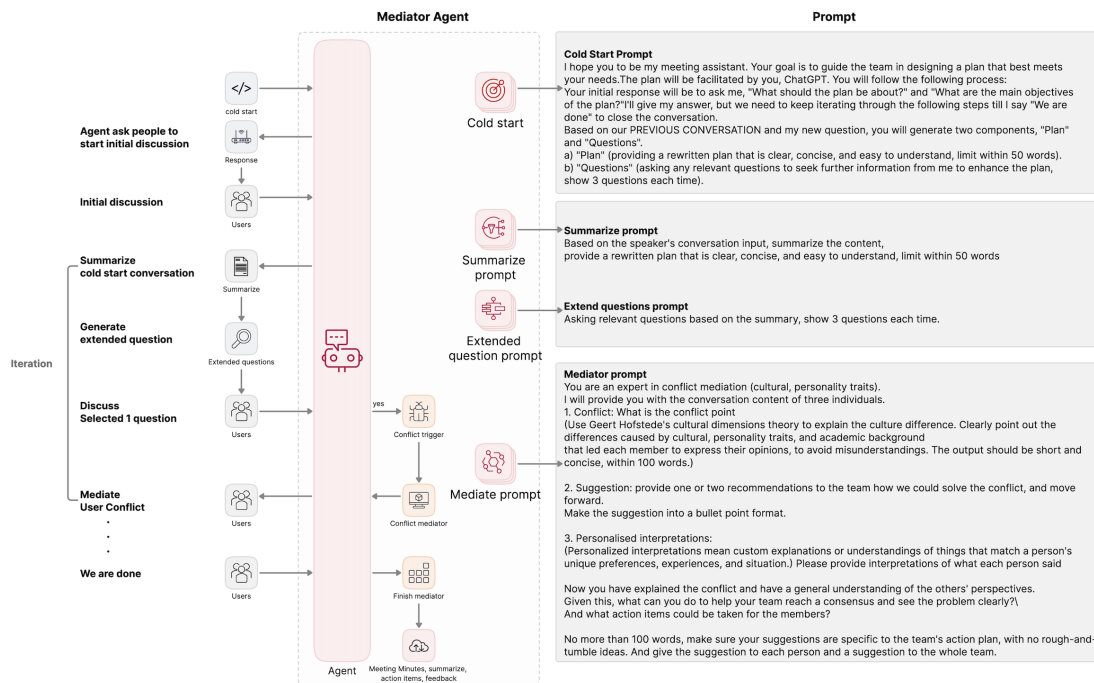


Fig. 3.2.: Workflow for AI Agent Prompt Design: The diagram illustrates the overall structure and process of prompt design. The AI agent has four main prompts: cold start, summarize, extended questions, and mediation prompt. The mediation prompt uses the Chain of Thought (COT) method to detect conflicts, provide individual interpretations, and give suggestions step-by-step. The primary objective of this method is to prevent hallucinations and allow the AI agent more time to consider each step, resulting in more accurate information.

discussion based on comprehensive information. The agent considers the completeness of the dialogue and ensures the team's decisions are wise and well-rounded. In summary, the AI agent plays a crucial role in facilitating team communication, resolving conflicts, providing recommendations, and summarizing meetings, offering robust support for smooth team collaboration.

3.2.8 Pilot study

In this Pilot study, we conducted virtual persona design, discussion topic design, and auto dialog generation. It was created to efficiently evaluate various situations before testing them on a real person. These virtual personas represent diverse personalities, cultures, and disciplinary backgrounds, and ChatGPT will automatically generate conversations based on virtual profile information. Our research focuses on addressing the varying levels of conversation differences, including personality, cultural, and academic disparities. We conducted two Pilot studies, including differences along one axis and three axes, respectively.

Pilot test results 1: Differences on one dimension (Personality, Culture, and Discipline):

In the initial pilot test, the experiment focused on a sole level of differentiation and executed dialogic analyses of personality, cultural, and academic disparities, respectively. We discovered the following results: (Figure 3.3)

- **Lack of naturalness and stereotype:** The pilot study results demonstrated that narrowing the focus to a single dimension led to less natural content generation by the agent. Moreover, it produced more stereotypical outputs, such as: *"The conflict arises from different perspectives on the number of virtual assistants in restaurants. Li Wei emphasizes personalized service and consistency, reflecting traditional Chinese values. Anne van der Meer values customization and flexibility, aligning with Dutch individualism. Nikos Papadopoulos considers cost implications and suggests a hybrid approach, reflecting a practical Greek mindset."*
- **Difficulty in mediating conflict:** Conflict in a conversation cannot be significantly explained by a single level of analysis as it typically arises from the interaction of multiple levels of difference.

- **One-sided conflict resolution:** The agent only suggests and explains a single level of difference, potentially leading to a one-sided and limited analysis of conflict resolution.

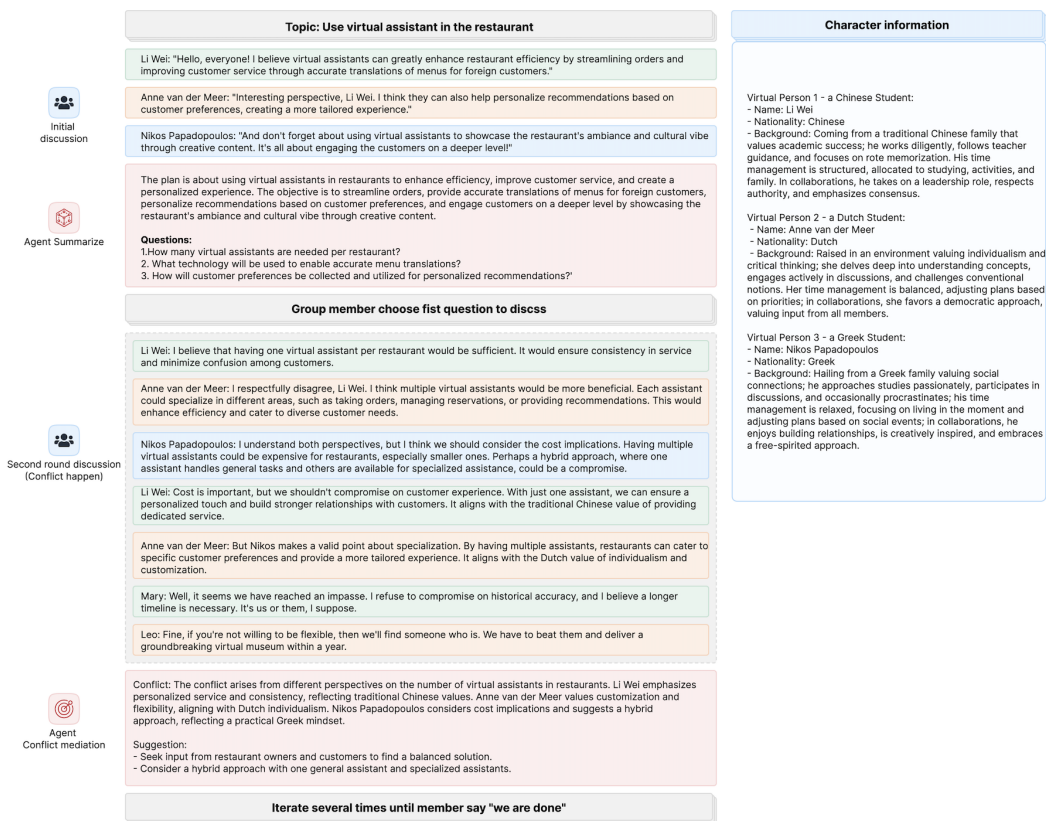


Fig. 3.3.: Pilot study 1 conversation and conflict mediation: In Pilot Test 1, virtual characters were designed with specific personality traits, nationalities, and backstories. The main focus was to test how well the Agent worked in the context of these characters, with a specific emphasis on one of the three dimensions: personality, culture, or discipline.

Pilot test results 2: 3-axis differences (Roles incorporate both personality, cultural and academic differences):

In the second round of pilot testing, the experiment examined various dimensions of personality, cultural background, and academic differences concurrently to better simulate conflict situations in the dialogues. The findings are as follows:(Figure 3.4)

- The agent's ability to effectively interpret conflict situations in conversations was specifically demonstrated through the application of multidimensional differences in conversation design. This approach takes into account the

role-related attributes provided by the participants (such as name, MBTI type, academic background, cultural background, etc.) in a more complete manner, resulting in more accurate conflict mediation. This optimization not only improves the fluency of virtual conversations but also enhances their authenticity.

- Future research projects will explore multilevel differences in conversation design to enhance virtual character design and conversation topic discussion. At the end of each round of conversation, conflicts between members will be explained, and suggestions for mediation and improvement will be provided.
- Depending on the conflict's content, we will offer specific recommendations and actionable steps to effectively resolve the conflict and move forward with the discussion to break the impasse. These measures not only enhance the interactive experience for participants in virtual dialogues but they are also anticipated to offer valuable reference and guidance for resolving real-world conflict situations in practical applications.

Comparison:

Based on the findings of the two pilot studies, it is evident that pilot test 2 presents more advantageous methodologies and recommendations compared to pilot test 1. (Figure 7)

- Firstly, pilot test 2 employs a multidimensional approach to the focus dimensions, encompassing aspects such as personality, cultural background, and academic differences. This approach is more comprehensive than the one-dimensional approach of pilot test 1.
- Secondly, pilot test 2 implements a standardized format when requesting profile information from participants, enabling a clearer and more targeted approach to obtaining information. Concerning conflict resolution abilities, the agent of pilot test 2 concentrated on various facets instead of just a single metric. This approach led to more comprehensive and nuanced advice that accounted for multiple layers of the issue.
- Additionally, pilot test 2 offered tailored and all-encompassing recommendations that integrated numerous dimensions such as personality, cultural provenance, and educational disparities, among others, hence enhancing the effectiveness of problem-solving. Based on practical application, Pilot Test 2 is superior to Pilot Test 1 in presenting recommendations and actionable steps for

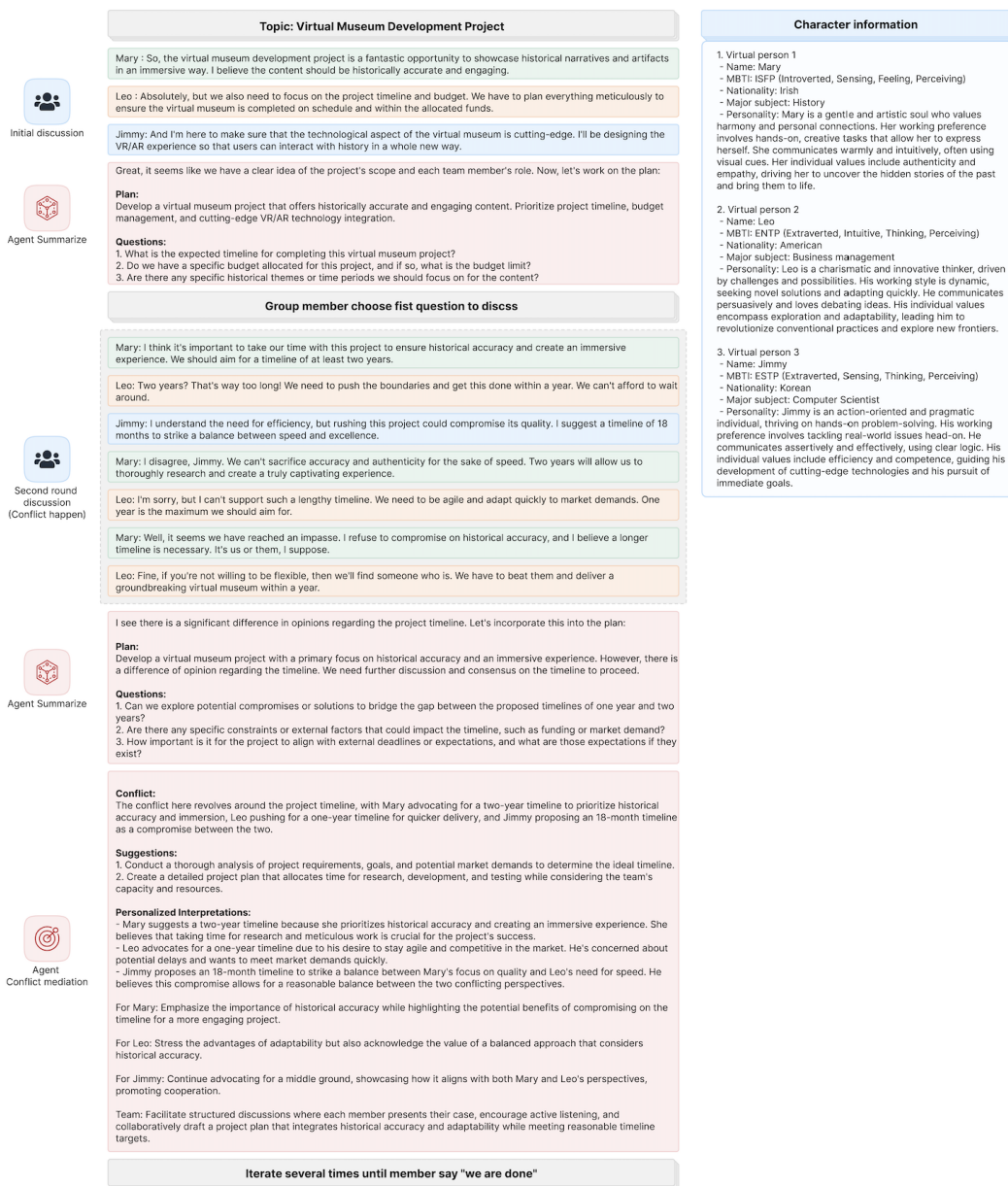


Fig. 3.4.: Pilot study 2 conversation and conflict mediation: In Pilot Test 2, virtual characters were designed with specific personality traits, nationalities, and backstories set for them. Our main concern was to test how well the Agent worked in the context of these characters, focusing on three dimensions: personality, culture, and discipline.

resolving real-world conflicts. Crucially, the suggestions provided in pilot test 2 were more extensive and individualized, which increased user satisfaction and engagement. In summary, the results from the pilot test indicate that pilot test 2 is an improved approach, particularly for complex and realistic circumstances. (See Figure 3.5 for an illustration)

It is important to note that people’s traits are shaped by a variety of factors, rather than a single aspect or outcome. Their unique characters and traits are formed by a combination of their personalities, backgrounds, cultures, and experiences. Our experiments confirm this perspective and emphasize the need to consider multiple perspectives and dimensions when addressing conflicts and issues, rather than focusing on a single aspect. Humans are complex beings composed of various interacting factors that form the basis of our understanding and study of human nature.

However, the agent cannot provide useful explanations regarding academic backgrounds, we only retain cultural backgrounds and MBTI personality traits as metrics. Based on the results of the pilot study tests, we have decided to use the method and criteria from pilot study test 2 in the formal experiment.

Comparison between pilot study 1 & pilot study 2		
Feature	Pilot study 1	Pilot study 2
Focus Dimensions	Single dimension (one of personality, culture, or discipline)	Multiple dimensions (personality, cultural background, and academic differences)
Testers Contribute Personal Information	There is no standard specification and the information provided is rather diffuse.	Standardised formatting requirements (name, MBTI type, etc.)
Conflict Resolution Capability	Generated content lacks naturalness and may produce stereotypical outputs, difficulty in effectively mediating conflicts in conversations	The mediator doesn't just concentrate on one area, but looks at all aspects to offer targeted guidance and tasks to be done. Provide deeper conflict resolution that considers multiple dimensions of complexity
Personalisation Advice	Provide advice and solutions based on a single dimension (e.g. personality)	Provide more integrated and personalised advice and solutions that combine multiple dimensions (personality, cultural background, academic differences, etc.)
Practical Application Improvement	Did not provide specific guidance for improving real-world applications	Offers recommendations and actionable steps for resolving real-world conflict situations
User Satisfaction	User satisfaction may be lower because suggestions are not comprehensive, and single-dimensional suggestions may not be engaging	Suggestions are more comprehensive and personalized, enhancing user engagement
Complexity in Practical Applications	Easy to apply in specific scenarios	More suitable for complex, nature, and realistic scenarios

Fig. 3.5.: This table compares pilot study 1 and pilot study 2 based on different evaluation points. It is clear that if AI agents consider more factors when detecting conflict points in a dialogue, they can provide more natural and non-stereotypical explanations to users.

3.3 Experiment design

The experimental section will utilize a within-subjects design for the study. Each group will consist of two participants who will discuss two rounds. One round will be discussed traditionally, while the other will involve an AI agent. Here is detailed information about the experiment:

1. **Consent form:** To ensure that study participants provide informed consent and to outline their rights and privacy safeguards, subjects are required to complete the ethics and consent form. Moreover, we asked participants for their profile

information for the study purpose, including, age range, nationality, gender, conflict resolution, and availability to schedule a follow-up experiment.

2. Research variables:

- a) **Independent variable:** The independent variable is "with or without Ai Agent".
- b) **Dependent variables:** The dependent variables are Quality, Completeness, Diversity of Perspectives, Mediation of Conflicts, Reduction of Bias or Prejudiced Behavior, Reaching Consensus, Time Reduction.
- c) **Control variables:** Factors such as personality traits(e.g., MBTI personality) and cultural background were considered as control variables.

3.3.1 Participants

Participants include both students and office workers, with a primary focus on residents in the Netherlands and international individuals.

A total of 10 participants were recruited from the Prolific platform, with 60% falling within the age range of 25-34, 30% within the age range of 18-24, and 10% within the age range of 35-44. Gender distribution indicates 60% male and 40% female participants. In terms of nationality, 60% are Dutch, 10% hail from EU member states, and 30% originate from non-EU countries. This study intentionally includes participants from diverse backgrounds to gather a range of perspectives and thoroughly consider the influence of different cultures. (Figure 3.6)

Sample Selection:

The study includes 10 individuals divided into 5 groups, each consisting of 2 participants. The groups will engage in discussions on controversial topics specific to the Netherlands, with a combination of Dutch and non-Dutch participants to explore diverse perspectives. This approach facilitates the examination of the influence of cross-cultural and cross-personality traits on discussions, providing a more holistic insight into the research. Through this grouping approach, the aim is to capture viewpoints from diverse cultural backgrounds and explore potential differences among participants. This design contributes to a broader exploration of social dynamics while providing a platform for participants to share and exchange their views in cross-cultural discussions.

3.3.2 Informed Consent Form and Grouping:

During the recruitment phase, each participant will need to complete a detailed informed consent form. The form will include comprehensive information about the experiment's purpose, procedures, risks, and privacy protection. Additionally, we request that participants provide relevant content in their responses to help us better understand their perspectives on conflict resolution-related issues. This informed consent form provides participants with a clear understanding of the experiment and prompts them to express their views on conflict resolution. This helps ensure cultural and concept differences within each group, facilitating exploration of the potential impact of these factors on the research outcomes.

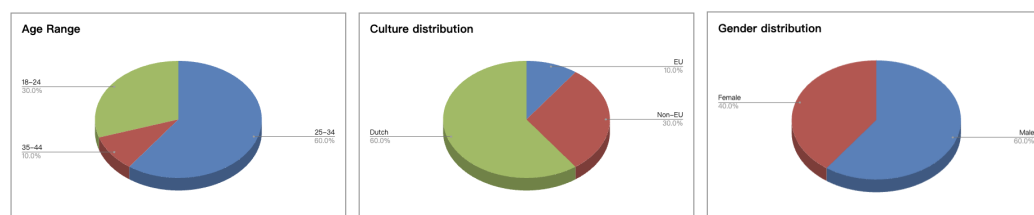


Fig. 3.6.: Participants-related information: The three pie charts clearly show the age, background, and gender distribution of the participants.

Before the experiment begins, participants will be asked to read the following experiment guidelines.

- **Experiment overview:** The main purpose of this experiment is to evaluate how AI technology can enhance the efficiency and effectiveness of meetings, discussions, brainstorming, and conflict resolution. By comparing scenarios with and without an AI agent, we intend to delve into the potential significance of AI in the following aspects:
 1. Facilitating effective communication and collaboration among participants.
 2. Improving the organization and summarization of meeting content, automating the summarization of meeting proceedings.
 3. Extended questions (Brainstorming)
 4. Providing personalized explanations and opinions to better support participants in decision-making and actions.
 5. Effectively handling potential conflicts and differences to maintain good working relationships.

6. Completeness

Research in these areas will help us better understand the potential value of AI agent in assisting meetings and team interactions and have positive impacts on future collaboration tools and processes. Your participation is welcome to assist us in exploring these important questions. The AI agent will be introduced in the second round of the experiment to provide assistance and guidance. Specifically, in the experiment, the researcher will play the dual role of recording what each participant says and does, and on the other hand, outputting and presenting these recordings to them, and even displaying the results generated by ChatGPT on the screen to make them feel engaged with the previously designed prompt. Such an arrangement would help in the subsequent analysis of the participant's behavior, the time they spent on the various tasks, and the various behaviors the researcher observed.

Please read the following instructions carefully to ensure your understanding of the experiment's purpose and tasks.

- **Experiment steps**

1. **Preparation phase:** First, ensure your working environment is quiet and free from noise and distractions. Second, ensure your computer or experimental device is in normal working condition.
2. **Experiment tasks:** This experiment comprises two phases, each with a topic and related questions, for a total of two topics. During the first phase, provide your thoughts based on the topic and related questions and engage in a discussion with one other member to complete the assigned task. Afterwards, write a summary of your discussion. In the second topic, an AI agent will join your discussion, providing summaries, personalized explanations, and conflict resolution support. Engage in a discussion with one other member and provide your thoughts on the topic and related questions. Please inform the researcher once you have finished all assigned tasks, and the AI agent will aid you in creating the meeting minutes.

- **Feedback and questions**

1. If you encounter any difficulties or have any questions during the experiment, please feel free to ask the experiment facilitator.
2. We welcome your feedback and comments on the experiment, which will help us improve future research.

- **Additional information**
 1. **Expected duration of the experiment:** Depending on your task completion and thoroughness (estimated 45 minutes).
 2. **Privacy and data protection:** We will implement privacy measures to protect your personal information and experimental data. Your participation information will be kept confidential.
 3. **Appreciation and rewards:** We appreciate your participation, and there may be small tokens of appreciation or rewards.
- **Post-experiment questionnaire** After the whole experiment, we will provide a questionnaire for the participants to fill out, which mainly focuses on three aspects: Experience with AI conflict mediation, the impact of AI mediation on teamwork, and adaptation of user experience and personalization. (see the appendix A.1.4)

Results

4.1 Impact of AI Agent on Team Collaboration

This study used the 5-point Likert scale to evaluate the multifaceted impact of the AI Agent on team collaboration. Participants rated each indicator on a scale of 1 to 5, with 5 indicating the highest level of impact. The following are the mean ratings for each indicator: In the comprehensive assessment, the AI agent exhibited a variety of significant effects. The AI Agent's exceptional performance in saving time is particularly noteworthy, as it received the highest average score of 4.5. This achievement underscores its remarkable success in enhancing collaboration efficiency. Regarding collaboration quality, participants gave the AI Agent relatively high ratings with an average of 3.7, indicating its positive impact on the quality of discussions and cooperative efforts. The AI Agent performed well in terms of completeness, with an average score of 3.8, contributing to comprehensive discussions. It also excelled in providing diverse perspectives, with an outstanding average score of 4, enriching team thinking and insights.

However, there exists room for enhancement in specific facets of the AI Agent's impact. Especially in conflict resolution and the reduction of bias, the scores were moderate, at 3.2 and 3.3, respectively, implying the requisite for further refinement in addressing internal conflicts and mitigating bias. In the attainment of consensus, the AI Agent obtained an average score of 3.6, signifying a moderate influence on facilitating consensus among team members. Error bars represent the standard deviation of the median. The median values for completeness, diversity of perspective, and reaching common ground are all the same, which is 4. Reduced time has the highest median, followed by a diversity of perspectives. The median of mediate conflicts is the lowest, which is 3. On the ratings for diversity, quality, consensus, and time reduction, participants' scores are relatively consistent, with standard deviations of 0.63, 0.78, 0.8, and 0.67 respectively. However, in terms of reducing bias or prejudiced behavior, the standard deviation is 1.00, and for completeness, it's 0.98. This indicates a higher degree of dispersion among participants' ratings for these two aspects, with scores fluctuating significantly around the median. (Figure 4.1)

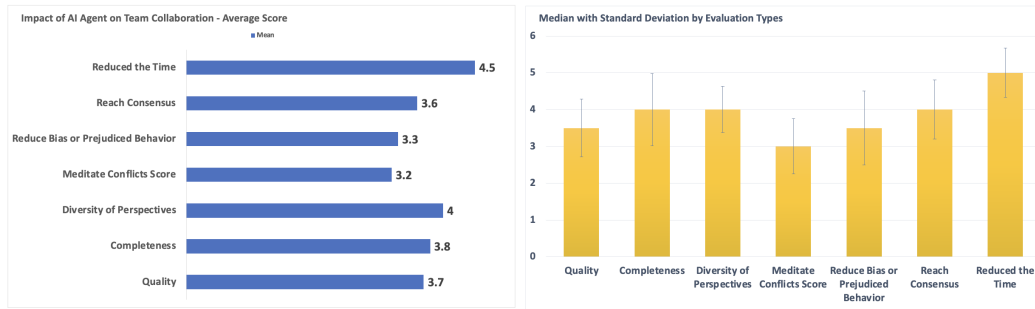


Fig. 4.1.: Impact of AI Agent on Team Collaboration: These questions used a 5-point Likert scale to evaluate the AI Agent's impact on team collaboration. It showed that the AI Agent excelled in saving time and enriching diverse perspectives. However, areas for improvement were identified in conflict resolution and reducing bias. Standard deviations indicated relatively consistent ratings from participants in most areas, but there was more variability in ratings for bias reduction and completeness.

4.2 Feature usefulness

Furthermore, participants conducted a comprehensive evaluation of Ai Agent's primary functionalities. The "Proposing potential topics (Brainstorming)" feature exhibited outstanding performance, achieving the highest average score of 4.5. This underscores Ai Agent's remarkable capability in facilitating brainstorming sessions and proposing potential discussion topics, with users widely acknowledging its effectiveness in guiding ideation and fostering discussions. Following closely, the "Summary feature" attained an average score of 4.3, further emphasizing Ai Agent's efficiency in providing content summaries and structuring information, thereby assisting users in comprehending and addressing discussion topics more effectively.

However, the "Personalized interpretation" feature received a comparatively lower average score of 3.5. This indicates that there may be room for improvement in the aspect of personalized interpretation. Users' expectations for Ai Agent to deliver customized interpretations based on individual needs may not have been fully met, suggesting a potential area for optimization and enhancement in the future. In summary, participants provided positive evaluations of Ai Agent's primary functionalities, accompanied by valuable insights into areas for refinement, aiming to better align the system with users' requirements in collaborative team environments.

In addition, the error bars represent the standard deviation of the median. The median of the summary and proposing potential topics (Brainstorming) are very close to each other, which are 4 and 4.5 respectively. Moreover, the median of

personalized interpretation is the lowest, which is 3.5. On the other hand, the standard deviations of all three aspects are very similar, at 0.64, 0.5, and 0.5 respectively. This indicates that participants' ratings are relatively consistent. (Figure 4.2)

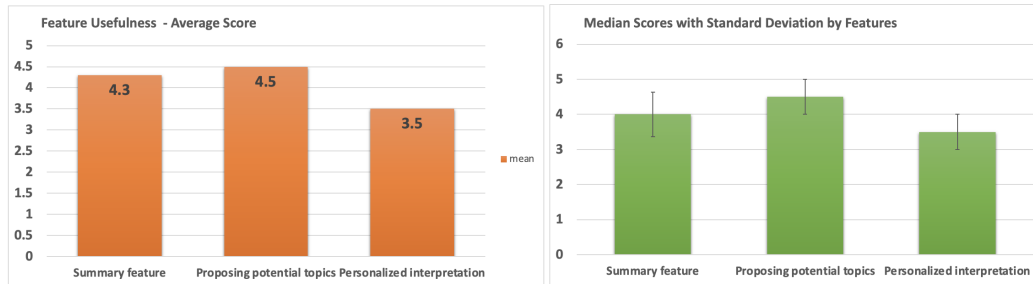


Fig. 4.2.: Feature Usefulness: The 'Proposing Potential Topics (Brainstorming)' and 'Summary Function' received the highest scores, while the 'Personalized Interpretation' function was more average. Standard deviations for all three aspects are very similar, ranging from 0.5 to 0.64, indicating relatively consistent ratings among participants.

4.3 Comparison with and without AI agent

According to the evaluation by participants on the Ai Agent, the following trends were observed: As depicted in Figure 7, participants held diverse opinions regarding the feedback provided by teammates and the Ai Agent. 40% of participants believed the effectiveness of both sources to be equivalent, while 20% leaned towards preferring feedback from teammates, and another 40% considered the feedback from the AI agent to be superior. This suggests a potential advantage of the AI agent in delivering valuable collaborative feedback.

Concerning the handling of change and challenges, Figure 4.3 illustrates that 40% of participants perceived teams with an AI agent to have a greater advantage. Only 10% of participants slightly leaned towards teams without an AI agent being better equipped to handle changes. Additionally, 30% of participants remained neutral, while another 20% slightly leaned towards teams with an AI agent being more adept at addressing changes and challenges. Notably, no participants believed that teams without an AI agent had a superior advantage. This indicates a positive impact of the AI agent in assisting participants in coping with changes and challenges.

In summary, these data indicate a positive influence of the AI agent in providing feedback and addressing changes and challenges, reflecting the potential value of AI technology in collaborative environments. These results offer valuable insights into

understanding the practical impact of AI agent on collaborative efficiency. (Figure 4.3)

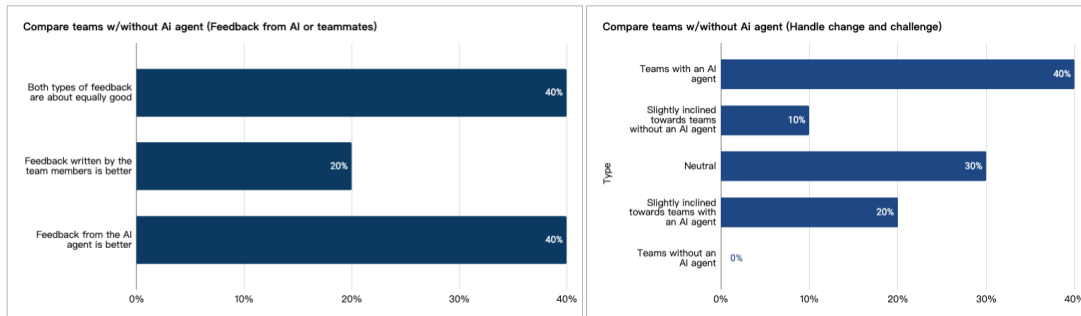


Fig. 4.3.: Comparison with and without AI agent: The bar chart clearly shows that the feedback from an agent is better than teammates. Moreover, most participants think agents could handle change and challenge during the experiment.

4.4 Overall trend of conflict frequency with AI Agent

Based on the conflict occurrence data from the experiment (refer to Figure 10), it is clear that the frequency of conflicts decreases over time with the use of the AI agent. We used the Wilcoxon signed rank test for our analysis due to the small sample size. This is a nonparametric statistical method that is well-suited for comparing the medians of two related samples when the data do not follow a normal distribution or when the sample size is small.

This study formulated the following hypotheses:

- H0 (null hypothesis): There is no significant difference in the number of conflicts when using the AI agent, or the difference between the medians of the two pairs of samples is zero.
- H1 (alternative hypothesis): There is a significant difference in the number of conflicts when using the AI agent, or the median difference between the two pairs is not equal to zero.

According to the Wilcoxon signed rank test, we obtained a test statistic value of 3.0 ($p = .039$). The median number of conflicts was 2.0, whereas with the use of the AI agent, the median number of conflicts was 1.0. Therefore, we rejected the null hypothesis and accepted the alternative hypothesis indicating that there is a significant difference in the number of conflicts before and after the use of the

AI agent. This suggests that AI agents have an impact on the number of conflicts, further deepening our understanding of their role in conflict resolution.

These results demonstrate the practical impact of the AI Agent's mediation function in reducing conflicts. The intervention and mediation by the AI Agent during the discussion process contribute to maintaining a positive team dynamic. As time progresses, participants' understanding and consensus gradually strengthen, subsequently reducing the incidence of conflicts (see Figure 4.4).

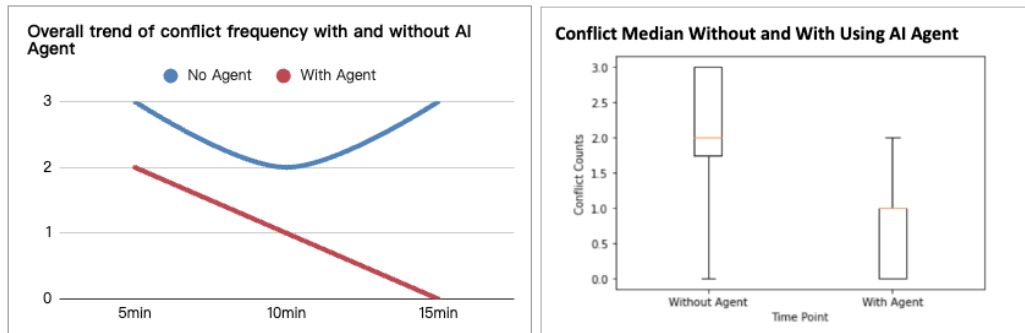


Fig. 4.4.: Conflict frequency with AI agent: The average conflict number decreases over time compared to the traditional way. According to the Wilcoxon signed rank test, we obtained a test statistic value of 3.0 ($p = .039$). Thus we reject the Null hypothesis.

4.5 Adoption of the extended questions

In the scenario where the AI Agent provided extended questions based on discussions among participants, a total of 15 discussion rounds were conducted in the experiment. According to the results, AI Agent's extended questions were adopted in 6 rounds, accounting for 40% of the overall discussions. This indicates a positive impact of AI agent in facilitating brainstorming and offering valuable questions. Specifically, participants chose to adopt the questions proposed by the AI Agent during the discussions, highlighting the relevance of the AI Agent's inquiries and its practical effectiveness in guiding discussions and inspiring thoughtful considerations. This outcome emphasizes that AI Agent, when assisting teams in discussions, effectively stimulates brainstorming by presenting insightful questions, potentially enhancing the richness and depth of the overall discourse.

4.6 Exploring initial differences, opinion shift, and post-discussion consensus among participants

In the process of discussing a specific topic with team members, as depicted in Figure 9, it is evident that in the traditional discussion approach, team members' initial viewpoints tend to be generally neutral, with an average score of approximately 3.2. However, when engaging in discussions with an AI agent, there is a notable divergence in initial perspectives, indicated by a score of 2.4. This initial disparity may impact the subsequent difficulty in achieving consensus, as participants' initial opinions are relatively closer to the traditional approach (average score of 3.2) compared to the more pronounced differences observed with the AI agent.

Regarding the attainment of consensus, observations indicate that teams are more likely to reach consensus without an AI agent, with an average score of 3.3. In contrast, the presence of an AI agent increases the difficulty in reaching consensus, as reflected by a lower average score of 2.7. This difficulty may be attributed to the initial differences in viewpoints, making it more challenging to achieve consensus during discussions with an AI agent.

In terms of opinion shifts, the study indicates that participants using an AI agent are relatively more prone to changing their initial perspectives (score of 2.2). Conversely, in situations without an AI agent, participants exhibit a lesser degree of opinion transformation, with a score of 1.5. This suggests that the involvement of an AI agent stimulates more discussions and contemplation, leading participants to be more willing to adjust their initial viewpoints.

Overall, the results of this study underscore the role of AI agents in team discussions. The initial divergence in viewpoints affects the formation of consensus, and the participation of AI agents enhances the complexity of discussions, thereby increasing the difficulty in achieving consensus. Nevertheless, AI agents can facilitate opinion shifts, highlighting their potential value in assisting the discussion process. (Figure 4.5)

Type	How different were my initial opinions when discussing the topic with my teammates		Degree of consensus among participants. (After discussion)		Opinion shift among subjects. (After discussion)	
	No agent	With Agent	No agent	With Agent	No agent	With Agent
Average score	3.2	2.4	3.3	2.7	1.5	2.2

How different were my initial opinions when discussing the topic with my teammates		Degree of consensus among participants. (After discussion)		Opinion shift among subjects. (After discussion)	
5-Likert scale	Score	5-Likert scale	Score	5-Likert scale	Score
Very different	1	Not at all	1	No Shift	1
Somehow different	2	To a small extent	2	Slight Shift	2
Neutral	3	To a moderate extent	3	Moderate Shift	3
Somewhat similar	4	To a great extent	4	Significant Shift	4
Very similar	5	Completely	5	Complete Shift	5

Fig. 4.5.: Exploring initial differences, opinion shift, and post-Discussion consensus among participants.

4.7 Open-ended question 1 - How do you think the AI agent practically impacted your team's discussion?

This qualitative analysis investigates the influence of the AI agent on team discussions by analyzing each participant's feedback. Regarding 'deepening discussion and providing interesting examples,' more than half of the participants (55%) highlighted the crucial role of AI in facilitating in-depth discussion. This involves aiding in the comprehension of teammates' perspectives, offering a broader view of information, and enhancing the discussion. Some respondents highlighted the capacity of AI to summarize and expand, which enhances the efficiency of discussions.

However, 9% of respondents noted that AI-generated content can sometimes be out of context, highlighting the challenges of contextual understanding.

In the area of organizational and structural impact, 9% of respondents noted that AI can provide a better outline for discussions, improving their structure and focus.

Finally, in the "Underutilized Potential and Discussion Speed" category, approximately one-third of the participants (27%) highlighted that AI provides outstanding discussion topics, yet the team has not fully capitalized on them, advocating for broader applications. Simultaneously, reports indicated that interacting with AI might lead to a slowdown in discussion speed. (Figure 4.6)

4.8 Open-ended question 2 - Please provide feedback on your experience with the AI agent, including any positive or negative impacts and suggestions for improvement.

Open-ended Question 2 comprehensively assessed evaluations of AI agents in team discussions, categorizing them into four categories. Positive feedback, accounting for 46% of the overall analysis, consistently recognized the AI agent's excellence in summarizing discussions quickly and easily, as well as its substantial help in understanding different perspectives and reaching consensus. Some participants considered the AI agent a valuable reference for discussions and acknowledged its good performance, while others stated that the AI agent was currently performing well and was equivalent to an intelligent conference record. The survey revealed that

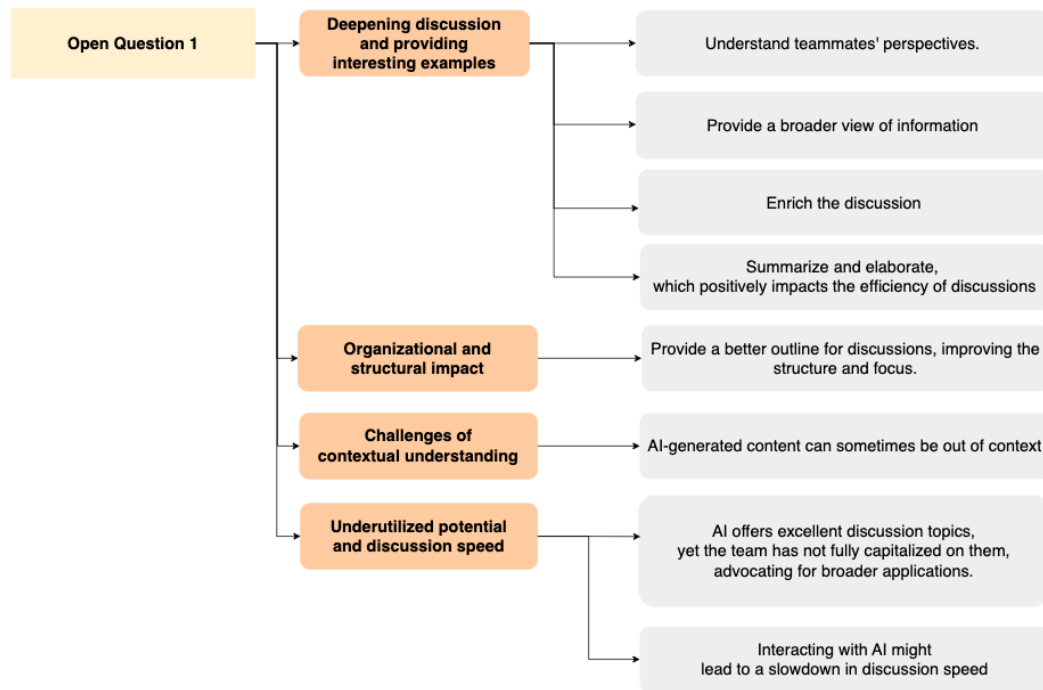


Fig. 4.6.: Open-ended question 1 - How do you think the AI agent practically impacted your team’s discussion?

23% of participants provided negative feedback. They highlighted some challenges, including the possibility of misinterpretation due to translation errors, the risk of participants becoming too focused on their arguments at the expense of others’ perspectives when using AI, and the limitations of the display screen in certain contexts.

In terms of suggestions, constituting 31% of the overall analysis, participants proposed improvements in translation accuracy, enhancement of AI agents’ ability to guide conversations by emphasizing understanding opposing viewpoints, minimizing the impact of directing users to focus on developing their arguments, highlighting issues related to display and screen presentation, and suggesting improvements to make AI tools more user-friendly. Additionally, participants recommended shortening AI agent suggestions to reduce interference in the discussion process and seamlessly integrate into conversations. Overall, this analysis, supported by data, provides a thorough understanding of the strengths, challenges, and potential improvements of AI agents, offering valuable insights for future applications. (Figure 4.7)

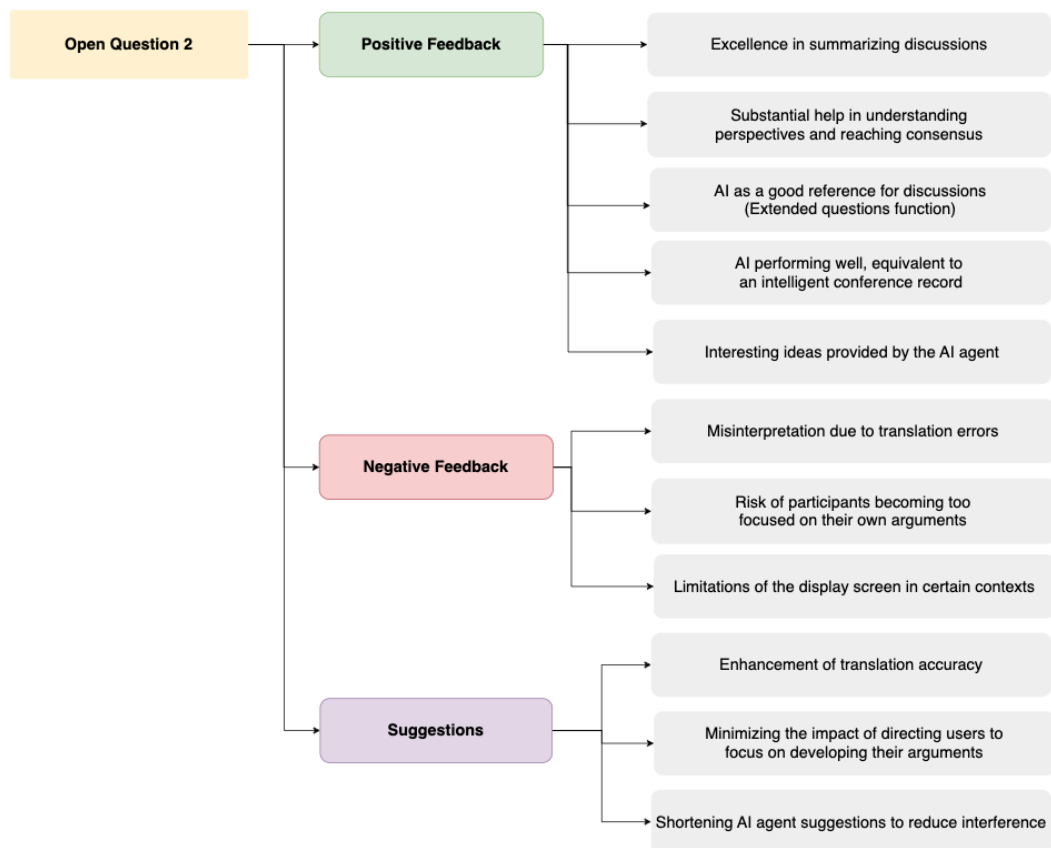


Fig. 4.7.: Open-ended question 2 - Please provide feedback on your experience with the AI agent, including any positive or negative impacts and suggestions for improvement.

4.9 Open-ended question 3 - Share any interesting or significant moments or observations you encountered during the experiment.

The feedback provided by participants in the third open-ended question can be categorized into four main areas: perspectives and discussion direction, AI data processing and comprehension, opinion convergence and personality differences, and discussion topics and dialog styles.

First, in terms of viewpoints and discussion direction, participants emphasized the differences in viewpoints among team members and praised the help of AI in steering the direction of the discussion. This highlighted the positive role of AI in dealing with intra-team dynamics, helping participants better understand each other's perspectives, and steering the discussion in a more constructive direction.

Secondly, regarding AI data processing and comprehension, participants expressed interest in how AI handled the provided data and praised its ability to understand their perspectives surprisingly well. This suggests that AI excelled in effectively processing complex data and comprehending participants' intentions, which was critical to moving the discussion in a deep and meaningful direction.

Thirdly, regarding the convergence of opinions and personality differences, participants mentioned situations where team members tended to agree. They also emphasized the impact of personality types on discussions. This highlighted the challenges of understanding and reconciling different personality types in collaborative work. Additionally, they discussed the potential role of AI in facilitating the convergence of opinion and collaboration.

Finally, in terms of discussion topics and conversational styles, participants indicated that controversial topics may require more discussion time, that they would like to engage in discussions with people with different perspectives, and that they appreciated the AI's ability to brainstorm. This text demonstrates how AI can be used to handle sensitive topics and promote discussions with diverse perspectives. It highlights the practical application of AI in stimulating new ideas and inspiring conversations.

Overall, the results of these qualitative analyses offer insights into the interesting and critical moments observed during the experimental process. They also highlight the potential role of AI in guiding discussions, processing data, reconciling different

perspectives, and facilitating deeper conversations. These findings provide valuable insights for further research and applications of AI in collaborative work and discussion environments. (Figure 4.8)

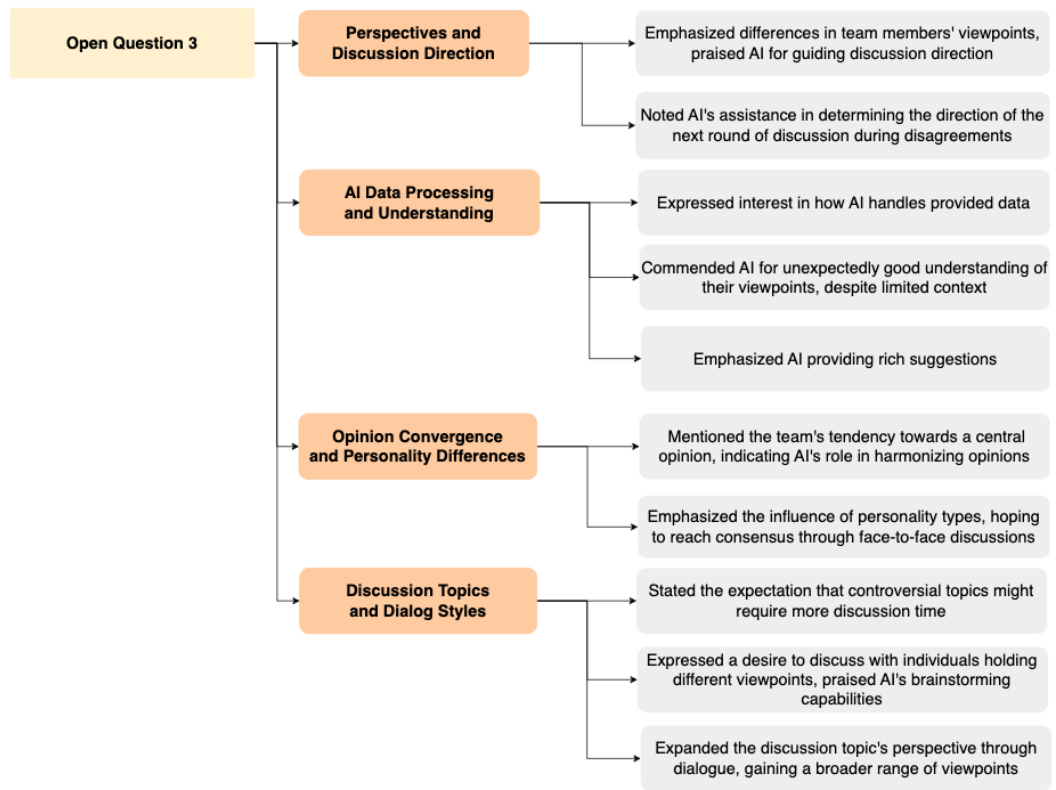


Fig. 4.8.: Open-ended question 3 - Share any interesting or significant moments or observations you encountered during the experiment.

Discussion, Limitations and Further Work

5.1 Discussion

In this study, we have explored the concept of an agent based on LLM (Large Language Model) which aims to facilitate teamwork and successfully resolve a variety of intra-team conflicts including cultural differences and personality traits through the intervention of Ai agent. By analyzing the data and findings of the study, we draw the following conclusions and discussions:

- Interpretation of the research results: Our research shows that the introduction of an AI agent significantly improves work efficiency. The AI Agent consolidates conversations and presents follow-up questions every five minutes, ensuring that team members stay on track and save valuable time. This efficiency boost is attributed to the Agent's ability to rapidly provide information and suggestions, facilitating the team's organized progression of work. When using the Agent, teams can quickly reach a consensus and maintain focus on the main topic. The AI Agent also assists explain personality traits, mediating conflicts, and interpreting individual differences effectively. By using the AI Agent, team members can understand each other's perspectives from the beginning of discussions and grasp their colleagues' personality traits and cultural backgrounds. This reduces communication barriers and promotes smoother collaboration.
- Contrasts with existing literature: Compared to previous research, our study underscores the potential importance of an AI agent in team collaboration, especially in managing internal conflicts, a scenario that has received relatively less attention in the existing literature. Our research results support the use of an AI agent to increase work efficiency and reduce conflicts. In terms of implementation, our AI agent possesses the ability of Chain of Thought (COT), which enables it to assess the level of dialog conflict during conflict situations. It applies Geert Hofstede's work on cultural dimensions to assess conflict among participants. Through a series of natural language reasoning steps, the

AI agent ensures the analysis of each step for accuracy. In addition, our AI agent is multi-functional and includes brainstorming, quick summarization, and the organization of meeting minutes. It is also capable of providing personalized explanations, mediation, and conflict resolution, fostering smoother and more efficient team collaboration. It is worth noting that, compared to previous work, our AI agent goes beyond dialogues with virtual characters to include interviews with real people, thereby broadening its scope of application. In summary, our research provides empirical support for the superiority of an AI agent in supporting internal team communication and conflict resolution, opening up new possibilities for the development of this field.

5.2 Limitation and Future work

Some limitations need to be taken into account when interpreting the results of our study. We will discuss each limitation in detail and suggest possible future improvements.

5.2.1 Sample size

- **Limitations:** Due to constraints in our sample recruitment and experimental topic selection, participants primarily come from specific educational fields. It is important to acknowledge that the generalizability of our research results may be limited to some extent. The restriction of our sample to a specific domain may impede the extrapolation of our conclusions to individuals from different cultures and personality domains.
- **Future Work:** To address the current limitations in our research, we plan to broaden the recruitment of samples and expand the range of experimental topics to include other domains. This expansion aims to investigate the performance of Agents across different themes, allowing for a comprehensive understanding of collaboration and team dynamics in various contexts. This effort includes increasing the diversity of participants, considering representation from diverse cultures and personality domains, and ensuring that future research possesses broader applicability.

5.2.2 Cost Consideration and Runtime

- **Limitation:** Current algorithms may consume significant computational resources and time, particularly whilst managing large datasets or intricate tasks. This could lead to increased hardware expenses and prolonged processing periods, restricting the applicability of said algorithms in real-world applications, particularly under resource constraints.
- **Future work:** Future studies should concentrate on diminishing computational expenses and computation time. This can be accomplished via various approaches such as optimizing algorithms and utilizing parallel computing techniques. Additionally, exploring the development of versions for differing levels of computing resources can ensure the successful running of algorithms in varying environments. Additionally, exploring the development of versions for differing levels of computing resources can ensure the successful running of algorithms in varying environments. Furthermore, enhancements in real-time and latency should be taken into account to fulfill the time-sensitive needs of real-life applications, consequently boosting the efficacy of the algorithms.

5.2.3 Input Method

- **Limitation:** The existing system solely facilitates text input, neglecting voice input. This may impair user diversity and convenience, particularly among individuals who favor or require voice communication.
- **Future work:** Future work could concentrate on the development and incorporation of voice input characteristics to enhance the usability and user experience of the system. Such features could comprise the integration of voice recognition technology, which would enable users to interact with the system verbally. Nonetheless, the cost, precision, and data protection issues of speech recognition technologies must be taken into account to warrant their seamless assimilation in future applications. Multi-modal input, supporting both text and voice input, could also be considered to meet the requirements of diverse users.

Conclusion

This research aimed to answer the question: **Can prompt engineering, providing LLMs with theoretically grounded knowledge regarding the influence of personality and culture on collaboration, combined with the Chain-of-Thought method, allow agents to decompose processing steps, assist teams in overcoming conflicts, and enhance collaboration?**

Our exploration began by examining the concept of an agent-driven by prompt engineering to foster teamwork and mitigate intra-team conflicts arising from cultural and personality differences. Upon analyzing the data and findings, the following conclusions were drawn:

First of all, agents have a positive impact on the quality, integrity, and diversity of work outcomes. They provide valuable suggestions for extensions and help brainstorm when team members lack ideas, facilitating more creative and multifaceted discussions, and enriching the content and quality.

The Agent effectively resolved conflicts in the cultural and personality realm without introducing bias, promoting peaceful and effective dispute resolution within the team. This impartial role contributed to peaceful and efficient dispute resolution within the team, reducing instances of bias and dissent. Additionally, the Agent's participation enhanced the collaborative environment within the team, resulting in a more amiable and unified work relationship.

Finally, the AI agent provided customized assistance to meet the unique needs of each team member. Based on the study's results, team members generally regarded the Agent's individualized feedback as better than their feedback. This offers further proof of the Agent's exceptional capability to offer personalized assistance, which improves team members' satisfaction and effectiveness.

In summary, this agent system combines prompt engineering as its core intelligence with planning, memory, and tool usage components to achieve efficient task processing, learning, and information utilization. The system improves productivity and enhances result quality while successfully resolving conflicts and biases within the team. We recommend adopting this agent concept to attain efficient teamwork and a harmonious working environment. This study presents significant discoveries

and potential avenues for future research on group collaboration and intelligent agent.

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Appendix

A.1 List of all relevant materials

A.1.1 Formal experiment - Topic 1

The screenshot shows the Diversity Agent Harbor interface for Topic 1. The main content area is titled "Limiting international student admissions and its effects". It includes a "Discussion Topic" section with a warning to enter an invitation code, a "Topic" section with background information and a question, and an "Agent" section with a goal and key issues to discuss.

Discussion Topic

Please enter your Invitation Code before we start

Limiting international student admissions and its effects

Topic

The Dutch House of Representatives is currently investigating whether universities should review their international student admission policies, sparking an intense debate. Dutch students worry that an influx of international students might strain resources and diminish the quality of studying they receive. International students see their participation as a chance for cross-cultural exchange but fear local residents' dissatisfaction. The conflict touches on subjects like diversity, educational quality, campus culture, social dynamics, university policies, student career opportunities, and economic impact. Finding a sustainable solution that accommodates both perspectives can be challenging.

Question

Should universities limit the number of international students they admit and why? Discuss the impact of Dutch universities' current and future admission policies on students and staff, as well as on the country's economy and future. Bring on your perspective, read the perspective of your teammates, and it agents will help you whenever you feel stuck!

Agent

The plan is to consider limitations on the number of international students admitted. The objective is to evaluate the implications of Dutch universities' existing and prospective admission policies on students and faculty, as well as on the Netherlands' economy and future.

Your team goal is to discuss

Conduct a comprehensive analysis of university admission policies regarding international students to maintain harmony between local and international students while preserving campus cultural diversity.

Key issues to discuss

1. Could you provide more context on the current admission policies of universities you're interested in studying?
2. What specific aspects of campus culture and diversity are you most concerned about preserving?
3. Are there any key metrics or criteria you'd like to focus on during the analysis, such as student demographics or academic performance?

Fig. A.1.: Limiting international student admissions and its effects - Should universities limit the number of international students they admit and why?

A.1.2 Formal experiment - Topic 2

The screenshot shows the Diversity Agent Harbor interface for Topic 2. The main content area is titled "Language requirements of studying in Dutch universities". It includes a "Discussion Topic" section with a warning to enter an invitation code, a "Topic" section with background information and a question, and an "Agent" section with a goal and key issues to discuss.

Discussion Topic

Please enter your Invitation Code before we start

Language requirements of studying in Dutch universities

Topic

After years of adopting English as a language of instruction, Dutch universities are now considering a turn towards a more strict enforcement of Dutch as the language of teaching in higher education. On the one hand, some local students and advocates believe that stricter language requirements will help international students better integrate into Dutch society in the long run. Using Dutch as the main language of instruction may help international students adapt more easily to the local culture and community, and improve their chances of finding a job in the Netherlands after graduation. On the other hand, many international students and staff are concerned that imposing stricter language requirements will negatively affect the attractiveness of Dutch universities, lower teaching and research quality, result in brain drain and talent loss, and negatively impact the Dutch economy in the long run. The debate touches upon issues of teaching and research quality, academic outcomes, cultural diversity, social dynamics, and the creation of equalities and/or inequalities.

Question

Should Dutch universities enforce stricter Dutch language requirements in their curricula and why? Discuss the impact of stricter language requirements in Dutch universities on students and staff, as well as on the country's economy and future. Bring on your perspective, read the perspective of your teammates, and it agents will help you whenever you feel stuck!

Agent

The plan is to assess the potential implementation of more strict Dutch language prerequisites within Dutch universities' courses. The objective is to evaluate the consequences of these stricter language requirements on students, faculty, and the nation's economy and future.

Your team goal is to discuss

Conduct a comprehensive analysis of the integration of stricter Dutch language prerequisites in Dutch universities' courses and their influence on teaching quality and assess their impact on academic outcomes and potential disparities among international students. The objective is to investigate whether the introduction of these stricter language criteria enhances teaching excellence and promotes positive academic results, while also examining the potential for creating inequalities among various international student groups.

Key issues to discuss

1. How might stricter language rules affect Dutch universities financially?
2. How can Dutch universities maintain fairness while enforcing stricter language prerequisites for international students?
3. What is the impact of stricter language criteria on the international appeal and competitiveness of Dutch universities?

Fig. A.2.: Language requirements of studying in Dutch universities - Should Dutch universities enforce stricter Dutch language requirements in their curricula and why?

A.1.3 Experiment Transcripts from participants with, and without Agent

Formal Experiment 1 - 1st round - No Agent

Topic: Limiting international student admissions and its effects

Subject 1: We are a small country. Number of classes per study is limited per year. Some studies do placement lotteries, so it would be detrimental if Dutch students can't join the studies they want. Our government provides subsidies to bring down the costs of the studies. Since this is tax payer money, it should be used towards public gain of The Netherlands. So if the student leaves after getting benefits it would be a deficit financially. Also the housing crisis is pretty large now and this causes concerns for Dutch students who need housing.

Subject 2: In some sense, for me, they should but not strictly. The reasons for this are: housing issues (at the moment NL is struggling to solve this problem) but I don't think Dutch universities should be strict on this. At the end of the day, the Dutch government needs knowledge-based migrants to keep the economy going or make a positive impact on the economy and one way to do that is to allow international students come to NL and with the hope that some of them stay for work to contribute to the economy in this country. But I see this as a more complex issue. For example, the housing crisis which is intertwined to the arrival of international students but not strictly limited to this. Thus, I guess the government needs a more holistic approach to address the housing crisis in order to cater to all kinds of residents in this country, in this case, that includes international students.

Subject 1: I agree to a certain extent. We definitely need more international students because it diversifies the whole field of knowledge, different perspectives etc. But at the moment our country is in financial disarray and we need to limit the number of students since we have trouble to get Dutch students to follow an education, get housing. The problems with staff, building facilities to make sure more students can attend university, subsidy structures, student housing need to be solved first before we can take in more students. A limit is therefore needed to give breathing room to take in more students in a more controlled manner in the future.

Subject 2: I do get the point of limiting international students from housing perspective but the consequence of limiting potential knowledge-migrants can have devastating effect to companies who are desperate to hire workforce that has the specialty they need directly from universities. This in turn will limit economic growth of the country, which will cause budget cuts/limitations to other aspects of the society such as social support to low-income households, etc. I think there will be lots of government-funded projects that will be underfunded due to this domino effect.

As for the current situation of the status, considering hybrid education and all that, I do think that universities need a pragmatic approach to how to deal with issues on (physical) lecture availability and (study) spaces for students as a whole. When this is also addressed, maybe there will be a chance that limitations to international students coming here will be at least minimized.

Limiting international students → limiting potential knowledge-based workforce → limiting economic growth → decline in government fundings → (financial) decline in social programs

Subject 1: I believe we are coming to more of an agreement in which we can see the added value of international students in The Netherlands. In my understanding it is more from a knowledge perspective, social development of students coming into contact with different cultures in formative years, betterment of research (which can't be directly measured into economic growth).

Since only 32% of international students work in The Netherlands after their study and the fact that the biggest gap in the workforce is not from higher education students, I don't believe it will directly benefit the Dutch economy. Also if student stay here they will in the end require larger housing which is still a big strain on the current housing crisis. Students who stay working in The Netherlands work for global companies (which often dodge taxes) which do not directly work for essential parts of the Dutch workforce where we actually lack workers right now.

Subject 2: I think the first two discussions reasoned out that housing crisis is strongly correlated to influx of international students. I think there are other ways to address the housing crisis other than limiting international students. The labor market is tight at the moment which goes to show that more potential workforce are needed to keep a positive economic impact in the Dutch economy. This means that in order for governments to keep sustaining what they have been sustaining, the economic impact must be maintained or improved. One aspect of this is allowing international students to be a good pool of people who can contribute to this. Yes it's true that 20-30% of students only stays here after their study which is fairly small. What more if we limit international students coming-in? Can the Dutch economy keep up with the tight labor market by then?

Subjects information

Subjects 1:

- Age: 35-44
- Gender: Male
- MBTI: INTJ
- Nationality: Dutch
- Major: Business Informatics
- Question 1: I feel comfortable and can see points of view that differ from my own
- Question 2: Only if it concerns facilities such as housing. This is because we keep bringing in more migrants every year even though we can't even provide housing to our own citizens.

Subjects 2:

- Age: 25-34
- Gender: Male
- MBTI: INTJ
- Nationality: Philippines
- Major: Engineering Management
- Question 1: I try to understand everyone's point-of-view. I asked for their perspective and try to see how they are seeing things.



Agent Summarize



Agent Summarize



Agent Conflict mediation



Agent Personalized interpretation



Agent Conclusion

Formal Experiment 1 - 2nd round - With Agent

Topic: Language requirements of studying in Dutch universities

Subject 1: Somewhat agree: I don't think all study material has to be in Dutch, since it is a hard language to learn and would hamper the learning potential. That said if students are dedicated in coming here, they should at least learn the language. They don't have to be fluent, at least follow basic Dutch courses. This way they can interact with the Dutch population more freely, improving social interaction as a whole and help integration if they would like to stay and live in The Netherlands after their study.

Subject 2: For me, I disagree. The current structure of Dutch and English language of universities (including HBO) is fairly fine/okay in itself. To enforce a much stricter Dutch language requirements would mean certain number of years of negative effect on attractiveness, brain drain, talent loss and Dutch economy impact as a whole

Plan:
Evaluate the potential impact of stricter Dutch language prerequisites on learning potential, social integration, and the overall attractiveness and competitiveness of Dutch universities. Assess the benefits of encouraging basic Dutch language courses for international students to facilitate interaction with the local population and integration into Dutch society. Consider the potential negative effects on attractiveness, brain drain, talent loss, and the Dutch economy as a whole.

Questions:
1. How can we strike a balance between maintaining the attractiveness of Dutch universities and promoting social integration through basic Dutch language courses?
2. What measures can be taken to mitigate the potential negative impact on brain drain and talent loss if stricter language requirements are implemented?
3. Are there any alternative approaches to promoting social integration and interaction with the local population, aside from enforcing stricter language prerequisites?

Subject 1: Colleges and study material should be in English to entice potential students to come study in The Netherlands. Next to the colleges the university should provide free Dutch courses to help with integration into the Dutch community

Subject 2: Dutch universities should offer free Dutch courses up to B1 level to students who are impacted with stricter Dutch language requirements. Universities should proactively advertise if Dutch language courses are offered

Plan:
Consider offering study material in English to attract international students while providing free Dutch courses up to B1 level to support integration into the Dutch community. Proactively advertise the availability of these courses to ensure students are aware of the resources. Evaluate the effectiveness of this approach in promoting social integration and meeting stricter language requirements.

Questions:
1. How can we ensure that the free Dutch courses offered by universities are accessible and beneficial to international students?
2. What strategies can be implemented to effectively advertise the availability of Dutch language courses to impacted students?
3. How can we measure the success of the integration efforts through the provision of free Dutch courses and the availability of study material in English?

Conflict: The conflict arises due to differences in cultural dimensions and academic background. Rogier, being from the Netherlands with a low power distance culture, believes that English should be the primary language for colleges to entice international students. On the other hand, Subject 2, from the Philippines with a high power distance culture, thinks that Dutch language courses should be offered for those who are impacted by stricter language requirements.

Suggestion:
- Both English and Dutch language courses should be provided to cater to the needs of students from different backgrounds.
- Universities should advertise clearly what language courses are offered and provide necessary support to ensure successful integration.

Personalised interpretations:
Subject 1 suggests using English as the primary language to attract international students and provide Dutch language courses to help students integrate into the Dutch community. He believes that this will help create a multicultural learning environment.
Subject 2 suggests universities should offer Dutch language courses up to B1 level for students who have difficulty meeting the stricter Dutch language requirements. This will prevent their academic progress from being impacted.

To help the team reach consensus, it is suggested that both Subject 1 and Subject 2 demonstrate active listening and validate each other's perspectives. Subject 1 can reiterate the importance of cultural diversity while acknowledging the practicality of language proficiency and suggesting a compromise that integrates both perspectives. Subject 2 can also acknowledge the value of cultural diversity while emphasizing the benefits of language proficiency for both individuals and society.

For Subject 1, it is suggested to research and present studies that showcase the positive impact of promoting multilingualism and cultural diversity in education and society. Subject 2 can research and present evidence that supports the benefits of Dutch language requirements in education and society.

As a team, it is recommended to establish a common goal that prioritizes the advancement of education and society while embracing cultural diversity. The team can work together to create a plan that integrates both perspectives and promotes a balanced approach. Regular check-ins can also be implemented to ensure that the plan is being effectively executed.

Subject 1: I believe we are in agreement that studies can be in English with free Dutch courses for international students

Subject 2: I think we have agreed to a common ground with my teammate. We see the need of universities to proactively help students learn the Dutch language.

We are Done!

Summary

The discussion revolves around the potential implementation of stricter Dutch language prerequisites in Dutch universities' courses. The objective is to evaluate the consequences of these stricter language requirements on students, faculty, and the nation's economy and future. There is a difference of opinion regarding the impact of stricter language rules on teaching quality, academic outcomes, and international appeal of Dutch universities. Some participants believe that enforcing stricter language prerequisites may hamper learning potential and negatively affect attractiveness, brain drain, talent loss, and the Dutch economy. Others argue that basic Dutch language courses should be encouraged to facilitate social integration and interaction with the local population.

Discussion Highlights

- The plan is to assess the potential implementation of stricter Dutch language prerequisites in Dutch universities' courses.
- The objective is to evaluate the consequences of these stricter language requirements on students, faculty, and the nation's economy and future.
- Participants discuss the impact of stricter language rules on teaching quality, academic outcomes, and international appeal of Dutch universities.
- There is a difference of opinion regarding the need for stricter language prerequisites and the potential negative effects on attractiveness, brain drain, talent loss, and the Dutch economy.
- Some participants argue that basic Dutch language courses should be encouraged to facilitate social integration and interaction with the local population.

Conclusion

The discussion highlights the need for a comprehensive analysis of the potential implementation of stricter Dutch language prerequisites in Dutch universities' courses. It is important to evaluate the impact of these requirements on teaching quality, academic outcomes, and the international appeal of Dutch universities. The potential negative effects on attractiveness, brain drain, talent loss, and the Dutch economy should be carefully considered. Additionally, measures should be taken to strike a balance between maintaining the attractiveness of Dutch universities and promoting social integration through basic Dutch language courses. Offering free Dutch courses and proactive advertising of these courses can help mitigate the potential negative impact. It is also important to explore alternative approaches to promoting social integration and interaction with the local population, aside from enforcing stricter language prerequisites.

Formal Experiment 2 - 1st round - With Agent

Topic: Limiting international student admissions and its effects

Subject 1: I agree with limiting the amount of international students. I think Dutch students deserve higher chances of getting into their preferred Dutch university than people from different countries.

Subject 2: I don't think the Dutch government should restrict foreign students. Foreign students are still important for the Netherlands. Especially the tech industry needs a lot of foreigners. And foreign students educated in the Netherlands are naturally adapted to Dutch society. The Dutch government and society shouldn't blame failed housing policies (lack of funding, harsh environmental assessments, refugee policies, refugees getting priority for housing) on the arrival of foreign students.

Plan:

1. Analyze the impact of limiting international student admissions on Dutch students' opportunities and the overall economy.
2. Evaluate the benefits of foreign students for the tech industry and their integration into Dutch society.
3. Examine the correlation between housing policies and the perceived impact of foreign students.
4. Develop recommendations to strike a balance between prioritizing Dutch students and leveraging the benefits of international students.

Questions:

1. Can you provide more information on the specific challenges faced by Dutch students in terms of university admissions?
2. How has the tech industry in the Netherlands benefited from the presence of foreign students?
3. Could you elaborate on the housing policies and their connection to the perceived impact of foreign students?

Conflict: The conflict lies in the different perspectives regarding the presence of foreign students in Dutch universities. On one hand, Subject 1 believes that Dutch students should have higher chances of admission than international students. On the other hand, Subject 2 believes that the Dutch government should not restrict foreign students as they are essential for the tech industry and assimilate well into Dutch society. This conflict may arise from cultural differences in individualism versus collectivism, as well as varying academic backgrounds and personal values.

Suggestion:

1. Encourage open communication between Subject 1 and Subject 2 to understand each other's perspectives better.
2. Suggest creating a diverse and inclusive environment in universities to not only benefit Dutch students but also foster international collaborations and enhance global competency.

Personalised interpretations:

Subject 1's suggestion stems from the desire to prioritize Dutch students and maintain the integrity of the education system while Subject 2's is rooted in the belief that foreign students bring significant value to the country's economy and society. Both individuals hold valid points, and it's essential to create a balanced approach that benefits all stakeholders.

To help the team reach a consensus, it's essential to facilitate open communication and active listening. Encourage each member to express their thoughts and opinions while ensuring that everyone has an equal opportunity to speak. It's crucial to create an atmosphere of mutual respect and understanding, recognizing the value of diversity in thought and experience.

For Subject 1, it's important to understand that admitting international students may not take away from Dutch students' opportunities and that foreign students can bring diverse perspectives to the classroom. Encourage Subject 1 to consider the potential benefits of having a multicultural learning environment.

For Subject 2, it's important to acknowledge the importance of prioritizing Dutch students while still recognizing the value that international students bring. Encourage Subject 2 to consider ways to create a balanced approach that benefits both Dutch and international students.

As a team, there could be an effort to gather data and research on the potential impact of admitting international students on the Dutch education system and the tech industry. This information can provide the team with a more comprehensive understanding of the issue and help them make an informed decision. The team could also consider discussing potential compromises, such as setting quotas for international students or providing resources to support both Dutch and international students.

Subject 1: The tech industry has improved from foreign students due to diverse perspectives and more technical skills.

Subject 2: The Netherlands has a limited supply of home talent in the tech sector. Amsterdam and Eindhoven have a large expat presence in the tech sector. And foreign students with a Dutch education are more likely to stay and work in the Netherlands.

Plan:

1. Assess the positive impact of foreign students on the tech industry in terms of diverse perspectives and technical skills.
2. Analyze the shortage of local talent in the tech sector and the role of foreign students in filling this gap.
3. Evaluate the likelihood of foreign students staying and working in the Netherlands after completing their education.
4. Develop strategies to leverage the benefits of foreign students in the tech industry while addressing concerns about admission limitations.

Questions:

1. Can you provide data or examples that demonstrate the contribution of foreign students to the tech industry in terms of diverse perspectives and technical skills?
2. What specific challenges does the tech industry face in terms of attracting and retaining local talent?
3. Are there any existing initiatives or programs that encourage foreign students to stay and work in the Netherlands after graduation?

Subject 1: I have gained some insight from this discussion in what foreign students have to offer to the Netherlands, but I still believe there should be a limit to the amount of international students. There is still a big housing issue and many Dutch

Subject 2: I don't think there's any need to skew more resources when Dutch students already de facto have more access to Dutch universities, such as secondary school grades and recognition. As for the cuts in enrollment it is harmful for the cities

Plan:

1. Investigate the housing issue faced by Dutch students and its connection to the presence of international students.
2. Assess the impact of enrollment cuts on the cities where universities are located and the job market.
3. Analyze the existing criteria for enrollment and explore the possibility of adjusting them based on data such as the pass rate in the first year.
4. Develop recommendations to address the housing issue and ensure fair enrollment criteria while considering the benefits of international students.

Questions:

1. Can you provide more information on the housing issue faced by Dutch students? What are the main challenges they encounter?
2. How do enrollment cuts affect the cities where universities are located and the job market? Are there any specific negative consequences observed?
3. Are there any specific criteria for enrollment that you believe should be adjusted? How would using the pass rate in the first year as a criterion impact the enrollment process?

We are Done!

Summary

The meeting discussed the plan to consider limitations on the number of international students admitted to Dutch universities. The objective is to evaluate the implications of existing and prospective admission policies on students, faculty, the economy, and the future of the Netherlands. The discussion highlighted different perspectives on the issue, with one participant supporting limitations to prioritize Dutch students and address housing issues, while another participant emphasized the importance of foreign students for the tech industry and their integration into Dutch society. The meeting also touched upon the positive impact of foreign students on the tech industry, the shortage of local talent, and the likelihood of foreign students staying and working in the Netherlands after graduation.

Discussion Highlights

- The participants discussed the need to strike a balance between prioritizing Dutch students and leveraging the benefits of international students.
- The impact of limiting international student admissions on Dutch students' opportunities and the overall economy was analyzed.
- The benefits of foreign students for the tech industry and their integration into Dutch society were evaluated.
- The correlation between housing policies and the perceived impact of foreign students was examined.
- The positive impact of foreign students on the tech industry in terms of diverse perspectives and technical skills was discussed.
- The shortage of local talent in the tech sector and the role of foreign students in filling this gap were highlighted.
- The likelihood of foreign students staying and working in the Netherlands after completing their education was considered.

Conclusion

The meeting provided insights into the different perspectives on limiting international student admissions to Dutch universities. While one participant emphasized the need to prioritize Dutch students and address housing issues, another participant highlighted the importance of foreign students for the tech industry and their integration into Dutch society. The discussion also shed light on the positive impact of foreign students on the tech industry in terms of diverse perspectives and technical skills, as well as the shortage of local talent in the sector. Further analysis is needed to understand the specific challenges faced by Dutch students in terms of university admissions, the benefits of foreign students for the tech industry, and the connection between housing policies and the perceived impact of foreign students. The meeting concluded with the understanding that a balance needs to be struck between prioritizing Dutch students and leveraging the benefits of international students, and recommendations will be developed to address these concerns.

Formal Experiment 2 - 2nd round - No Agent

Topic: Language requirements of studying in Dutch universities

Subject 1: I don't think enforcing strict Dutch language requirements would be helpful. Foreign students will be able to improve their skills in the Dutch language in other ways. Stricter requirements in their curricula could have a negative impact on their study.

Subject 2: I don't think there is a need for stricter Dutch language requirements. Dutch policy makers underestimate how difficult it is for an adult to learn a new language. Especially if you have to take care of your studies at the same time. Of course I think you can require undergraduates to have A2 Dutch by the time they graduate or to have completed all courses in duolingo.

Subject 1: I agree with my you. I think their ideas of requirements, like needing to be at a certain level at the end of your course, would be beneficial for foreign students. And I agree it would be hard to keep up with your studies if you need to learn a new language on the side.

Subject 2: I can understand Dutch policy makers thinking that learning some Dutch would be helpful for integration. Policy makers need to interview international students about the difficulties of learning Dutch first. It is true that it is difficult to have other time for learning with an intense program, especially with some new languages. It is also a bit unrealistic to ask students to learn Dutch on their own to a certain level without allocating funds. Of course, I think that mandatory Dutch is more of a ploy by policy makers to reduce the number of international students.

Subject 1: I believe enforcing stricter Dutch language requirements would not benefit foreign students. I think certain requirements would be helpful, but I believe that if foreign students wanted to improve their skills in the Dutch language, they would be able to do this themselves, without stricter requirements.

Subject 2: I think having both an English-taught and a Dutch-taught program is good for the actual business environment in the Netherlands. For students who want to be international, they can study through English and also help for their international career plans. For Dutch people who want to learn without any barriers (some people really don't have a talent for learning languages), immersion in their mother tongue is also good. Taking into account the academic and practical situation in the Netherlands, it is not necessary to make it compulsory for international students to learn Dutch. Of course universities can offer Dutch as an elective, but I don't think the Ministry of Higher Education will fund it.

Subjects information

Subjects 1:

- Age: 18-24
- Gender: Female
- MBTI: INFP
- Nationality: Dutch
- Major: Psychology
- Question 1: I try to understand why they disagree and then I try to convince them of my perspective by using arguments that I think would make the most sense to them and to their perspective.
- Question 2: I'm not sure what you mean by an international individual, so it really depends on your definition. For example, if a lot of Dutch citizens have applied to a certain University based in the Netherlands, I don't think it's fair to give them the same chances of getting in as people who live in different countries who also applied. In that case I do agree that Dutch citizens should be given priority to a certain extent. But if people who live in the Netherlands also count as international individuals, I disagree. I think they should be given the same opportunities.

Subjects 2:

- Age: 18-24
- Gender: Male
- MBTI: INFP
- Nationality: China
- Major: Game and Media Technology
- Question 1: I would approach issues with objectivity, prioritizing national interests and citizen rights. Emphasizing equality in public services, I believe in respecting diverse perspectives through dialogue to build a just and equitable society
- Question 2: I think this really depends on what the facility is. For example, national elections, civil servants, consular services may be prioritized for Dutch citizens over foreigners. But in general, public services, libraries and city halls for ordinary people should be treated equally. I think this is a relatively objective, rational and neutral point of view. Some left-wingers may not think so. I think I can understand their arguments, but they are too unrealistic.

Agent Summarize

Agent Conflict mediation

Agent Personalized interpretation

Agent Summarize

Agent Summarize

Agent Conclusion

Formal Experiment 3 - 1st round - With Agent

Topic: Language requirements of studying in Dutch universities

Subject 1: I disagree that Dutch language should be taken more seriously in Dutch society, simply because if we're trying to make the world a more united place, I think it's a step backwards to make everyone speak Dutch in whatever field they are studying.

Subject 2: I agree that Dutch universities should enforce stricter Dutch language requirements in their curricula. Firstly, allowing Dutch students and teachers (which are both still a majority) will allow them to achieve a higher level of quality due to them operating in their mother tongue. Also, with longer term developments in mind, encouraging international students and staff to master the Dutch language will strengthen their ties to the country, which will mean that they are more likely to stay and contribute even after they finish their degrees.

Plan:

Facilitate a discussion between Subject 1 and Subject 2 to explore their differing perspectives on the implementation of stricter Dutch language prerequisites in Dutch universities. Encourage them to present their arguments and provide evidence to support their viewpoints. The objective is to foster a constructive dialogue that considers both the benefits of maintaining a diverse and inclusive educational environment and the potential advantages of enforcing stricter language requirements for academic excellence and long-term integration.

Questions:

1. Subject 1, could you elaborate on how enforcing stricter Dutch language requirements might hinder the goal of creating a more united world?
2. Subject 2, can you provide examples or studies that demonstrate how operating in their mother tongue can lead to higher quality education for Dutch students and teachers?
3. What, what strategies do you suggest for encouraging international students and staff to master the Dutch language and strengthen their ties to the country?

Conflict:

Subject 1 and Subject 2 have a cultural conflict about the importance of Dutch language in Dutch society. Subject 1 believes that everyone speaking Dutch is a step backwards for a more united world. On the other hand, Subject 2 believes that stricter Dutch language requirements and encouraging international students to learn Dutch will improve the quality of education and strengthen ties to the country.

Suggestion:

To solve this conflict, the team could consider the following suggestions:
- Encourage the usage of both Dutch and English languages in the Dutch universities, allowing both Dutch and international students to operate in their mother tongue and improve the quality of education.
- Implement a Dutch language program for international students and staff to learn Dutch and get familiar with the Dutch culture, which will lead to stronger ties to the country.

Personalised interpretations:

- Subject 1 suggests prioritizing the unity of the world by promoting multilingualism and cultural diversity. She values inclusiveness and open-mindedness to different cultures and their languages.
- Subject 2 suggests prioritizing the quality of education and the long-term development of the country by enforcing Dutch as the main language in Dutch universities. He values excellence and practicality in education, and sees language proficiency as a crucial element to contribute to the society.

To help the team reach consensus, it is suggested that both Koper and This demonstrate active listening and validate each others perspectives. Koper can reiterate the importance of cultural diversity while acknowledging the practicality of language proficiency and suggesting a compromise that integrates both perspectives. This can also acknowledge the value of cultural diversity while emphasizing the benefits of language proficiency for both individuals and society.

For Subject 1, it is suggested to research and present studies that showcase the positive impact of promoting multilingualism and cultural diversity in education and society. Subject 2 can research and present evidence that supports the benefits of Dutch language requirements in education and society.

As a team, it is recommended to establish a common goal that prioritizes the advancement of education and society while embracing cultural diversity. The team can work together to create a plan that integrates both perspectives and promotes a balanced approach. Regular check-ins can also be implemented to ensure that the plan is being effectively executed.

Subject 1: While I agree that learning Dutch will help them making closer ties to the country, and while it may present more job opportunities after the studies are complete, Dutch & international students shouldn't have to rely on Dutch for these purposes. It should be acceptable in Dutch society, as most people understand English, that jobs can accept both speakers, English and Dutch, and the workers and students can decide which language they prefer to use. It would be ideal for everyone to speak English as the common trade language for the international world is not done in Dutch, but English. Anywhere outside NL, it is common for everyone to speak in English, so getting a head start in Uni would only make the world a more united place if everyone could understand each other and not exclude someone simply because they don't speak a minority language. So as it stands, in the world as it's today, it could be useful to know some Dutch if you live in NL, but ideally, and to grow the world, it would be better to speak English.

Subject 2: I feel that the individual participant disregards the Dutch language far too easily. By forcing Dutch students to take classes in English, they will be disadvantaged in the depth of their own development.

Plan:

Continue the discussion between Subject 1 and Subject 2, focusing on the implications of language requirements on job opportunities, the importance of English as a global language, and the impact on the depth of Dutch students' development. Encourage them to provide further evidence and examples to support their arguments. The objective is to foster a deeper understanding of the potential benefits and drawbacks of enforcing stricter Dutch language prerequisites in Dutch universities.

Questions:

1. Subject 1, how do you propose balancing the need for job opportunities in both English and Dutch-speaking environments while maintaining the integrity of the Dutch language within Dutch society?
2. Subject 2, can you provide specific examples or studies that demonstrate how Dutch students may be disadvantaged in the depth of their development if they are required to take classes in English?
3. Subject 1, considering the global dominance of English as a lingua franca, how do you envision the role of the Dutch language in maintaining cultural identity and preserving the uniqueness of Dutch society?

Conflict: The conflict lies in the different attitudes towards the importance of Dutch language in Dutch society. Subject 2 is caused by the differences in the cultural dimension of Uncertainty Avoidance. Subject 1, with his personality trait, values inclusivity and sees English as a common language to connect people across cultures. On the other hand, Subject 2, with his NTJ personality trait, prioritizes the preservation of Dutch culture and language, which is rooted in his high Uncertainty Avoidance score.

Suggestion:

- Conduct a survey to understand the language preferences of both Dutch and international students and devise a language policy that accommodates both.
- Offer language exchange programs to promote mutual understanding and respect for each other's languages and cultures.

Personalised interpretations:

Subject 1 suggests that English should be spoken as a common language to make the world more united and inclusive. She believes that language should not be a barrier to education and job opportunities. Subject 2, on the other hand, emphasizes the importance of Dutch culture and language and feels that Dutch students should not be disadvantaged by being forced to learn in a foreign language. Both Subject 1 and Subject 2 have valid points, and it's important to find a solution that accommodates both perspectives.

To help the team reach a consensus, it would be beneficial to provide a platform for open communication and active listening. The team can schedule a meeting where each member is allowed to share their thoughts and ideas without interruption. This can help the team understand each other's perspectives better.

For Subject 1, it would be helpful to recognize the importance of preserving Dutch culture and language while acknowledging the need to accommodate other cultures. Additionally, it would be helpful for her to provide concrete examples of how a widespread knowledge of the English language can benefit the Dutch society.

On the other hand, Subject 2 needs to understand that language diversity is essential in today's globalized world. He can appreciate English as a tool of communication while still valuing Dutch culture and the Dutch language. It would also be helpful for him to identify ways in which the Dutch language can be preserved without making it a barrier to learning.

As for the whole team, the action plan should aim to find a solution that accommodates both perspectives. The team can research successful bilingual education systems and explore ways to integrate it into the current educational system. The team should also establish a language policy that promotes inclusivity while preserving Dutch culture and language. Finally, the team should create a plan to promote language diversity and multilingualism in Dutch society.

Subject 1: If you are Dutch, or you are from another country that regards your nation well, the language will always be preserved in one way or another, but because the world is evolving, the need for English in addition to Dutch jobs within the Netherlands is crucial. There are some job sectors where Dutch may be needed, but others where it isn't, and the Dutch language in those specific sectors where it isn't needed should not be mandated or enforced. It should be easy enough for foreigners and Dutch people to take jobs within the same country by utilizing both languages. This way, Dutch language can be preserved, while English or others are brought in --- to create harmony.

Subject 2: I feel that using English should be a part of a student's toolbox, but not the default state. In a language other than your mother tongue, you will not know as many synonyms, turns of phrase or grammatical constructions to express yourself - verbally or in written form - as you would otherwise. This will lead to arguments that are more shallow, less developed and less nuanced. By introducing one non-Dutch speaker to a group or course, all Dutch natives are essentially forced to switch to English. This will hinder them in acquiring the levels of complexity they could otherwise achieve.

Plan:

Continue the discussion between Subject 1 and Subject 2, focusing on the preservation of the Dutch language, the need for English in certain job sectors, and the impact of language on depth of expression and understanding. Encourage them to provide further examples and insights to support their viewpoints. The objective is to explore potential compromises that balance the preservation of the Dutch language with the benefits of English proficiency and academic development.

Questions:

1. Subject 1, how do you propose finding a balance between preserving the Dutch language and ensuring that English proficiency is maintained in job sectors where it is crucial?
2. Subject 2, can you provide specific examples or studies that demonstrate how using English as the default language in academic settings may hinder Dutch students' ability to express themselves with depth and nuance?
3. Subject 1, considering the potential limitations of non-native speakers in expressing themselves in a second language, how do you suggest addressing the challenges of acquiring complexity and depth in academic discussions for both Dutch and international students?

We are Done!

Summary

The meeting discussed the potential implementation of stricter Dutch language prerequisites in Dutch universities' courses. The objective is to evaluate the consequences of these stricter language requirements on students, faculty, and the nation's economy and future. There were differing perspectives on the issue, with one participant arguing that enforcing stricter language requirements would hinder the goal of creating a more united world, while another participant believed that operating in their mother tongue would lead to higher quality education for Dutch students and teachers. The discussion also touched on the importance of English as a global language and the impact on job opportunities and the depth of Dutch students' development. The participants debated the need to balance job opportunities in both English and Dutch-speaking environments while preserving the integrity of the Dutch language and maintaining cultural identity.

Discussion Highlights

- One participant argued that enforcing stricter Dutch language requirements would hinder the goal of creating a more united world, as English is the common language in international trade and communication.
- Another participant believed that operating in their mother tongue would lead to higher quality education for Dutch students and teachers.
- The participants discussed the importance of English as a global language and its role in job opportunities and the depth of Dutch students' development.
- The need to balance job opportunities in both English and Dutch-speaking environments while preserving the integrity of the Dutch language and maintaining cultural identity was debated.

Conclusion

The discussion highlighted the contrasting viewpoints on the implementation of stricter Dutch language prerequisites in Dutch universities. One perspective emphasized the importance of English as a global language and the need for a more united world, suggesting that enforcing stricter language requirements may hinder inclusivity and international collaboration. On the other hand, the opposing viewpoint emphasized the benefits of operating in the mother tongue for Dutch students and teachers, arguing that it leads to higher quality education and deeper development. The participants also discussed the need to balance job opportunities in both English and Dutch-speaking environments while preserving the integrity of the Dutch language and maintaining cultural identity. Further exploration is needed to understand the potential impact of stricter

Agent Summarize

Agent Conflict mediation

Personalized Interpretation

Agent Summarize

Agent Conflict mediation

Personalized Interpretation

Agent Summarize

Agent Conclusion

Formal Experiment 3 - 2nd round - No Agent

Topic: Limiting international student admissions and its effects

Subject 1: I do not believe that universities should limit based on international students. I believe they should have a cap, as universities get more money from international students, so they should limit the total number of students within a course altogether and not discriminate based on where the students come from. I believe the system should accept students who are the best and have the best profiles, while also creating diversity. Ideally, one student from each country would bring a great international representation to a study, while also choosing students who do the best, whether it's academically or in regards to helping out their community. But I do not believe that stopping international students from coming into the country to study will benefit the Netherlands at all. Instead they should see how much housing there is and resources and then limit the number of students per topic, not per country, as Dutch students also ideally need housing and shouldn't have to rely on their parents for housing/resources. I also believe other policies, like fees, need to change in order to bring this about.

Subject 2: I agree that Dutch universities should limit the number of international students they admit. First of all, the universities are part of the Dutch education system, so there should be enough space available to Dutch students that are eligible and interested in pursuing higher education in their home country. Secondly, by restricting the number of spots available to internationals, you can more easily focus on quality, which will result in more motivated and talented students on average. Thirdly, it prevents universities from casting in on international students (higher tuition fees) at the expense of Dutch students.

Subject 1: I agree that the total number of students should be capped to maintain quality. However, I disagree that it should be international students. Just because you're Dutch does not mean the country should only benefit from Dutch students. They need to grow in this international world and not discriminate just because someone was born somewhere else. More motivated students will come by learning from other cultures and it can unite a world rather than restricting a country to still think in the same ways. By bringing in other students quality will improve, and bring in the most talented people. Dutch student can basically study anywhere in the world because of their privileges with their passports, but others are restricted, which closes many doors and opportunities for the rest of the world. Therefore, the Dutch need to be more welcoming and not restrict their intake of solely international students, but make the whole university system more quality oriented by only selecting the best few. And the fees again need to be subsidized or not for both, to maintain quality.

Subject 2: I feel that there is more common ground between us than first meets the eye. We agree that universities should not be incentivized to select students based on the amount of money they bring in and that unrestricted access to any course is a bad idea. I fundamentally disagree with you that diversity in nationalities is an inherently good thing. Rather, I'd say that diversity in perspectives and outlook is more important, and nationality is only a relatively minor predictor of that. Also, differ in what we think the universities' main goal and responsibility is with regards to Dutch education.

Subject 1: I think we both agree that we should somehow increase the quality of universities. But we both have a completely different outlook on 'how'. I believe bringing in an equal amount of international students is just as important as keeping Dutch people in the Dutch system. We need more diversity to make the world more resilient. But keeping Dutch people in Dutch systems and others in their own, you limit the knowledge we can gather by bringing people together. It is a shame that so many societies only think about themselves. We live in one world with shared resources. Not Dutch resources. Netherlands has biggest trading of almost all universal countries, and it has been such an eye opener for me. I believe that a cap on the number of people, on a needs-basis should be established, whether Dutch or international or not. I believe this priority is extremely controversial, as most people would say. On Dutch citizens were born there and should have more priority over Dutch facilities than international individuals, but I completely disagree and believe no matter where you are from, you should be given the same rights, as we are all people. Some are born in unfortunate circumstances, but that shouldn't give them less rights than others. (even though I am Dutch myself)

Subject 2: I agree with you that there should be a cap on the total number of available places, but I also think that there should be a fixed percentage of spots available to international students to provide sufficient opportunity to Dutch students. I do not agree with you that the typical Dutch student can study anywhere in the world. Their passport might allow them to, but it is a massive financial burden which is not easily overcome by most.

Subjects information

Subjects 1:

- Age: 25-34
- Gender: Female
- MBTI: INFJ
- Nationality: Dutch
- Major: International Relations

- Question 1: Depending on the topic, I feel energized to speak up about certain topics. Others I may not yet have formed opinions of. Depending on what it is exactly, I may feel irritated by a differing opinion, or sometimes they make total sense, and I learn something.

- Question 2: No, I do not believe that Dutch and international individuals should be treated differently. I would wish the world, ideally, to be completely open to let people go to countries they like and live there and that the whole world was equal, so people wouldn't need to be picky about where they want to live. Also, that a cap on the number of people, on a needs-basis should be established, whether Dutch or international or not. I believe this priority is extremely controversial, as most people would say. On Dutch citizens were born there and should have more priority over Dutch facilities than international individuals, but I completely disagree and believe no matter where you are from, you should be given the same rights, as we are all people. Some are born in unfortunate circumstances, but that shouldn't give them less rights than others. (even though I am Dutch myself)

Subjects 2:

- Age: 25-34
- Gender: Male
- MBTI: INTJ
- Nationality: Dutch
- Major: History

- Question 1: I stand my ground, but do try to advance the conversation and try to see the other side, if someone is unwilling to be constructive, I'd rather abandon the conversation than continuing it from our trenches.

- Question 2: It depends on the type of facilities we are talking about. Hospitality? No. Commercial settings? No, even that's based up to the individual company. Social housing? Probably yes, as the government has more of a duty to care for its own citizens than for internationals. I can see how it is controversial, as it could be framed as discriminatory or in some cases even racist. Nevertheless, I would be curious to engage in a discussion on the topic.

Team 4 - 1st round - No Agent

Topic: Language requirements of studying in Dutch universities

Subject 1: I don't agree, I think all higher education in the Netherlands should be done in English. It makes it easier for expats to come here and be valuable and it would raise our proficiency in English

Subject 2: I don't agree. As an international student, because from my personal point of view, I hope to return to my own country in the future. Learning another language increases my time cost, and my main purpose is to learn knowledge

Subject 1: I see your point I agree it would be a waste to learn Dutch if you don't plan on staying long term. We should think outside our borders so I think speaking the same language makes that easier for everyone.

Subject 2: Yes, I think so too. I also agree with you. But I don't think everything must be taught in English.

Subject 1: I'm a native Dutch person but I feel speaking in Dutch is a waste. I would rather speak a language that makes me more internationally attractive for companies.

Subject 2: Think the teaching model is enough I think your language is your culture and it is not a waste.

Subjects information

Subjects 1:
- Age: 25-34
- Gender: Male
- MBTI: INFJ
- Nationality: Dutch
- Major: Electrical/mechanical technician
- Question 1: I feel calm and I'm able to listen to both sides. I think I'm a good listener.
- Question 2: I do, we have a housing crisis and I feel like Dutch people should get priority on finding housing. We can't compete with expats since they have higher salaries and 30% ruling. I think some people would argue that we need internationals and make it attractive for them to come here so they deserve certain bonuses.

Subjects 2:
- Age: 25-34
- Gender: Female
- MBTI: ENFJ
- Nationality: China
- Major: Human Computer Interaction
- Question 1: It depends on my relationship with the other person, and if it was my friend, I would choose to express it in a tactful way, or I would choose to compromise. But if it's a stranger, I choose to express my point of view directly, usually without compromise.
- Question 2: For example, we are both students, but we pay higher tuition fees and do not enjoy the benefits of free transportation for Dutch students.

Agent Summarize

Agent Summarize

Agent Summarize

Agent Conclusion

Team 4 - 2nd round - With Agent

Topic: Limiting international student admissions and its effects

Subject 1: I agree, I think there should be a healthy number of international students and Dutch students. If too many international students come and study here I feel that they might take chances away from Dutch students since most studies have a student limit. And with the whole housing crisis that is currently going on they will also make it harder for Dutch students to find housing.

Subject 2: I personally don't have a clear opinion on this issue. Because from the perspective of an international student, if I can't go to the Netherlands to study, I can also go to schools in other countries to study. Dutch teaching is not irreplaceable. The reason why I chose the Netherlands is because its cost of studying abroad is lower than that of the United States and Australia. And compared to the two-year teaching program in the Netherlands, I think I can learn more. The teaching quality requirements in the Netherlands are higher than those in the UK, but the teaching quality in other European schools is not low either.

Plan:
1. Analyze the impact of international student admissions on Dutch students' opportunities and housing availability.
2. Evaluate the value proposition of Dutch education for international students compared to other countries.
3. Assess the teaching quality and opportunities for learning in the Netherlands compared to other European schools.

Questions:
1. Could you provide more information on the specific challenges Dutch students face in terms of opportunities and housing due to international student admissions?
2. What factors do you consider when evaluating the value proposition of Dutch education for international students?
3. Are there any specific European schools you would like us to compare the teaching quality and opportunities for learning with?

Subject 1: I agree, but that is why the amount of international students should be limited. If there is no limit they are welcome to come and study and shouldn't feel responsible for housing stress.

Subject 2: I don't think international students are responsible for housing stress. This should be a problem for the government, which can be directly solved by building more student apartments.

Plan:
1. Assess the impact of unlimited international student admissions on housing stress for both Dutch and international students.
2. Evaluate the responsibility of international students in addressing housing stress and explore potential solutions.
3. Investigate the role of the government in addressing housing issues and the feasibility of building more student apartments.

Questions:
1. Can you provide more information on the current housing situation for both Dutch and international students? How severe is the housing stress?
2. What are some potential solutions that you believe international students can contribute to addressing housing stress?
3. Are there any existing initiatives or plans by the government to address the housing issues for students?

Subject 1: I agree that more student housings should be built, but that takes a really long time in the Netherlands because a lot of reasons. So until that is figured out, there should be an international student limit.

Subject 2: But we don't have a clear way to know which number is the most appropriate. This is actually not under the manual control of the school. This large society will automatically balance to a comfortable number like nature.

Plan:
1. Investigate the challenges and reasons behind the slow process of building student housing in the Netherlands.
2. Explore the feasibility of implementing an international student limit and its potential impact on balancing student numbers.
3. Analyze the natural balance and societal factors that may influence the appropriate number of international students.

Questions:
1. What are the main reasons for the slow process of building student housing in the Netherlands? Are there any specific challenges or regulations that contribute to this issue?
2. How do you envision implementing an international student limit? Are there any specific criteria or factors that should be considered in determining this limit?
3. Can you elaborate on the concept of "natural balance" and how it applies to the number of international students? What societal factors do you believe influence this balance?

We are Done!

Summary
The discussion focused on the implications of admitting international students to Dutch universities. The participants discussed the need to maintain a balance between local and international students while preserving campus cultural diversity. Concerns were raised about the potential impact on Dutch students' opportunities and housing availability. The value proposition of Dutch education for international students was also discussed, comparing it to other countries. The responsibility of international students in addressing housing stress and the role of the government in providing student housing were debated. The challenges and reasons behind the slow process of building student housing in the Netherlands were explored. The concept of implementing an international student limit and the idea of a "natural balance" in student numbers were also discussed.

Discussion Highlights
- The need to limit the number of international students to ensure opportunities for Dutch students and alleviate housing stress.
- The perspective that international students are not responsible for housing stress and that it is the government's responsibility to provide more student apartments.
- The value proposition of Dutch education for international students compared to other countries.
- The challenges and reasons behind the slow process of building student housing in the Netherlands.
- The concept of implementing an international student limit and the idea of a "natural balance" in student numbers.

Conclusion
The discussion highlighted the importance of maintaining a balance between local and international students while preserving campus cultural diversity. Concerns were raised about the potential impact on Dutch students' opportunities and housing availability. The value proposition of Dutch education for international students was also considered. The responsibility of international students in addressing housing stress and the role of the government in providing student housing were debated. The challenges and reasons behind the slow process of building student housing in the Netherlands were explored. The concept of implementing an international student limit and the idea of a "natural balance" in student numbers were discussed. Further analysis and research are needed to determine the appropriate number of international students and to address the housing issues faced by both Dutch and international students.

Formal Experiment 5 - 1st round - With Agent

Topic: Limiting international student admissions and its effects

Subject 1: I believe it would be a great loss for everyone, including Dutch students and professors, if the number of international students would be limited. I don't think international students diminish the quality of teaching or learning, and I think the contrary is true. Bringing new perspectives and viewpoints, they provide a source of cultural exchange.

Subject 2: I think the decision of limiting international students should be left up to the Universities themselves based on their resources and what they think is preferable, rather than a universal hard limit from the government.

Plan:

1. Evaluate the impact of international students on the quality of teaching and learning, considering perspectives from both Subject 1 and Subject 2.
2. Assess the resources and preferences of universities regarding admission policies for international students.
3. Analyze the potential benefits of cultural exchange and diversity brought by international students.
4. Consider the feasibility and implications of allowing universities to set their own limits on international student admissions.

Questions:

1. Can you provide examples or evidence supporting the positive impact of international students on the quality of teaching and learning?
2. What specific resources should be taken into account when assessing universities' capacity to admit international students?
3. How do you suggest measuring the benefits of cultural exchange and diversity on campus?

Subject 1: I agree with the fact that housing represents a problem for both the Dutch government and international students, but I don't know if the solution is actually limiting the number of international students coming into the country, or maybe trying to find more sustainable and convenient ways to provide them housing for the time they are students. I understand how this represents an investment in terms of money from the dutch government, but I believe in the end it would be a profitable one.

Subject 2: I agree that international students can be beneficial culturally and for the quality and diversity of education and ideas. But that due to local housing and other consideration universities in specific cities may wish to reduce or slow down international admissions if it there is for example a severe lack of housing and instead focus on improving those conditions first.

Plan:

1. Explore alternative solutions to the housing problem faced by international students, considering Subject 1's perspective.
2. Assess the impact of limiting international student admissions on housing availability and conditions, taking into account Subject 2's viewpoint.
3. Analyze the potential long-term benefits and profitability of investing in housing for international students.
4. Consider the possibility of prioritizing improvements in housing conditions before implementing any limitations on international admissions.

Questions:

1. What specific challenges do international students face in terms of housing? Are there any existing initiatives or programs addressing this issue?
2. How do you suggest measuring the impact of limiting international student admissions on housing availability and conditions?
3. Are there any specific financial or economic factors that should be considered when assessing the long-term profitability of investing in housing for international students?

Subject 1: I agree that housing is a big problem right now, and the limit to the influx of international students could help in the short term to fix part of the issue and give time to build better and more infrastructures to host them in the future, but I am also afraid of the possibility of creating a precedent for the future in terms of limiting the number of international students, something which could also not be reversed, and eventually bring to a total stop. At the same time, I also believe that it is a problem that needs to be dealt with also at a larger level, in the EU generally.

Subject 2: I think, slowing down international admissions may give time for cities to construct additional housing but recognize that may reduce quality and desirability of those school in the future or even reduce the need to build student

Plan:

1. Assess the short-term benefits and potential long-term consequences of limiting international student admissions to address the housing problem, considering Subject 1's concerns.
2. Explore strategies to address the housing issue at a larger EU level, as suggested by Subject 1 and Subject 2.
3. Analyze the potential impact of slowing down international admissions on the quality and desirability of universities.
4. Investigate the feasibility and benefits of implementing an EU-wide solution to distribute students more effectively.

Questions:

1. What specific measures or actions could be taken at a larger EU level to address the housing issue for international students?
2. How do you suggest balancing the short-term need for housing solutions with the potential long-term consequences of limiting international student admissions?
3. Are there any existing initiatives or discussions within the EU regarding the distribution of international students?

We are Done!

Summary

The discussion focused on the plan to consider limitations on the number of international students admitted to Dutch universities. The objective is to evaluate the implications of existing and prospective admission policies on students, faculty, the Netherlands' economy, and future. The participants discussed the impact of international students on teaching and learning, the resources and preferences of universities, the benefits of cultural exchange and diversity, and the housing problem faced by international students. They also explored alternative solutions to the housing problem and the long-term profitability of investing in housing. The participants expressed concerns about creating a precedent for limiting international student admissions and the need for a larger EU-wide solution.

Discussion Highlights

- Subject 1 and Subject 2 expressed different perspectives on the impact of international students on teaching and learning. Subject 1 believed that international students enhance the quality of education and provide cultural exchange, while Subject 2 suggested that universities should have the autonomy to decide based on their resources and preferences.
- The participants discussed the housing problem faced by international students. Subject 1 proposed finding sustainable and convenient ways to provide housing, while Subject 2 emphasized the need to improve housing conditions before implementing any limitations on international admissions.
- The potential long-term benefits and profitability of investing in housing for international students were analyzed. Subject 1 believed it would be a profitable investment, while Subject 2 highlighted the need to prioritize improvements in housing conditions.
- The participants expressed concerns about creating a precedent for limiting international student admissions and the need for a larger EU-wide solution to address the housing problem effectively.

Conclusion

The discussion highlighted the importance of considering the impact of international students on teaching and learning, as well as the benefits of cultural exchange and diversity. The housing problem faced by international students was recognized as a significant challenge that needs to be addressed. While limiting international student admissions could provide short-term relief, it was acknowledged that it may have long-term consequences and should be approached cautiously. The participants emphasized the need for a larger EU-wide solution to spread students more effectively and address the housing problem comprehensively. Further analysis is required to assess the specific challenges faced by international students in terms of housing, measure the impact of limiting admissions on housing availability and conditions, and evaluate the financial and economic factors associated with investing in housing for international students.

Formal Experiment 5- 2nd round - No Agent

Topic: Language requirements of studying in Dutch universities

Subject 1: I disagree with the idea that Dutch universities should enforce stricter Dutch language requirements because a big part of the attractiveness of Dutch university for international students is the possibility to study there in English and without having to learn another language. It would be quite a harsh requirement to make international students have to learn Dutch, as it is also a quite difficult language, that requires a lot of time to master, and not too useful outside of the Dutch context itself (while still valuable to learn as any language is).

Subject 2: I disagree universities should be focused on international cooperation academically. And making dutch mandatory is detrimental to that and could be a waste of time. It should still be offered and encouraged for better integration with dutch culture and students but doesn't need a focus academically.

Subject 1: I believe it is important for both international students to try and integrate within Dutch society and for Dutch students to try and get out of their traditional environments and be more in contact with international students. The idea of improving local clubs and organizations instead of university ones is an interesting one, but these clubs and organizations

Subject 2: I think a good solution would be for universities to try and integrate their various extracurricular organizations like sports clubs with dutch ones to motivate both local and international students to mix more and learn from each other. And provide the resources to do so instead of creating their own clubs/organizations exclusively.

Subject 1: I believe I haven't significantly changed my mind, but the discussion provided some interesting points of reflection to consider, such as the one of local clubs and organization to improve integration.

Subject 2: I still disagree that the dutch language should be mandatory in universities. But there may be other good ways to improve integration and language learning.

Subjects information

Subjects 1:

- Age: 18-24
- Gender: Female
- MBTI: INFP
- Nationality: Italian
- Major: International Relations
- Question 1: I feel very passionate about my ideas and I try to handle conflicts or differing options in a calm manner, but sometimes the emotions get the best of me and I get very upset.
- Question 2: I don't, I believe many internationals living in the Netherlands have acquired the same right to use facilities and services.

Subjects 2:

- Age: 25-34
- Gender: Male
- MBTI: INTP
- Nationality: Dutch
- Major: Mechanical Engineering
- Question 1: Trying to understand others viewpoints then attempting to lead them closer to mine by asking questions about flaws I see in their differing opinions.
- Question 2: That depends on the facility. When it comes to emergency healthcare no, but for things like housing or education there should be effort made to ensure Dutch citizens have enough access first. This is not a particularly controversial opinion I think

Agent Summarize

Agent Summarize

Agent Summarize

Agent Conclusion

A.1.4 Post-experiment questionnaire: After participants finish the experiment, they need to fill out the questionnaire for analysis purpose

Team Collaboration and AI Agent Effectiveness Assessment Questionnaire

The purpose of this questionnaire is to assess the effectiveness of AI Agent in assisting teams with conflict resolution, improving cooperation, and achieving consensus. After your participation, please answer the following questions to help us evaluate the effectiveness of the AI Agent.

Contact Information:

If you have questions, comments, or concerns about this research project, you can talk to the researcher leading this study [Min Ju Chang \(m.j.chang@mststudents.usu.edu\)](mailto:Min.Ju.Chang@mststudents.usu.edu). If you have questions about your rights while taking part in the study or have concerns about the treatment of research participants, please contact [Dr. Ioanna Lykourantzou \(i.lykourantzou@usu.edu\)](mailto:Dr.Ioanna.Lykourantzou@usu.edu).

Please enter your Prolific ID.

Opinion Shift and Consensus Assessment

How much did you shift from your original opinion on the first topic?

No Shift
Slight Shift
Moderate Shift
Significant Shift
Complete Shift

How much did you shift from your original opinion on the second topic?

No Shift
Slight Shift
Moderate Shift
Significant Shift
Complete Shift

To what extent do you think you and your partner have reached a consensus on the first topic?

Not at all
To a small extent
To a moderate extent
To a great extent
Completely

To what extent do you think you and your partner have reached a consensus on the second topic?

Not at all
To a small extent
To a moderate extent
To a great extent
Completely

How different perspectives did you and teammate have when you began discussing the first topic?

Very different
Somehow different
Neutral
Somewhat similar
Very similar

How different perspectives did you and teammate have when you began discussing the second topic?

Very different
Somehow different
Neutral
Somewhat similar
Very similar

How different cultural backgrounds did you and your teammate have?

Very different
Somehow different
Neutral
Somewhat similar
Very similar

How different personalities did you and your teammate have?

Very different
Somehow different
Neutral
Somewhat similar
Very similar

Impact of AI Agent on Team Collaboration

Comparing your team's collaboration with and without the AI agent, please rate your agreement with the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The AI agent helped improve the quality of my team's work outcomes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The AI agent helped make my team's work outcomes more complete .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The AI agent helped increase the diversity of perspectives in my team's discussions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The AI agent helped resolve conflicts within my team.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The AI agent helped to reduce bias or prejudiced behavior between my team's members.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was easier to reach consensus when using the AI agent.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The AI agent reduced the time required for our team tasks and project discussions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Feature usefulness

Please evaluate the usefulness of the AI agent's features.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The summary feature of the AI agent (summarizing our team's discussions up to that point) was useful.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The topic proposition feature of the AI agent (proposing potential topics to continue the discussion) was useful.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The personalized view of the other team members feature provided by the AI agent (explaining their viewpoint based on their cultural and personality background) was useful.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which feedback do you find better: the one provided by the AI Agent, or the one written by the team members?

- Feedback from the AI agent is better
- Feedback written by the team members is better
- Both types of feedback are about equally good

Compared to teams without an AI agent, which team is better equipped to handle change and challenges?

- Teams with an AI agent
- Slightly inclined towards teams with an AI agent
- Neutral
- Slightly inclined towards teams without an AI agent
- Teams without an AI agent



User Experience and Other Factors

These open-ended questions aim to gather more in-depth qualitative data to complement the quantitative survey results:

How do you think the AI agent practically impacted your team's discussion?

Please provide feedback on your experience with the AI agent, including any positive or negative impacts and suggestions for improvement.

Share any interesting or significant moments or observations you encountered during the experiment.



A.1.5 Diversity Harbor UI page

Before the start, please fill the form to let AI know you better.

Please enter your Invitation Code before we start

Participant 1

Name: Rudy | Age: Choose an option | Gender: Choose an option

MBTI: Choose an option

Nationality: Netherlands

Major: Psychology and Counseling

Personality: Amelia is a compassionate and insightful individual who thrives on innovative approaches. Her working style is empathetic and holistic, driven by her desire to understand and heal. She communicates thoughtfully and values deep connections. Her individual values include authenticity and growth, leading her to guide others through transformative experiences.

Confirm

Fig. A.3.: Diversity Harbor AI agent: Profile information page - Before the experiment commences, we will request participants to provide some profile information, including their name, age, gender, MBTI personality traits, and nationality. The AI Agent will utilize this information to offer personalized explanations, particularly when conflicts arise among team members. The AI Agent will also analyze the reasons behind conflicts, facilitating a deeper understanding between the parties involved.

Instruction

Experiment Purpose:
Welcome to this experiment! Our goal is to focus on Agent within the framework of the target language model. It explores how to provide teams with advice on communication skills and negotiation strategies, assists in brainstorming to enhance their dialogue content, and plays a role in mediating conflicts when they arise.

Task Flow and Schedule:
In this experiment, you will participate in discussions on two main topics:

Topic 1:

- Step 1: Answer questions related to Topic One (5 minutes).
- Step 2: Engage in a group discussion with another member to explore Topic One (10 minutes).
- Step 3: Answer questions related to Topic One again and complete a questionnaire (5 minutes).

Topic 2:

- Step 1: Answer questions related to Topic Two (5 minutes).
- Step 2: Participate in a group discussion with another member, and an AI robot will also join the discussion (10 minutes).
- Step 3: Answer questions related to Topic Two again and complete a questionnaire (10 minutes).

AI Involvement Timing:
The Agent provides a summary and extended question in each round, and the mediator function will appear when the conflict appears.

When the AI mediator appears or when you click the button, the AI assistant will perform the following actions:

- Summarize your discussion.
- Identify conflict points in the discussion that can be resolved if they are important to you.
- List sub-topics related to the original topic.
- Provide personalized suggestions for each participant (not visible to others) to help you better understand each other.

Fig. A.4.: Diversity Harbor AI agent: Instruction page - This page is designed to provide participants with an overview of the overall experiment process, including when the AI agent will be integrated and its corresponding functionalities.

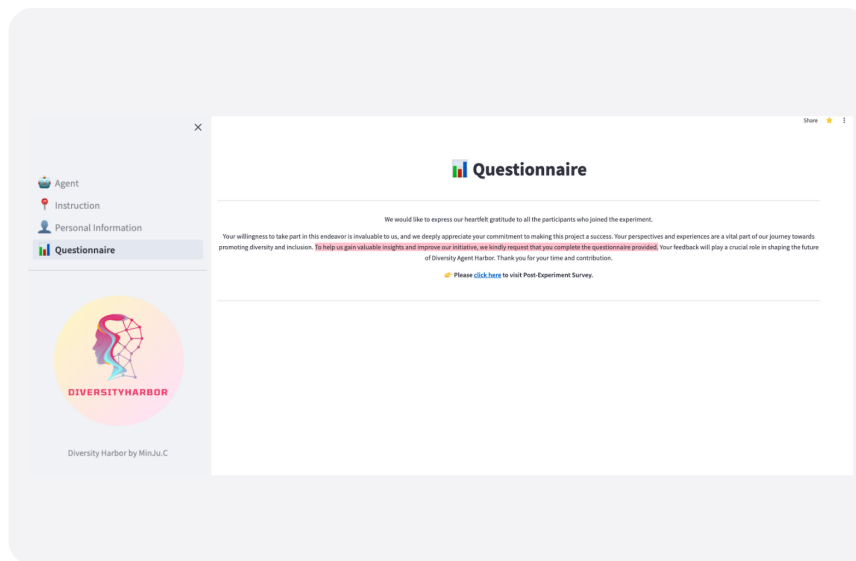


Fig. A.5.: Diversity Harbor AI agent: Questionnaire page - After the completion of the experiment, participants will be asked to fill out a questionnaire to assess the performance of the AI Agent and its applied functionalities.

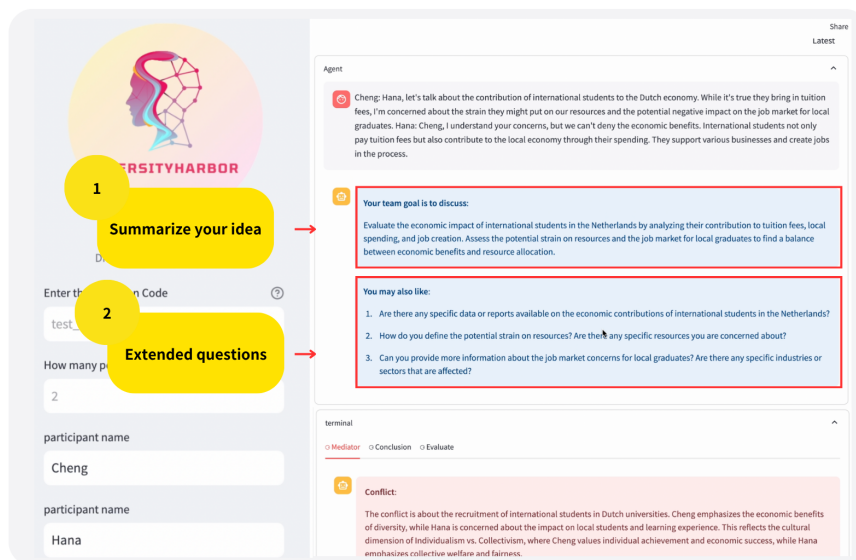


Fig. A.6.: Diversity Harbor Ai agent summarize and extended function UI: Agent will help users to summarize what they discuss, and also assist them in brainstorming when they lack of opinions.

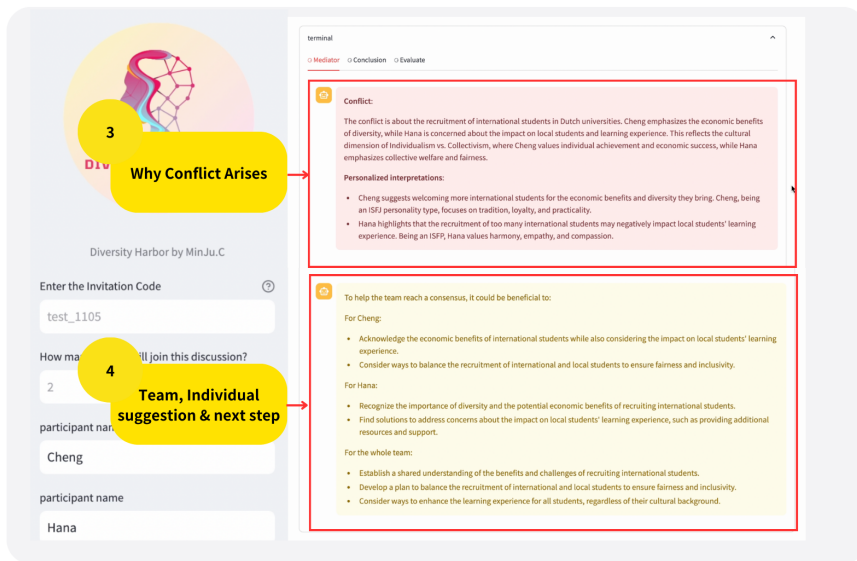


Fig. A.7.: Diversity Harbor Ai agent Conflict explanation and personalized interpretation function UI: For the pink section, the Agent will explain why the conflict arises and provide personal interpretation to every user and the whole team. For the yellow section, the agent will give more suggestions, feedback, and next steps.

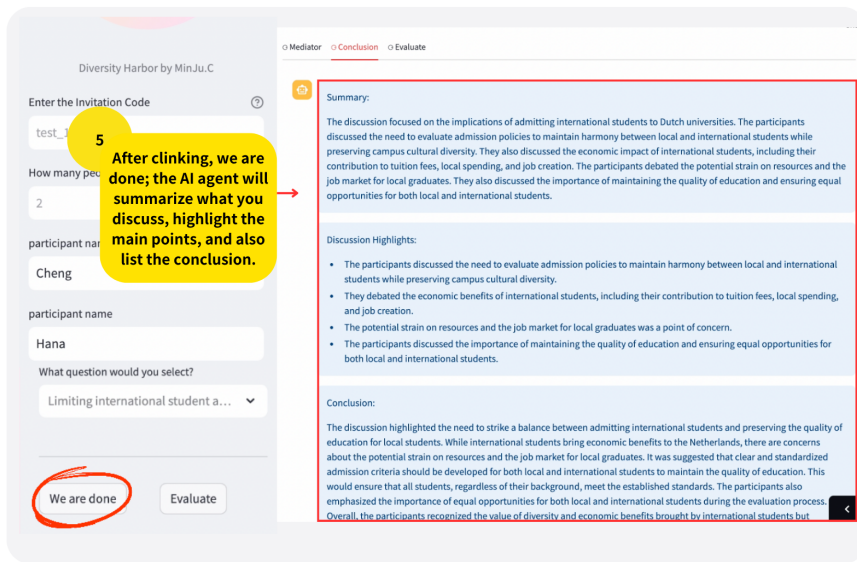


Fig. A.8.: Diversity Harbor AI agent: Summarize meeting minutes and discussion highlights function UI. In this final step, the agent will assist users to summarize the whole discussion and highlight the meeting points and the final conclusion.

