Exploring Initial Interactions: High School Students and Generative AI Chatbots for Relationship Development

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This paper aims to provide recommendations for tech companies on promoting a positive student-AI relationship in high school settings, ensuring responsible and beneficial use of AI tools. The study explores the design considerations necessary to address concerns of overreliance and diminished critical thinking skills while harnessing the benefits of AI in education. By conducting a two-day study involving qualitative analysis of data from various sources, including word clouds, scale responses, group activities, chatbot interactions, interviews, and assignments, the research identifies common themes and perceptions. These insights lead to the generation of five need-based personas that represent student preferences and needs. The findings emphasize the importance of personalizing chatbot experiences based on individual student requirements and fostering positive attitudes towards AI adoption. The study highlights the need to address skeptical students and design chatbots that emulate supportive friends, enhancing engagement and trust. The conclusions provide actionable recommendations for tech companies to design AI-powered chatbots that facilitate personalized learning experiences and foster meaningful relationships in high school settings. By addressing the research aim, this study contributes to the development of effective strategies for promoting responsible and beneficial use of AI tools in education.

1 INTRODUCTION

Artificial Intelligence (AI) has transformed various domains, particularly Natural Language Processing (NLP) [1]. AI systems can emulate human brain operations, making them capable of handling monotonous tasks with the aid of vast datasets [2]. Among these AI advancements, ChatGPT, developed by OpenAI, has emerged as a groundbreaking conversational agent, designed to comprehend human language and provide relevant responses, showcasing the transformative power of AI in education [3].

In the field of education, technology has revolutionized the learning process, and chatbots have been no exception. By granting access to vast amounts of information and extending learning opportunities beyond physical classrooms, chatbots play a crucial role in shaping the future of education [4]. Particularly, students are enthusiastic about applying language models in classrooms, and the integration of ChatGPT offers them the chance to interact with an advanced conversational agent, enhancing their learning experiences through easy usage, instant feedback, explanations, and personalized information retrieval [5, 6]. Moreover, ChatGPT holds the potential to become a personal assistant to students, increasing motivation and engagement among self-directed learners [7] and supporting overall student success [8].

However, it is essential to strike a balance, as over-reliance on ChatGPT may hinder critical thinking, creativity, and collaboration, potentially affecting problem-solving skills [9, 10]. Thus, understanding the limitations and strengths of the system is crucial to ensure its optimal and effective use in enhancing educational experiences [10].

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*All authors contributed almost equally to this research.

This paper addresses the research question: **"What considerations should developers take into account when designing generative artificial intelligence tools for a high school environment, with a focus on developing a sustainable relationship between the tools and high school students?"** It aims to provide recommendations for the responsible integration of AI tools in high school education, promoting a positive student-AI relationship while mitigating the risks of overreliance and diminished critical thinking skills. This research is relevant as it explores ways to enhance education and prepare students for an AI-driven future. We conducted a two-day study to explore how high school students interacted with ChatGPT and SnapBot 'My AI', gaining insights into their perception and comprehension. Day one involved qualitative analysis of data from a word cloud generator, scale responses, and a group activity. Day two extended the analysis to chatbot interactions, assignment feedback, and interviews, revealing themes and suggestions for food truck concepts. This paper's structure includes the methodology (Section 2), results (Section 3), conclusions and implications (Section 4), and future directions (Section 5).

2 METHODOLOGY

The researchers chose this study based on their expertise and participant availability. They integrated real-life scenarios to ensure accurate results. The study included 26 participants, aged 14-16, from 's Gravendreef College, Leidschendam (NL). Participants were selected based on voluntary participation and parental consent. The two-day study aimed to understand participants' perception and interaction with ChatGPT and SnapBot, AI language models. The objective was to gain insights into their comprehension, potential uses, and perceptions of quality influences.

On Research Day 1, participants engaged in a collaborative workbook assignment (A.1) and discussed their visions of the future. The first assignment, "Pop Up WordWeb," involved using a word cloud generator to answer questions about AI-powered chatbots. The second assignment, "Cross the Line," included statements for participants to agree or disagree with regarding AI-powered chatbots. Additionally, participants completed assignment 3, "Picture the Future," where they shared their thoughts and predictions about AI-powered chatbots using ambiguous pictures. This research day aimed to observe the integration of chatbots in a high school course through observation and interviews.

On Research Day 2, participants received an introduction to the study and used either ChatGPT (46%) or SnapBot (54%) as AI-powered tools for generating food truck ideas. They completed assignments involving interaction with the chatbot and sought its assistance while working on the food truck assignment (A.2). Feedback was collected on their experience, collaboration with the chatbot, and the impact on their work quality. The research day aimed to integrate chatbots into a high school course while minimizing interference and employing techniques like observation, interviewing, and paper-based responses for analysis.

Thematic analysis was employed to comprehensively analyze qualitative data. It involved steps such as familiarization, coding, theme searching, reviewing and refining themes, defining and naming themes, and generating the final analysis. Detailed information on the analysis of the data can be found in appendix B

2.1 Ethical Considerations

Informed consent was obtained from the participants' parents/guardians prior to their participation. The research protocol and data collection procedures were reviewed and approved by the Delft University of Technology. Confidentiality and anonymity of the participants were maintained throughout the study, and the collected data were securely stored.

3 RESULTS

Employing a flexible and rigorous approach, the researchers derived meaningful insights, contributing to a deeper understanding of the research question. Five major themes emerged from the raw data: implementation in the school system, understanding, familiarity, reliability, and hesitance. Each theme encompasses three to five subthemes, providing a comprehensive analysis, each with multiple subthemes. A more detailed description of the themes can be found in appendix C.
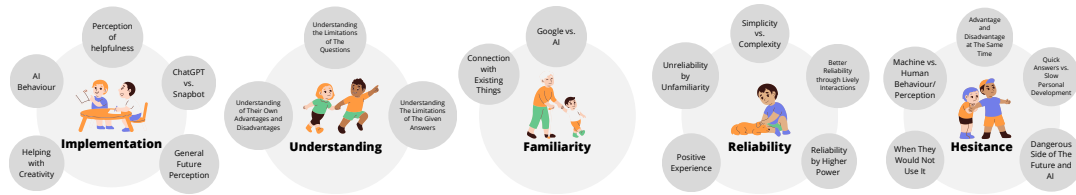
Fig. 1. The five themes as a result of the research

The first theme, **"Implementation in the School System"**, explored students' perceptions of AI-powered chatbots in an educational setting. It covered subthemes such as the role of chatbots in fostering creativity, the behavior of chatbots in the classroom, students' perception of chatbot helpfulness, the differences between ChatGPT and SnapBot, and students' future perceptions of chatbot integration.

The second theme, **"Understanding"**, focused on students' perception of the role of AI tools in their learning process. Subthemes included students' understanding of the advantages and disadvantages of chatbots compared to humans, their recognition of the limitations in the types of questions they could ask, and their awareness of the limitations of chatbot responses.

The third theme, **"Familiarity"**, explored students' level of familiarity with AI tools and their perceptions of these tools in an educational setting. Subthemes included students' connection with chatbots when integrated into existing platforms, their preference for traditional search engines like Google, and their perceptions of chatbot reliability.

The fourth theme, **"Reliability"**, examined students' perceptions of the limitations and usefulness of chatbots and addressed potential misconceptions. Subthemes included students' positive experiences with chatbots, the impact of unfamiliarity on reliability, the trade-off between simplicity and complexity, the desire for more engaging interactions, and the association of chatbots with higher reliability.

The fifth theme, **"Hesitance"**, focused on students' hesitance towards using chatbots. Subthemes included concerns about limitations and connectivity issues, comparisons between machine and human behavior, conflicting views on advantages and disadvantages, the tension between quick answers and personal development, and concerns about the future implications of AI.

These themes and subthemes provide valuable insights into students' perceptions, experiences, and concerns regarding the implementation of AI chatbots in high school settings.

4 DISCUSSION

Despite its valuable insights, the study has limitations. The small sample size and single-school setting may restrict the generalizability of the findings. Self-reported feedback and interviews introduce potential biases, as participants' perceptions can vary. Mitigation efforts included voluntary participation and clear research descriptions.

Nevertheless, the study provides valuable insights into high school students' interactions with AI language models. It enhances understanding of effective integration in practical courses, fostering creativity and improving work quality.

Future research can explore the long-term effects and transferability of chatbot tools in education. Larger and more diverse studies would enhance generalizability and validate the benefits of AI-powered chatbots.

5 CONCLUSION

The data analysis in this research revealed five major themes and 20 sub-themes, providing valuable insights into familiarity, perceptions, interactions, and limitations of chatbots in education. These diverse perspectives deepen our understanding of the research questions.

Additionally, the development of five need-based personas based on these insights offers valuable recommendations for designers, specifically addressing the sustainable relationships between AI tools and high school students. These personas

go beyond demographics, uncovering users' specific needs, desires, and motivations, guiding designers in creating tailored solutions that meet user requirements [11].

Fig. 2. The five personas as a result of the thematic analysis

Five personas have been identified in this study, each representing a different perspective on chatbot usage among high school students. The personas are as follows:

(1) The **"Blindsided Stranger"** has a negative perception of chatbots, preferring familiar platforms like Google. Design recommendations include integrating chatbots into academic tasks, highlighting their unique benefits, and addressing concerns about reliability.
(2) The **"Curious Beginner"** is intrigued by chatbots and sees their potential in education. Design recommendations include gradual integration into the school system, playful learning experiences, and clear explanations of chatbot applications.
(3) The **"Efficient Q&Aer"** views chatbots as tools for quick and accurate information retrieval. Design recommendations include creating more humane interactions, fostering collaborative partnerships, and enabling natural conversations.
(4) The **"Friend Seeker"** values personal connections and seeks friendship and support. Design recommendations include creating time-saving interfaces, offering emotional support, and delivering precise and trustworthy answers.
(5) The **"Skeptical Reject"** is initially skeptical of chatbots and has concerns about limitations and trustworthiness. Design recommendations include prioritizing student safety and comfort, providing transparency, and creating familiarity through interfaces resembling familiar platforms.

These personas guide designers in creating personalized chatbot experiences for high school students, aligning with their unique needs and preferences. Personalized learning approaches have been shown to enhance educational outcomes, making it crucial to consider individual student needs when designing chatbots in the education sector [12].

Addressing the needs of high school students who have a negative perception of chatbots, particularly the "Blindsided Stranger" persona, is crucial for successful integration of chatbot technology in education and society. Neglecting this group could hinder chatbot adoption. Building stronger connections and positive attitudes toward chatbots can help engage users and overcome resistance [13].

Designing chatbot systems that prioritize the "Friend Seeker" persona, fostering collaborative and supportive relationships, is important. Personalized interactions with human-like characteristics enhance user engagement and trust, as shown in studies on human-computer interaction [14]. Emphasizing social interaction aligns with Vygotsky's sociocultural theory, which highlights its role in cognitive development [15]. By emulating the dynamics of a supportive friend, chatbots can effectively engage students and be seen as valuable resources, enhancing acceptance and effectiveness in high school settings.

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A   ELABORATION ON CONDUCTED RESEARCH

A.1   Research Day 1

Collaborative Workbook - Assignment 1: Pop Up WordWeb

Participants were provided with access to a word cloud generator tool, specifically Mentimeter. They were presented with a series of questions [1] related to chatbots and asked to enter their responses into the tool. The questions included:

(1) What is an AI powered chatbot?
(2) In what situation can you use AI powered chatbots?
(3) Why would you use AI powered chatbots?
(4) Why wouldn't you use AI powered chatbots?

The participants engaged in a 20-minute alternating question/discussion session, facilitated by the researcher, to share their thoughts and perceptions about AI powered chatbots.

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[1] The questions were designed to enhance comprehension of the high school students' beliefs and gain insight into their perspectives.

Collaborative Workbook - Assignment 2: Cross the Line
Participants received a list of questions with statements related to AI powered chatbots. They were asked to indicate their level of agreement or disagreement using a 3-point scale (agree, neutral, disagree).[2] The statements included:

(1) I am smarter than AI powered chatbots.
(2) AI powered chatbots are not good for my development.
(3) I use AI powered chatbots often if it is allowed.
(4) AI powered chatbots will help me in school.
(5) I feel like my work is improving when I use AI powered chatbots.
(6) AI powered chatbots make me smarter.

This research day aimed to observe the integration of a chatbot into a practical course at a high school, with a focus on minimizing interference to gather authentic information. The techniques employed included observation and interviewing. Additionally, all participants were requested to answer the questions from assignment 3 on paper, providing further data for subsequent analysis.

Collaborative Workbook - Assignment 3: Picture the Future
Participants worked collaboratively in groups using ambiguous pictures representing the future[17]. They used post-it notes and markers to add their thoughts and predictions about the future and the potential use of AI powered chatbots in four years. The researcher encouraged discussions and reflections on their interactions with AI powered chatbots.

A.2 Research Day 2

Assignment 1: Understand the assignment - interaction
Participants used an AI-powered chatbot to find ideas for starting a food truck, with the option to customize the suggestions based on allergies and restrictions. They interacted with the chatbot to explore various possibilities related to the food truck concept.

Assignment 2: Use the Bot in your work - adaptation[3]
Participants were encouraged to ask questions to the chatbot instead of the teacher for assistance while working on the food truck assignment. This allowed them to experience the adaptive nature of ChatGPT and SnapBot and its potential role as a support tool in their academic work.

Assignment 3: Rate the Assignment - critics
After completing the workshop activity, participants provided feedback on their experience of working with ChatGPT. They reflected on their overall experience, collaboration with ChatGPT or SnapBot, and the impact of using the chatbot tool on their work quality. Interview questions were posed to gather additional insights, including:

(1) How did you experience working with an extra tool - ChatBot? Would you use a chatbot in different scenarios now that you have experienced it?
(2) Would you rather work with or without a ChatBot, and why? How did you experience the collaboration with ChatGPT in comparison to working without the tool?
(3) How did the chatbot tool help you in coming up with activities or food truck ideas? Did you perceive an improvement in the quality of your work because of using the chatbot tool?
(4) Which questions were least helpful in obtaining useful information? Which questions were most helpful in obtaining useful information?

This research day aimed to observe the integration of a chatbot into a practical course at a high school, with a focus on minimizing interference to gather authentic information. The techniques employed included observation and interviewing.

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[2]The statements were crafted to improve the understanding of the beliefs held by high school students and to provide insight into their viewpoints. The selection of a 3-point scale [16] was aimed at achieving a balance between clear differentiation among the options and the number of choices available for students to articulate their perspectives.

[3]The questions and tasks in assignments 2 & 3 of this research day were formulated and formed by analyzing the outcomes of the first research day, aiming to discern how students integrated the bots into their school environment.

Fig. 3. Students working with ChatGPT during Research Day 2

Additionally, all participants were requested to answer the questions from assignment 3 on paper, providing further data for subsequent analysis.

B   ANALYSIS OF THE OBTAINED DATA

To analyze the data, we employed a thematic analysis approach. Thematic analysis is a versatile and flexible method suitable for various types of qualitative data. It allows researchers to delve deeply into the data, explore emergent patterns and themes, and gain a comprehensive understanding of the research phenomenon. Whether the data sources are interviews, focus groups, observations, or textual materials, thematic analysis proves to be an effective choice for analyzing diverse qualitative data.

Table 1. Steps in the analysis of the data

The following steps were undertaken in the thematic analysis of this research;		
1. Familiarization with the Data	**2. Searching for Patterns**	**3. Searching for Themes**
We immersed ourselves in the qualitative data to understand its content comprehensively and familiarize ourselves with the context and nuances	We identified meaningful units of data and assigned descriptive codes to capture the essence of each segment, facilitating further analysis.	We systematically searched for themes by grouping similar codes or data segments together, identifying recurring patterns and concepts across the dataset
4. Reviewing and Refining Themes	**5. Defining and Naming Themes**	**6. Generating the Final Analysis**
We reviewed the identified themes, ensuring their accuracy in representing the data and alignment with our research objectives. Themes were refined through merging, splitting, or revision to create a meaningful and comprehensive representation of the data	We provided clear definitions and concise names for each theme, capturing their core meaning and facilitating effective communication of the findings	We presented the identified themes, supported by evidence from the data, to provide a coherent and logical analysis that reflected the depth and complexity of the data.

For Research Day 1, we utilized the methods to analyze the data collected from the word cloud generator, scale responses, and collaborative group activity. The goal was to identify common themes and perceptions related to AI-powered chatbots based on the participants' responses. We examined the word cloud generator data and scale responses to uncover patterns and frequencies of words, shedding light on the participants' familiarity with AI-powered chatbots and their perceived applications.

Additionally, we qualitatively analyzed the data from the collaborative group activity (Assignment 3). By reviewing the post-it notes and markers, we categorized the ideas, thoughts, and predictions expressed by the participants into themes.

Moving on to Research Day 2, we continued our qualitative analysis by examining the collected data, which included chatbot interactions, feedback from Assignment 3, and interview responses. The chatbot interaction data allowed us to identify common themes, suggestions, and ideas generated by the participants regarding food truck concepts. We also transcribed and coded the interview responses and the results of Assignment 3, categorizing them into themes. This analysis aimed to provide insights into the participants' perceptions of working with the chatbot tool.

Table 2. Sources of data retrieved in the research

Research Day 1		
Source	**Quantitative Data**	**Qualitative Data**
Assignment 1: Pop Up WordWeb	Word webs	Transcript of audio recording, Observation notes
Assignment 2: Cross the Line	Cross the line numbers	Transcript of audio recording, Observation notes
Assignment 3: Picture the Future	-	Annotated future vision images, Transcript of audio recording, Observation notes
Research Day 2		
Source	**Quantitative Data**	**Qualitative Data**
Assignment 1: Understand the assignment - interaction	-	ChatGPT history and SnapBot screenshots, Observation notes
Assignment 2: Use the Bot in your work - adaptation	-	Implementation Presentation of students, Observation notes
Assignment 3: Rate the Assignment - critics	Questionnaire about their experience with the assignment	Semi-transcripts, Observation notes

C ELABORATION ON THE THEMES

By employing this flexible and rigorous approach, the researchers were able to derive meaningful insights and contribute to a deeper understanding of the research question and subquestions. In total, we generated 5 big themes out of the raw data generated from the user research. The 5 big themes include implementation in the school system, understanding, familiarity, reliability and hesitance. Each of the five themes has three to five subthemes.

C.1 Implementation in The School System

The first theme, "Implementation in the School System," addresses the following sub-research question: What are the perceptions of high school students of AI-powered generative Chatbots in an educational setting? What are the key factors that influence student engagement and interest in AI education in high school? 5 subthemes were generated to explore this question:

(1) **Helping with Creativity:** Chatbots, particularly ChatGPT, have been found to help in fostering creativity by serving as a source of inspiration for students' own ideas. This is analyzed by looking through the history of the chatbots' answers to their questions and comparing them with their final idea to see whether the students fully copied and pasted their answers, which was not the case. The Snapchat bot, however, was perceived as less helpful when it comes to the support of creativity. This was concluded by the negative responses to the use of the bot and the analysis of the user behaviour, which contained questions unrelated to the research.

(2) **AI Behaviour:** According to the observations made, it is concluded that the behaviour of AI chatbots, including ChatGPT and the Snapchat bot, did not disrupt the class as thought would be the case, which benefits the in-class teaching. However, students expressed in their presentations their concerns about the limited scope of chatbot utility beyond writing reports.

(3) **Perception of helpfulness:** Students expressed both chatbots are generally helpful in providing answers to their questions while recognizing that personal inquiries may be less effectively handled. This can also be traced back to the division in preferences in wanting to work with or without the chatbot. The opinions were equally divided with 9 students responding positively and 9 students responding negatively.

(4) **ChatGPT vs. Snapbot:** The user experience varied between ChatGPT and the Snapchat bot, with the latter offering a more casual and personal interaction according to the students' chat history that contains more personal questions.

(5) **General Future Perception:** Derived from the future perception exercise, the students expressed a desire for future integration of chatbot technology into smaller robots, emphasising environmental considerations and acknowledging potential future roles for robots in replacing human functions.

These subthemes provide insights into how the implementation of chatbot technology influences creativity, classroom dynamics, students' perception of helpfulness, user experience differences, and their expectations for future integration.

C.2   Understanding

The second theme, "Understanding," addresses the following sub-research question: How do high school students perceive the role of artificial intelligence tools (input/output) in their learning process? What are the barriers for them to use the AI tools? The understanding of chatbots among students includes 3 subthemes.

(1) **Understanding of Their Own Advantages and Disadvantages:** Students expressed the advantages and disadvantages of chatbots compared to humans, acknowledging the chatbot's ability to provide quick answers while acknowledging the physical limitations that humans surpass.

(2) **Understanding the Limitations of the Questions:** Students gained an understanding of the limitations of the questions they could ask during their try-out, recognizing and expressing the constraints of personal inquiries, new trending words, and requests for physical assistance. They also adapted their questioning strategies during interactions, realizing they could use command-style questions.

(3) **Understanding the Limitations of the Given Answers:** Students indicated the development of an understanding of the limitations of the given answers, including the expectation of multiple answer options and the explanatory nature of chatbot responses. These insights highlight students' evolving understanding of chatbot capabilities and limitations within the educational setting.

These subthemes shed light on students' comprehension of the benefits and drawbacks of chatbots, their awareness of the limitations in the types of questions they can ask, and their evolving understanding of the capabilities and limitations of chatbots within the educational context.

C.3   Familiarity

The third theme, "Familiarity," addresses the following sub-research question: What is the level of familiarity of high school students with artificial intelligence tools, such as AI-powered generative ChatBots, and what are their perceptions of these tools in an educational setting? What are the key factors that influence student engagement and interest in AI education in high school? The familiarity with chatbots among students revealed 2 subthemes.

(1) **Connecting with Existing Tools and Platforms:** Students perceived a stronger connection with chatbots when they were integrated into existing platforms or systems they already used in their daily lives, such as social media or Google. This can be seen in the way they described the AI bots, relating them to Snapchat and Google. It provides a sense of familiarity and comfort, as students recognized and related to the chatbot as part of a familiar ecosystem.

(2) **Google vs. AI:** When given the choice, students expressed a preference for traditional search engines like Google over chatbots. They perceived Google as a more reliable and familiar tool, and they found chatbots to be more confusing, opting for the familiarity and perceived reliability of Google.

These subthemes explore how students' familiarity with existing platforms and tools influences their connection with chatbots, as well as their preference for traditional search engines like Google over chatbots.

C.4   Reliability

The fourth theme, "Reliability," addresses the following sub-research question: How do high school students perceive the limitations and usefulness of using AI-powered ChatBots, and how can potential misconceptions be addressed to promote a balanced understanding of AI's capabilities and limitations, considering students' diverse backgrounds and prior knowledge? The 5 subthemes provide valuable insights to explore this research question.

(1) **Positive Experience:** 23 students expressed that they generally had a positive experience using chatbots in educational settings and 0 students as negative, on which basis we can then assume then we can assume that the overall experience was beneficial.

(2) **Unreliability by Unfamiliarity:** The students mentioned that their unfamiliarity with chatbots contributed to a perception of unreliability, as they were unsure about how to best utilize the technology and questioned the trustworthiness of the information provided.

(3) **Simplicity vs. Complexity:** The students indicated that they valued the simplicity and quickness of chatbot interactions, and they expressed a desire to maintain this simplicity to ensure reliability.

(4) **Better Reliability through Lively Interaction:** The students expressed interest in more playful and engaging interactions with chatbots, as they believed this could enhance the meaningfulness of their interactions and lead to using the chatbot more often.

(5) **Reliability by Higher Power:** Students viewed chatbots as a higher power, mentioning as a reason for helping out and improvements with their work that the chatbots immediately know the answer to their questions.

These subthemes highlight students' overall positive experiences, the impact of unfamiliarity on perceived reliability, the trade-off between simplicity and complexity, the role of interactive and lively chatbot interactions in enhancing reliability, and the association of higher power with increased reliability.

C.5   Hesitance

The final theme, "Hesitance," addresses the following sub-research question: How do high school students perceive the limitations and usefulness of using AI-powered ChatBots, and how can potential misconceptions be addressed to promote a balanced understanding of AI's capabilities and limitations, considering students' diverse backgrounds and prior knowledge? The subthemes provide insights into students' hesitance towards using chatbots.

(1) **Connectivity and Inconvenience:** The students expressed their concerns around limitations and connectivity issues, such as the need for constant internet access and the perception of chatbots as inconvenient or unable to handle future topics, and therefore contribute to hesitance.

(2) **Machine vs. Human Behaviour/Perception:** The students made the comparison between machine and human behaviour and raise doubts about trusting chatbots, as students value human qualities, emotions, and privacy.

(3) **Advantage and Disadvantage At The Same Time:** The students hold conflicting views on the advantages and disadvantages of chatbots, with quick answers seen as beneficial but with personal issues and independent learning as potential drawbacks.

(4) **Quick Answers vs. Slow Personal Development:** It is expressed that the tension between the generation of quick answers and the slower personal development process of independent learning can lead to hesitation in the use of the bot.

(5) **Dangerous Side of The Future and AI:** Concerns about the future implications of AI and chatbot integration were mentioned, including potential dangers and the loss of human connection, that can lead to hesitance of the user of AI.

These subthemes shed light on students' concerns about technology-related issues, perceived lack of authenticity in chatbot interactions, fear of becoming overly dependent on chatbots, and the belief that chatbots might hinder their learning experience.

D   ELABORATION ON THE PERSONAS

D.1   Blindsided Stranger

The Blindsided Stranger is a high school student who has never used chatbots before and holds a negative perception towards them. They prefer relying on familiar platforms like Google for information retrieval, considering it more reliable, familiar, and less confusing. They are hesitant to use chatbots due to their belief that humans are superior to machines, valuing human

intelligence, emotions, and the ability to handle personal matters with discretion. They have a strong desire to be independent learners and perceive chatbots as a potential hindrance to that goal. Their rejection is rooted in the belief that chatbots cannot match the reliability and familiarity of platforms like Google.

Needs and design recommendations

(1) Reinforced Integration: To encourage the usage of chatbots, the Blindsided Stranger needs them to be incorporated into assignments or academic tasks, making their use obligatory and unavoidable.
(2) Familiar Integration: Chatbots should be seamlessly integrated into systems or platforms that the Blindsided Stranger is already familiar with, such as social media or widely used educational tools. This familiarity can help ease their resistance and increase their willingness to try chatbots.
(3) Demonstrating Benefits Over Google: Design recommendations should focus on highlighting the unique benefits and advantages of chatbots over traditional search engines like Google. This could include emphasizing quick and accurate responses, personalized assistance, or specific features that enhance the learning experience.
(4) Clear Value Proposition: The Blindsided Stranger needs a clear understanding of the value that chatbots can provide in their educational journey.
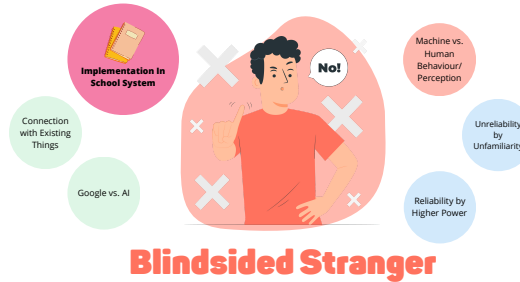

Fig. 4. Cluster of sub-themes of the blindsided stranger

D.2 Curious Beginner

The Curious Beginner is a high school student who has recently discovered chatbots and is intrigued by their potential. They are open-minded and see the benefits of using chatbots in various aspects of their education. Although they have only scratched the surface of what chatbots can do, they have had a positive initial experience using them in an educational setting (they are not aware of what it can mean more to them). The Curious Beginner is characterized by their curiosity, enthusiasm, and eagerness to explore the capabilities of chatbots. They are receptive to learning and adaptable to new technologies. They have a willingness to experiment and try different approaches when interacting with chatbots. Their positive first-time experience has fueled their interest in further integrating chatbots into the school system. While they lack awareness of the potential risks and limitations, their curiosity masks any concerns they may have.

Needs and design recommendations

(1) Gradual Integration: The Curious Beginner seeks a step-by-step integration of chatbots into the school system to facilitate their learning and understanding of how to utilize them effectively.(Create interactive learning experiences or gamified modules)
(2) Playful Learning: They desire interactive and playful methods to explore the limitations of chatbot responses and refine their questioning techniques.

(3) Awareness of Drawbacks: They need information and guidance to become aware of the potential negative aspects and risks associated with chatbots, without dampening their curiosity and enthusiasm

(4) Enhanced Explanation: They require clearer explanations and examples of the different ways in which chatbots can be utilized, expanding their understanding of the technology's applications.

(5) Progressive Feedback: They need feedback mechanisms that provide guidance and suggestions on how to improve their interactions with chatbots, helping them refine their questioning techniques and get more accurate and relevant responses.

Fig. 5. Cluster of sub-themes of the curious beginner

D.3 Efficient Q&Aer

The Efficient Q&Aer is a high school student who views chatbots primarily as a tool for quick and accurate information retrieval. They prefer to maintain a focused and efficient interaction with the chatbot, seeking immediate answers to their questions rather than developing a personal relationship. They frequently use chatbots for schoolwork in a repetitive, one-way manner. They recognize that chatbots have limitations and do not need to mimic human behavior. Using of chatbots makes the temptation to cheat harder for them. although Learning, to them, is a self-driven process that involves finding their own answers rather than relying on external sources. They perceive chatbot usage as a means to save time and enhance efficiency in their schoolwork, but they also value learning as a personal endeavor and not simply a way to cheat.

Needs and design recommendations

(1) More Humane Interactions: Efficient Q&Aer seek empathetic and conversational chatbot interactions, valuing a warm and friendly demeanor. Design chatbots to exhibit empathy, understanding, and a conversational tone, creating a more human-like experience.

(2) Collaborative Companion: Efficient Q&Aer desire chatbots that actively collaborate, engaging in brainstorming and problem-solving activities. Design chatbots as supportive partners that work together with Efficient Q&Aer, fostering a collaborative and interactive environment.

(3) Conversational Experience: Efficient Q&Aer prefer chatbots capable of natural and flowing conversations, understanding context and maintaining cohesive dialogue. Design chatbots that follow conversational threads and provide seamless interactions, enhancing the conversational experience.

(4) Integration into Daily Routine: Efficient Q&Aer want chatbots to be present throughout their daily activities and routines, acting as companions. Design chatbots to extend beyond specific tasks, integrating into various aspects of Efficient Q&Aer's lives.

(5) Emotional Support: Efficient Q&Aer seek chatbots that offer emotional support and encouragement. Design chatbots to understand and empathize with Efficient Q&Aer's feelings, providing reassurance and assistance when needed.

(6) Human-like Characteristics: Efficient Q&Aer's prefer chatbots that exhibit human-like traits and personalities. Design chatbots to display warmth, understanding, and relatability, creating a more comfortable and engaging interaction.

Fig. 6. Cluster of sub-themes of the efficient Q&Aer

D.4   Friend Seeker

The Friend Seekers is an high school student who values personal connections and seeks friendship and support in her daily life. This person is outgoing, creative, and enjoys exploring new ideas. They are active user of social media platforms and are familiar with chatbots. They see chatbots as potential friends who can provide support, engage in conversation, and offer creative suggestions. The friend seekers perceptions of current chatbots are that they are still robots, just providing a service, they are not able to help with personal questions.

Needs and design recommendations

(1) Time-saving: Design chatbots with a user-friendly interface that enables quick input and retrieval of information, seamlessly integrating with other platforms for efficient access and management of information[14].
(2) Efficiency in work: Customize response parameters such as word count, tone, or format, to allow Friend Seekers to personalize their chatbot experience, optimizing productivity and avoiding excessive time spent on school-related activities.
(3) Expectation and precise answers: Keep the chatbot's features minimal, focusing on delivering accurate and trustworthy responses that align with the intended queries of Friend Seekers, fostering trust and meeting their expectations.

Fig. 7. Cluster of sub-themes of the friends seeker

D.5　Skeptical Reject

The Skeptical Reject persona represents a high school student who initially dislikes and is highly skeptical of chatbots. They perceive chatbots as having numerous limitations, including the need for an internet connection, which they believe hinders their learning process. They feel that relying on the internet for answers is detrimental to their learning and are suspicious of the chatbot's ability to handle unknown questions. Trustworthiness is a major concern for them, as they doubt the accuracy and reliability of chatbot responses. They view the quick answers provided by chatbots as potentially harmful to the learning experience. Furthermore, they harbor fears about the future, particularly regarding the potential dominance of robots and negative consequences of technological advancements.

Needs and design recommendations

(1) Feeling of Safety: Design chatbots to prioritize students' sense of security and comfort, addressing privacy and data security concerns. Integrate empathetic features to build trust and create a more human-like chatbot experience [18].
(2) Transparency: Provide clear and transparent information about chatbot operations, data sources, and knowledge limitations to establish trust and credibility.
(3) Feeling in Control: Create chatbot interactions that empower students, avoiding an all-knowing persona and offering customization options for their preferred level of interaction and agency.
(4) Familiarity and Comfort: Develop chatbots with interfaces and functionalities resembling platforms familiar to students, such as Google, to enhance their comfort level and minimize the need to step out of their comfort zone.

Fig. 8.　Cluster of sub-themes of the skeptical reject

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