By interacting with the chatbot students will:

1. Learn how to write clear, effective prompts to get relevant and accurate responses from AI systems, improving their communication with generative AI tools.

2. Understand how AI technologies are applied in real world contexts (e.g. media, education, business) and define basic terms such as natural language processing.

3. Evaluate the ethical risks and impacts of AI understanding of ethical guidelines and disruptive potentials of AI, including but not limited to, bias, misinformation, privacy, job displacement, and discuss how these issues can affect society and individuals.

Literature review **(Version 1)**

AI-driven adaptive learning for sustainable educational transformation

- Adaptive learning chatbots should personalize content based on students' performance, pace, and preferences to optimize their learning. (Strielkowski, 2024)
- Effective chatbot design includes simulating human-like interactions to guide students through learning materials and provide instant feedback. (Strielkowski, 2024)
- Chatbots should support self-paced learning to increase accessibility for diverse student needs. (Strielkowski, 2024)
- Integrating intelligent tutoring functions in chatbots can allow them to answer questions, explain concepts, and continuously assess understanding. (Strielkowski, 2024)
- Using data analytics in chatbot design can enable adaptive recommendations of learning pathways and resources best suited to each learner. (Strielkowski, 2024)

AI in education: A review of personalized learning and educational technology

- Personalized learning in a chatbot should adapt and tailor towards student behaviors such as learning speeds, unique needs, and behaviors of each student, covering a range of learning styles. (Ayeni et al., 2024)
- Immediate feedback provided by AI chatbots allow for students to continuously adjust mistakes and learn in a timely manner (Ayeni et al., 2024)
- Chabots acting as an intelligent tutoring system (ITS) should provide tailored instructions and support, emulating a human tutor. The effectiveness lies in its ability to address learning gaps, clarify ideas, and evolve to the needs of each student (Ayeni et al., 2024).

<u>Course Content*not paraphrased</u>

<u>Ethical considerations</u>

AI algorithms are trained on historical data, and if that data reflects biases, the algorithms can perpetuate and even exacerbate these biases. In the context of education, algorithmic biases can result in unfair advantages or disadvantages for certain student demographics. For example, if historical data used to train an algorithm contains biases related to gender, ethnicity, or socioeconomic status, the algorithm may inadvertently perpetuate these biases in educational outcomes. (Ayeni et al., 2024)

One of the foremost challenges in the integration of AI in education revolves around privacy concerns. As AI systems collect and analyze vast amounts of student data, including performance metrics, learning patterns, and behavioral data, the potential for privacy breaches becomes a critical issue. Safeguarding sensitive information is paramount to maintaining trust within educational communities. (Ayeni et al., 2024)

Core Topics

Topic	Description	Goal	Objective #
Prompting	The words or sentences used in order to generate an output from an AI chatbot model. Clear, powerful prompts set a role for the chatbot, give a descriptive task, and provide context.	Students will be able independently create prompts for the chatbot in order to obtain its most effective performance with minimal confusion back and forth.	1
Applied AI Technology	AI applicational technology is any software that uses AI to perform specific tasks. This software can typically act independently, minimizing the need for human intelligence or intervention.	Students will be able to identify and differentiate between different AI technology, defining uses and capabilities of mainstream tools.	2
Ethical Considerations	Ethical considerations such as bias, misinformation, privacy or job displacement, refer to the negative consequences AI can have that impact society or an individual.	Students will have increased awareness of AI ethical challenges and the negative impact that AI can pose on society.	3

Category	Areas	Design principles	Source
Feedback	Personalized feedback	The chatbot should personalize content based on students' performance, pace, and preferences in order to optimize teaching and cover a range of learning styles, more effectively teaching AI literacy skills. By tailoring feedback specific to the student's wording, the chatbot teaches how to phrase prompts more effectively. (Objective 1)	(Strielkowski, 2024); (Ayeni et al., 2024); (Kaiss et al., 2023)
	Instant feedback	Immediate responses will simulate human interaction and better guide students through course content, allowing them to continuously improve and adjust based on chatbot outputs. This allows students to question the chatbot about AI topics, allowing for a deeper, more advanced understanding of AI compared to just reading through an article. (Objectives 1, 2)	(Strielkowski, 2024); (Ayeni et al., 2024); (Tsai et al., 2025); (Jung et al., 2020)
Guidance and Scaffolding	Prompt facilitation	Instead of listing facts, discussions should be initiated with guidance, questions or directions based on previous conversation. This will improve learning as the chatbot can introduce AI topics unknown to the user. (Objectives 1,2,3)	(Chang et al., 2023), (Ayeni et al., 2024), (Kaiss et al., 2023)
	Self-regulated scaffolding	The chatbot should provide prompts and guidance that help students stay focused, reflect on what they are learning, and plan their next steps to improve understanding. This fosters independence while building a complex understanding of AI ethical issues and technology. (Objective 1,2)	(Tsai et al., 2025); (Cerny, 2023); (Jung et al., 2020)
	Guided assistance	When students respond with "I don't know" or struggle to answer a question, the chatbot will provide supportive hints and assistance to guide them towards understanding, breaking down the lesson rather than simply providing an answer. This	(Cerny, 2023); (Chang et al., 2023); (Jung et al., 2020)

		supports learning more specific topics such as job displacement, bias or natural language processing. (Objectives 1,2,3)	
Engagement	Goal setting	At the beginning of each topic, the chatbot will set achievable, distinct learning goals that will help increase focus, engagement and student motivation. This will give students a clear understanding of the extent and aims of AI literacy concepts that will be explored throughout the course. (Objectives 1,2,3)	(Chang et al., 2023); (Hew et al., 2023); (Brandt 2000)
	Pre-instruction subject overview	Before beginning specific instruction or asking questions, the chatbot will provide an overview of the topic, providing students with an immediate context and prepares them for deeper learning.	(Sajjad, 2010); (Aslani et al 2013)
	Prior knowledge activation	After providing an overview of the topic, the chatbot will ask the student to share any prior knowledge that they already know about the topic, allowing for more personalized AI literacy instruction adapted to each student's diverse background.	(Annapureddy et al., 2024); (Kochhar 1985); (Bidabadi et al 2016); (Sajjad, 2010)
	Scenario-based Anchoring	When explaining topics in depth, the chatbot will use example prompts, realistic scenarios, and common misconceptions throughout the learning process to reinforce meaning and support long term retention of AI literacy skills.	(Park and Kim, 2025); (Zhao et al., 2025); (Sajjad, 2010)
	User-friendly interaction style	The chatbot will use a casual, friendly tone modeled after peer-level conversation rather than formal instruction. It will avoid jargon, use relatable examples, and embed lightweight humor or playful phrasing where appropriate to reduce intimidation and increase approachability. This lowers barriers between complex AI concepts and student understanding, improving student motivation and making learning topics seem less like formal classes. (Objectives 1, 2, 3)	Choi and Chang, 2025; (Jung et al., 2020); (Reddy et al; 2024)

| Instructional chunking | The chatbot will break each major topic (Prompting, AI applicational tech., Ethical considerations) into smaller, logically sequenced steps or sub-topics to avoid overwhelming students with too much information at once, increasing engagement and comprehension. Each sub-topic will build upon the last, supporting progressive learning. (Objectives 1,2,3) | (Sajjad, 2010); (Rosenshine, 2012) |

→ **Pre-Course Assessment**

- Likert-Scale Confidence Survey (e.g., "I feel confident crafting a good AI prompt." 1–5)

- Multiple-Choice Knowledge Check (covers all 3 core topics)

COURSE START

→ Chatbot Welcome & Course Introduction

Module 1: Prompting

→ Subject Overview (Prompting)

→ Prior Knowledge Check

→ Prompting Subtopic 1

→ Scenario-Based Activity or Misconception Challenge

→ Prompting Subtopic 2

→ Practice Task or Guided Application

→ Prompting Subtopic 3

→ Student Revision or Extension Task

→ Reflection Question

→ Wrap-Up & Transition

Module 2: Application Technology

→ Subject Overview (Application Technology)

→ Prior Knowledge Check

→ Application Tech Subtopic 1

→ Scenario-Based Activity or Misconception Challenge

→ Application Tech Subtopic 2

→ Guided Breakdown or Analysis

→ Application Tech Subtopic 3

→ Student Task or Response Evaluation

→ Reflection Question

→ Wrap-Up & Transition

Module 3: Ethical Use & Responsibility

→ Subject Overview (Ethical Use)

→ Prior Knowledge Check

→ Ethics Subtopic 1

→ Scenario-Based Activity or Misconception Challenge

→ Ethics Subtopic 2

→ Guided Case Discussion

→ Ethics Subtopic 3

→ Application or Correction Task

→ Reflection Question

→ Final Course Wrap-Up

END OF COURSE

→ **Post-Course Assessment**

• Likert-Scale Confidence Survey (same items as pre-course)

• Multiple-Choice Knowledge Exam (parallel to pre-course)

→ Optional Completion Message or Personalized Summary

I added exemplary research demonstrating how you should work on developing design principles/strategies for the instructional tool/system design below. After reviewing a list of literature, you should better develop a table consisting of different areas/components and clearly listing the principles with source references. Later on, you should then demonstrate how each principle has been embedded into the actual design (in other words, how each function/feature of your system reflects on design principles from literature as Table 15 from Park & Lim (2019) has shown.

Park, T., & Lim, C. (2019). Design principles for improving emotional affordances in an online learning environment. *Asia Pacific Education Review*, *20*, 53-67. [Design principles for improving emotional affordances in an online learning environment | Asia Pacific Education Review](#)

Table 8 The initial design principles via the literature review

EAs	Design components	Design principles
Visceral EAs	Expressive user interface	1. Principle of intimacy: design familiar (visual) screen elements which can help e-learners intuitively recognize and use
		2. Principle of aesthetic: design attractive visual screen elements that lead to e-learners' (visual) attention, interest, and joy
Behavioral EAs	Manipulative user interface	3. Principle of controllability: design to give e-learners opportunities to easily move their learning paths and control them to plan for the following study
		4. Principle of ease of use: design the usage of e-learning platforms that learners can be easily adapted to
Reflective EAs	Learning activities	5. Principle of playfulness: design playful learning activities and materials for learners to learn through play
		6. Principle of clarity: provide learners with clearly structured learning activities, visuals, or materials
	Learning support	7. Principle of humanity: use humanistic approach to facilitate student's emotional attachment to learning content and teacher
		8. Principle of balance: guide learners to harmonize their learning and personal life balance
	Social interaction support	9. Principle of self-disclosure: design for learners to disclose their image and emotions freely for social interaction
		10. Principle of solidarity: design for learners to seek social support or exchange sympathetic feedback by sharing learning experience and difficulties with colleagues

Table 14 The final design principles for EAs in online learning environments

Components	Principles	Intended emotion	Technical examples
Learning Activities	1. Principle of Positivity Design learning activities that can lead to positive imagination such as learning completion or success	Inducing or increasing hope, confidence Suppressing or reducing anxiety, fear, boredom, envy	• Structural map of modules/sections and periods/units on learning content according to the criteria of learning themes, goals/objectives, levels, material types • Flow chart of learning phases • Detailed and clear course completion criteria
	2. Principle of Playfulness Provide a pleasant individual and collaborative learning activities that give an opportunity of studying while playing	Inducing or increasing joy/delight, confidence, hope, satisfaction/contentment, sympathy Suppressing or reducing fear, boredom, frustration, anxiety, isolation, anger, shame	• Illustrations, photos, cartoons, sounds, videos, animations which show the different results happened when learners know and don't know the knowledge and skills • Stories, episodes, cartoons, comics, exercises adding fun elements • Collaborative learning activities such as discussion, forum, team project, group inquiry of the interesting issues, and topics • Challenging and interactive online quizzes, puzzles, quests • Learning activities of breaks or energizers during 5, 10, 15, 20 mins
Learning Support	3. Principle of Humanity Design a sympathetic professor formation and feedback taking into account the human side	Inducing or increasing relief, joy/delight, confidence, satisfaction, hope Suppressing or reducing boredom, frustration, anxiety, fear, anger, envy	• Welcoming messages or icebreaking questionings • Goal-oriented evaluation rather than criteria-oriented evaluation • Awarding badges or stickers depending on the performance level • Time management tools for extending a deadline as well as keeping track of start/due dates • Providing different instructional treatments/feedbacks such as content types, facial expressions, or messages of start/due according to expressed emotion
	4. Principle of Self-disclosure Design to feel free to expose his or her story/episode, opinion, information, difficulties	Inducing or increasing sympathy, relief, joy/delight, confidence, hope, satisfaction Suppressing or reducing isolation, boredom, anger, frustration, anxiety, fear, shame	• Mapping emotional states to the features of the avatar, character, mascot, photo • Netiquette rules for online communication manners • Setting privacy bounds of bulletin board, cafe, blog, SNS • Allowing anonymous/visitor upload posts • Creating course atmosphere making the mistakes and failures considered as a learning opportunity • Providing synchronous communication tools as well as asynchronous communication tools for seeking help from others or providing help to others
Learner Interface/ Learner eXperience (LI/LX)	5. Principle of Safety Provide appropriate technical guidance and support when so can feel a sense of stability in the use of the program	Inducing or increasing confidence, relief, satisfaction Suppressing or reducing anxiety, fear, frustration	• Guidance and orientation on how to use the program by function descriptions of menus/icons on the mouse-over screen or video tutorials • Guidance bars/messages for the progress rate of learning • Quick help buttons/agents at the time when there are technical difficulties
	6. Principle of Personalization Design to be able to set the personalized learning environment themselves by freely moving to the learning path they want	Inducing or increasing confidence, relief, satisfaction, hope, joy/delight Suppressing or reducing boredom, frustration, anxiety, fear	• Navigation maps/bars for learning routes/progress • Providing customized controller with the buttons of play/pause, display/hide the subtitle/script, playback speed, replay • Concepts/themes of skins, layouts, showing/hiding of character agent, text fonts based on individual preferences and emotion
Learning screen	7. Principle of Affinity Design an attractive learning screen that can give visually a favorable impression	Inducing or increasing joy/delight, satisfaction, relief Suppressing or reducing anxiety, frustration, anger	• Selecting ≤ 5 dominant colors per web-page to symbolize the emotional atmosphere of screen concepts • Designing appealing fonts, typography, graphics creating visual rhythm • Applying responsive and adaptive web to change the format and layout based on the screen size
	8. Principle of Intimacy Design a visually familiar learning screen to be able to intuitively recognize	Inducing or increasing joy/delight, satisfaction, hope, relief Suppressing or reducing boredom, isolation, fear, anxiety, frustration	• Creating a visual or tactile metaphor for friendly feelings • Designing human-like (anthropomorphic) characters, facial expressions, gestures

Table 15 Samples of technical examples for the design principles

	[Positivity] Setting learning goal and timetable	[Playfulness] Break activities for fun
Learning Activities		
	[Humanity] Empathetic feedback with emoticons	[Self-disclosure] Autobiographical board
Learning Support		
	[Safety] Quick help button	[Personalization] Navigation map for customized learning routes
LI/LX		
	[Affinity] Appealing typography	[Intimacy] Anthropomorphic characters
Learning Screen		

Table 1 Blending suggestions in related BL theories

	Face-to-face	Online
Didactical 3C model (Kerres and Witt 2003)	Communication component that provides interpersonal interactions for more complex or arguable learning tasks Constructive component that facilitates learners to actively engage in most complex learning tasks	Content component that makes factual learning content available to learners
Cost of communication (Hollingshead, 1996; Kerres and Witt 2003) *Media richness theory* (Daft and Lengel 1984; Rice, 1992)	Dependent on time and location Higher cost Bi-/multi-directional interaction Intensive high benefit challenging learning activities Equivocal learning tasks with multiple interpretations	Less dependent on time and location Lower cost Uni-directional transmission Less intensive, less challenging learning activities Unequivocal tasks with low haziness
Media synchronicity theory (Dennis and Valacich 1999)	Synchronous environment Convergence process for learners' shared focus and a common understanding at the same time	Asynchronous environment Conveyance process for the exchange of information

Lee, J., Lim, C., & Kim, H. (2017). Development of an instructional design model for flipped learning in higher education. *Educational Technology Research and Development*, *65*, 427-453. https://doi.org/10.1007/s11423-016-9502-1

1. **Foster an accurate conceptualization of conversational AI.** Some related work suggests strategies to introduce young learners to machine learning (Carney et al., 2020; Zimmermann-Niefield, Turner, Murphy, Kane, & Shapiro, 2019) and natural language processing concepts (Bandyopadhyay, Xu, Pawar, & Touretzky, 2022; Druga, 2018; Hjorth, 2021). Similarly, as learners create and tinker with conversational AI, the system should represent AI concepts accurately, such as the importance of training data and design of conversational flow (Long & Magerko, 2020).

2. **Embodiment of AI agents.** Embodiment of a virtual agent can significantly improve children's engagement in a learning activity (Baylor & Ryu, 2003; Hew & Cheung, 2010; Johnson et al., 2000; Park et al., 2022). Customization of the agent's embodied characteristics, such as gender, skin tone, and voice, can enhance learner's identity (Kim, Koh, Lee, Park, & Lim, 2019) and create a better sense of belonging, thus encouraging youth to engage more with the system (Qian, 2008). However, agent customization options can also distract from the learning activity itself (Li, Kizilcec, Bailenson, & Ju, 2016). We therefore sought to balance the freedom of customization with the core cognitive tasks (e.g., designing the dialogue, creating intents, entering training phrases) afforded by the interface.

3. **Simplicity and age appropriateness.** Younger learners face lower cognitive load and report a better user experience when presented with large design elements (Harbeck & Sherman, 1999), simple and intuitive displays (Bilal, 2000; Taslim, Wan Adnan, & Abu Bakar, 2009; Wu, Tang, & Tsai, 2014), and concepts that are conveyed visually rather than with dense text (Large & Beheshti, 2005; Park, Han, Kim, Oh, & Moon, 2013). Thus, we aim to keep interface elements simple and interactive to maintain youth's attention.

4. **Flexible input modalities.** Research finds that interfaces supporting multimodal interaction are preferred over unimodal interfaces because of their flexibility to adapt to user needs (Griol & Callejas, 2016; Schachner, Keller, Von Wangenheim, et al., 2020). Multimodal interaction is especially beneficial for users developing conversational agents (Schaffer & Reithinger, 2019). Our interface follows this path to provide flexible input methods (e.g., typing and voice) to improve input efficiency and adaptivity.

Drawing from the above design principles, especially the agent embodiment and simplicity, we drafted two initial interface mockups (Fig. 4). The two interface mockups pared down the information in DialogFlow and displayed it in graphical form inspired by Blockly.[3]

Tian, X., Kumar, A., Solomon, C. E., Calder, K. D., Katuka, G. A., Song, Y., ... & Israel, M. (2023). AMBY: A development environment for youth to create conversational agents. *International Journal of Child-Computer Interaction*, *38*, 100618.https://doi.org/10.1016/j.ijcci.2023.100618
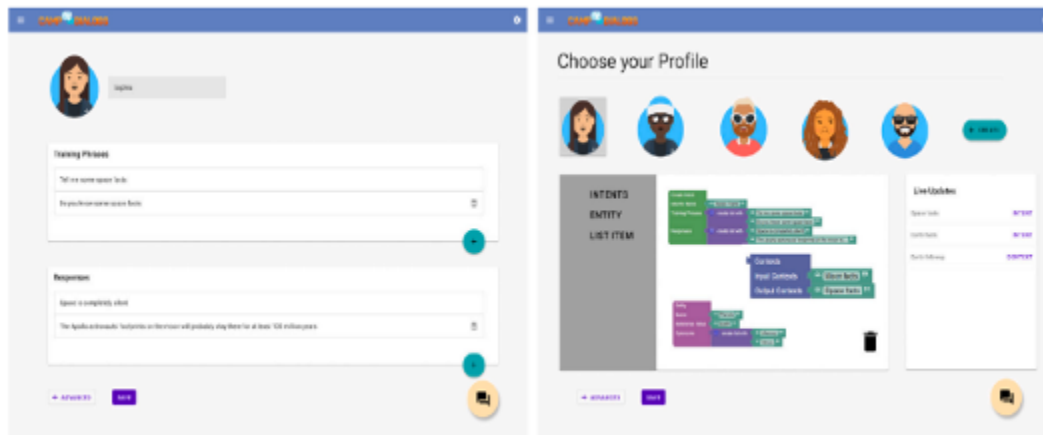
Fig. 4. The two interface mockups used during the focus group in the contextual inquiry study (Study 1).