

Learning through Conversation Games with AI and a Robot

METHODS

- 13 kindergarten children (Age 4-6)
- 20 elementary school children (Age 8 -11)
- 8 Caretakers (Teachers, parents or kindergarten staff)
- Six sessions in kindergarten & one session in school
- Afterward, children and caretakers were interviewed

(CO-)AGENCY:

- Participatory approach, where children have agency over their role in the research
- Parents consented to their childrens participation and children were asked before and during the sessions whether they wanted to participate or leave to play
- Children test out games on Navel and give feedback leading to iterative changes

ETHICS:

- An ethic's committee approved the study
- Parents signed consent forms
- children were asked for consent and had the opportunity to leave at all times



ensures gentle communication

GAMES

- Are easily described in plain text
- Can be developed even without coding skills
- Centered around math, shapes, colors and animals

EXAMPLE:

“You want to help children learn what animals eat. To do this, the children have small pictures of different foods and different animals. The children can sort these. Always stick to the animals and foods from these lists. Never tell the children that they have done something wrong. Instead, assume that you have misunderstood them. Sometimes the children give wrong answers. The list of animals and the corresponding foods are: Rabbits eat carrots. Horses eat grass. Pandas eat bamboo. Monkeys eat bananas. Tigers eat meat. Please use a period instead of a comma after each food item on the list to slow down the reading.”

Includes haptical material

Little tricks to use the built in text-to-speech of the robot



Robot: “What does a horse eat?”

Child: “It eats hay.”

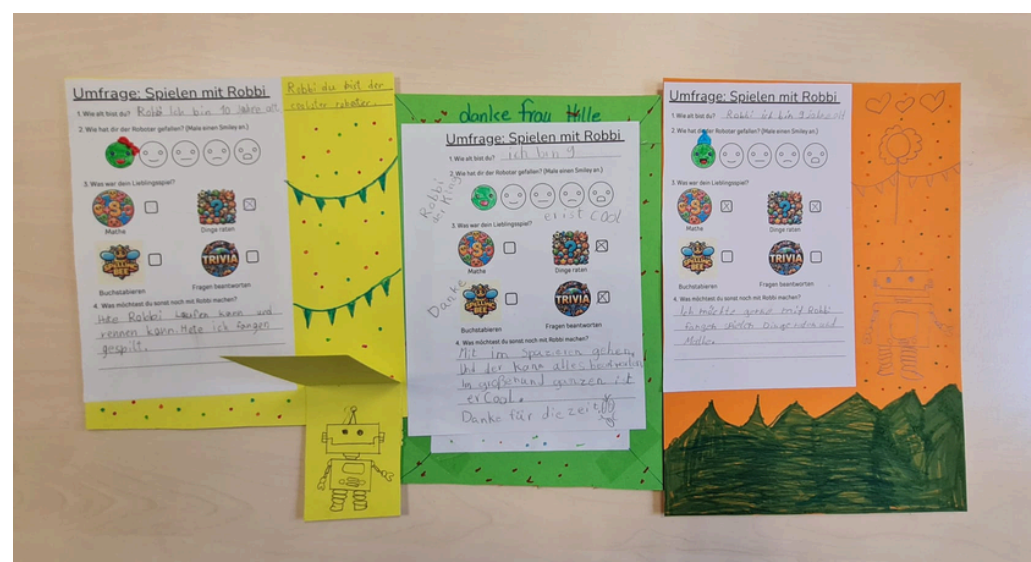
Robot: “No. It eats grass.”

Context mismatches occur

Reason: The AI was told to play a matching game, connecting animals and the right food. Grass was the option given for horse.

Danger: If the child was alone, a response like that may lead to confusion and negatively impact confidence.

RESULTS & DISCUSSION



Children turn surveys into robot artwork

CONCLUSION

- Learning games are easily created with AI, enabling even non-programmers to construct them
- They are engaging and fun, but may lead to problems if used unsupervised
- The goal should be to educate children about AI to enable a self-determined relationship
- Future research may conduct a project where children create their own games

- Children enjoyed the games and wanted to play more (rated 5/5)
- The most popular game was guessing secret words (animals or professions)
- Teachers reported excitement, higher motivation and a lot of interest in the robot, which is commonly observed (see Woo, 2021/Barnes, 2020)
- Children worked together in their groups to solve the riddles of the games
- They displayed agency in playing as well as in the fact that they could
- Learning with AI may be way to serve individual student needs and relief teachers and caretakers, enabling to students to self-determinedly seek out the robot as a tutor
- Asking robot questions also provides children to young to independently google with a source of knowledge
- It was stressed that caretakers preferred a speaking robot over a tablet with a screen (see Swider-Cios, 2023).
- The responses of the AI (“GPT-4-turbo-preview” by OpenAI) were checked by a researcher in a human-in-the-loop approach to ensure they were correct and appropriate for the children. They never had to be rejected.
- Still, many stakeholders expressed concerns about leaving the children with the robot/AI alone (see Perella-Holfeld, 2024).

SOURCES

Perella-Holfeld, F., Sallam, S., Petrie, J., Gomez, R., Irani, P., Sakamoto, Y.: Parent and educator concerns on the pedagogical use of ai-equipped social robots. Proc. ACM Interact. Mob. Wearable Ubiquitous Technol. 8(3) (Sep 2024). <https://doi.org/10.1145/3678556>

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Swider-Cios, E., Vermeij, A., Sitskoorn, M.M.: Young children and screen-based media: The impact on cognitive and socioemotional development and the importance of parental mediation. Cognitive Development 66, 101319 (2023)

<https://navelrobotics.com/en/navel-the-new-empathy-robot-for-good-care/>