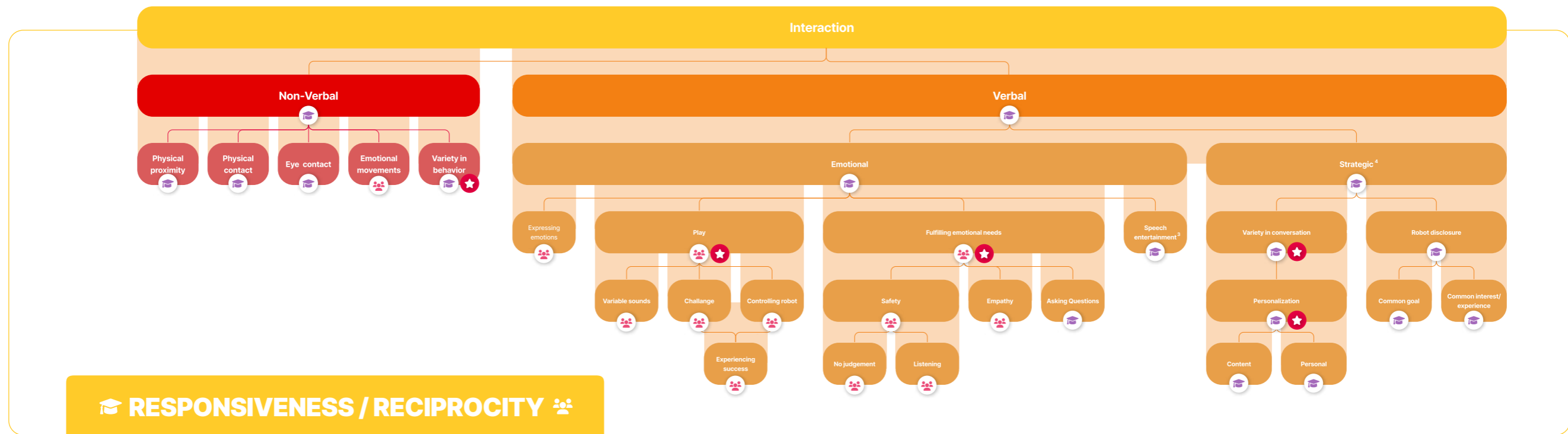
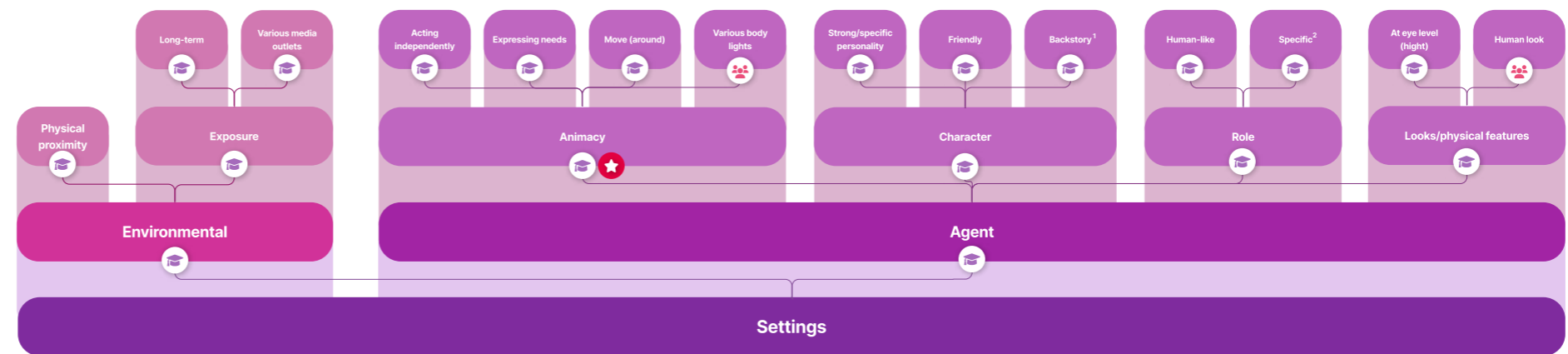


**AGE-APPROPRIATE** 🧑🏫

Potential  
**Child  
Robot  
Relationship  
Factors**

**Opportunity map**



**RESPONSIVENESS / RECIPROCITY** 🧑🏫

From academic literature  
 From practitioners (KIEM consortium)  
 Most important factors

**1. Backstory:** personal story/information of the robot (e.g., origin, family/friends, hobbies, abilities, limitations)  
**2. Specific role:** e.g., tutor, peer, someone younger  
**3. Speech entrainment:** robot's voice adapts to child's voice (in speed, pitch, volume, exuberance)  
**4. Strategic interaction:** is aimed at advancing a relationship

## WORKSHOP INSIGHTS

### AIM OPPORTUNITY MAP

Robots are increasingly being used in education. But children's motivation to interact with a robot often disappears once the novelty wears off. As a result, learning effects are short-lived and offer little added value for education. A new, more sustainable, motivation for children to keep interacting could be that they feel a meaningful relationship with a robot. However, little is known about how robots can stimulate relationship building.

For this reason, several workshops with child-robot researchers and practitioners (i.e., robot software developers, robot vendors, school robot facilitators and trainers, pedagogical experts) were organized to identify factors (from academic literature and field experiences) that potentially stimulate relationship formation between children and robots. This opportunity map presents the most important insights to inspire researchers and practitioners in the educational field to further develop, test and implement these factors.

### IMPORTANT CHILD-ROBOT RELATIONSHIP FORMATION FACTORS

In addition to the factors from academic literature, practitioners identified and placed more emphasis on the emotional interaction with a robot, and cited several concrete examples of this. Out of all the factors in the opportunity map, the following were considered as most important:

1. **Emotional interaction**, specifically fulfilling emotional needs and play.
2. **Strategic interaction**, specifically personalization (by tailoring the educational content to the child and making the interaction more personal).
3. **Responsiveness / reciprocity**, an overall factor influencing child-robot-interactions, specifically variety in behavior and conversation.
4. **Animacy**; as being more important than whether a robot looks like a human. As long as the robot appears alive, children want to take care of it and do not see it as a piece of plastic.

The top 3 are all components that indicate how "pedagogically sensitive" the robot is (an essential skill for relationship formation that teachers learn during their training). It concerns the extent to which someone is responsive, attunes well, is empathetic, does not judge, shows interest. Children also want to be seen and heard; an incorrect response from the robot can give the child the impression that he/she is not understood.

An important point raised by practitioners is that "responsiveness", originally identified in the academic literature as an important "robot" characteristic, goes both ways. Meaningful relationships are characterized by interactions in which both parties (robot and child) respond adequately to each other's verbal and non-verbal signals. For this reason, "reciprocity" is considered a more accurate and inclusive term.

The open question remained whether children should be able to program the robot. On the one hand, it can give children a sense of control, security, success, fun, and responsibility. On the other hand, it can also hinder relationship formation if it makes the robot feel more like a thing than an autonomous, independently-acting agent.

### BARRIERS OF CHILD-ROBOT RELATIONSHIP FORMATION

- **Attitude & skills teachers:** teachers often have little experience with robot technology, nor the time to gain more knowledge and skills. This makes them feel less comfortable using robots in the classroom.
- **Embedding in education:** robots must be incorporated into everyday educational practice, from lower to upper classes.
- **Limited AI:** understanding and generating human language is a challenging task for robots as each individual uses it differently. It is also difficult for robots to recognize children's emotions and determine the correct empathic responses.
- **Lack of content:** it takes time to create interaction and educational content for the robot that adapts well to the context and personal needs of children.
- **Responsible and secure data storage:** for relationship formation it is important that the robot remembers information about a child. This requires a clear plan and infrastructure to securely store this type of sensitive and personal data.

### FOCUS POINTS FOR IMPROVING CHILD-ROBOT RELATIONSHIP FORMATION

- **Advancements in AI** to (a) appropriately (timely and emotionally) respond and adapt to the child, and (b) have a sustained, reciprocal, and personal interaction.
- **Transdisciplinary collaboration** between educators, content creators, programmers, and children to create high quality robot content.
- **Embedding in domain:** robot adoption by teachers, school boards, and IT managers.

## COLOPHON 2022

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A reference list of the academic papers used for the opportunity map can be obtained from the authors.

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