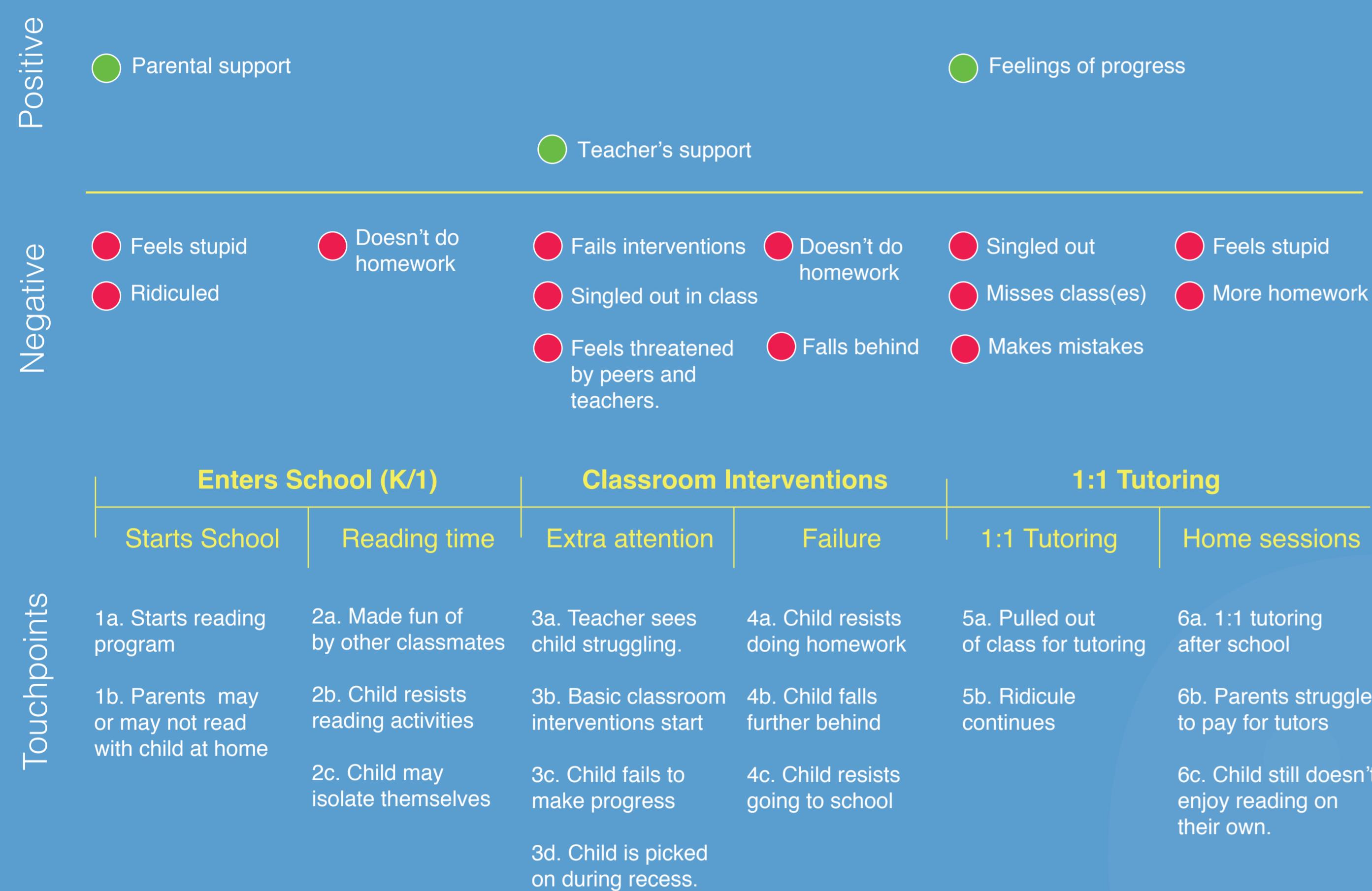


# Integrating Affective Responses and Gamification into Early Reading Acquisition Software Applications

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**Sisu** is a gamified learning application designed to assist school-aged children who are struggling to read. Sisu utilizes readily-available technology to promote learning at home, with unique elements tied to the learning experience: (1) a spelling game with (2) an empathic agent, and (3) a mini-game. The empathic agent utilizes a facial action coding system (FACS) to recognize core expressions of the child user and respond to the child's affect in-game. We anticipate that Sisu's accessible and affective nature will not only support children's emotional needs, but the addition of gamified elements will motivate them to practice reading and assist them in their learning objectives.

## User Journey Map



## Research Questions

Does a home-based spelling application with affective and gamified elements :

- RQ1) improve spelling accuracy,
- RQ2) increase the duration of time spent in the spelling game,
- RQ3) increase number of sessions of game play per week, and
- RQ4) increase levels of enjoyment of children aged 7-8 who are struggling to read?

## Research Plan

In a home-environment, children aged 7-8 will do their homework using this tool. Each child will be randomly allocated to 1 of the following conditions:

- (1) spelling app with the mini-game,
- (2) a spelling app with the empathic agent, and
- (3) the spelling app with both the mini-game and empathic agent.

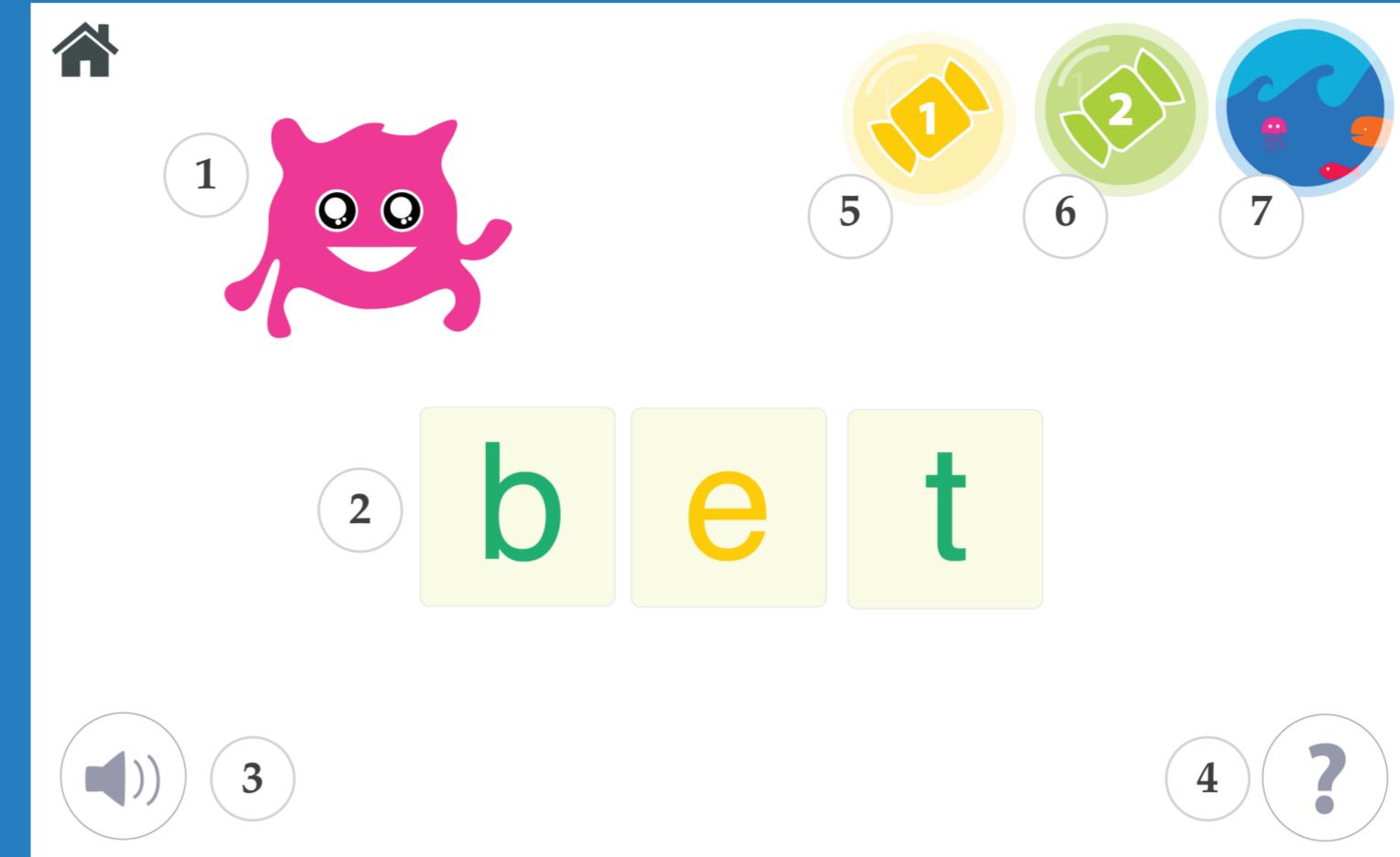
A between-group analysis will be performed on learning outcomes, time spent spelling, number of practice sessions per day, and facial expression logs over time.

### Key References

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- Stanisla Dehaene. 2010. Reading in the Brain: The New Science of How We Read. Penguin Books, New York, NY, USA.
- Min Fan, Alissa N. Antle, Maureen Hoskin, Carman Neustaedter, and Emily S. Cramer. 2017. Why Tangibility Matters: A Design Case Study of At-Risk Children Learning to Read and Spell. Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, ACM, 1805-1816.

## Design Concept

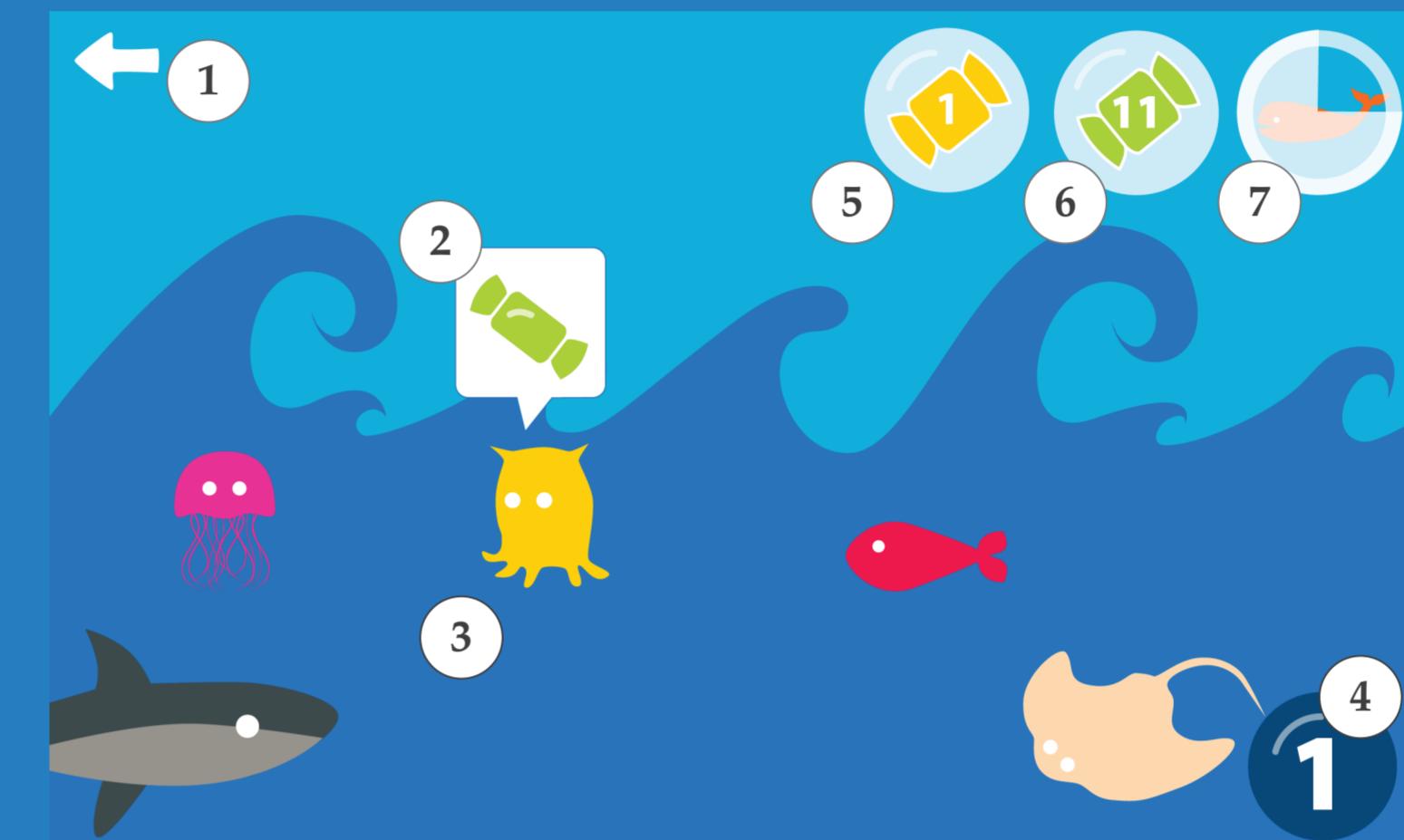
### I) Educational Spelling Application



#### Measurement tool

- 1 Empathic agent (see III)
- 2 Spelling area that supports up to 7-letter words and dynamic colour cues
- 3 Repeats the word
- 4 Provides access to a series hints
- 5 Bonus Counter
- 6 Correct-word counter
- 7 20-minute timer (provides access to the mini-game)

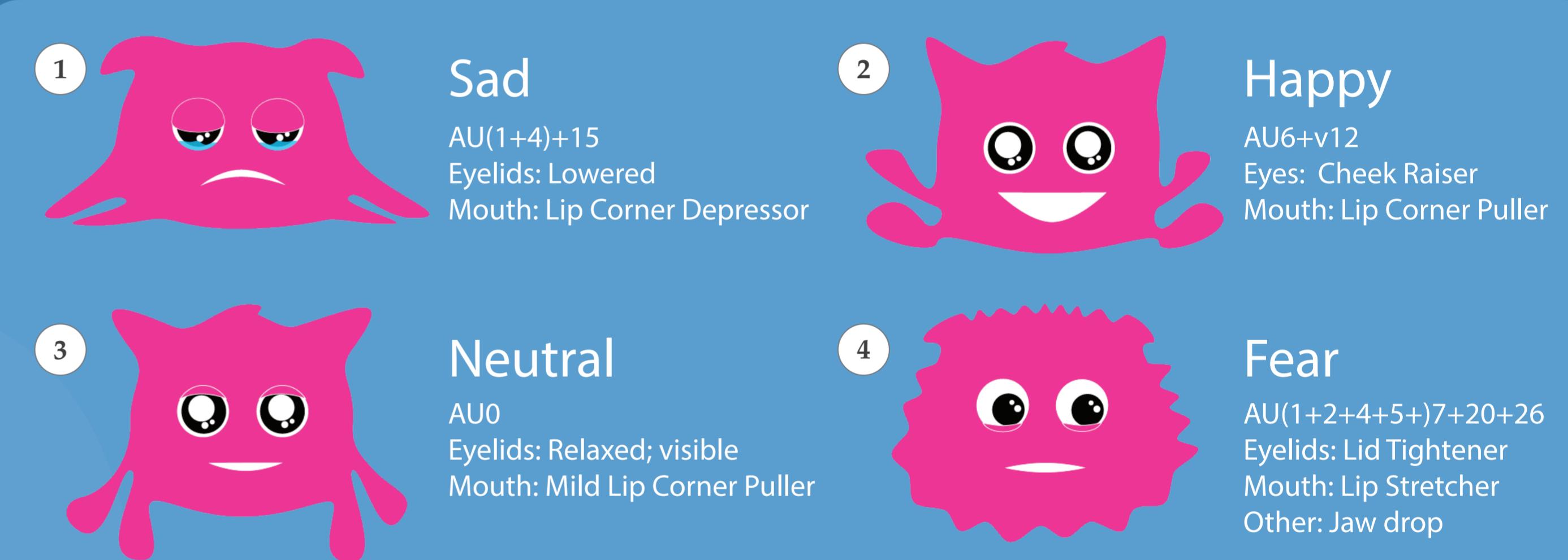
### II) Mini-Game



#### Motivational tool

- 1 Takes user back to the spelling game
- 2 Notifications when creatures are "hungry"
- 3 Creatures are earned based on time-spent in spelling app
- 4 Tracks the users level (synced with timer)
- 5 Bonus points now act to cure "ill" creatures
- 6 Correct-word points now act as "treats" to feed creatures
- 7 Timer (releases new creatures based on time spent in the spelling app)

### III) Empathic Agent



## Emotion-based Responses

### Struggling while spelling a word

Fear: Non-verbal cues directing child to incorrect letter  
Sadness: Agent tilts head  
Anger: Agent elicits fear response (2-seconds)

### Distraction and inattention

At scheduled intervals, the agent will prompt the child to return to the spelling task.

### Highly attentive

Agent animation will be reduced to breaths and eye blinks.

### Repeated mistakes

Neutral/Happy: "I know you can do it. Try again!"

Sadness: "This one is really hard. Let's figure it out together."

Disgust: "Let's try a different word!"

Anger: "Sometimes learning new things is hard. We can take a break and try again later."

## Discussion

The purpose for developing Sisu is to increase the accessibility of learning applications and provide struggling readers with the emotional and motivational support they need to overcome the hurdle of learning to spell and read outside of the classroom. We aim to discover design and implementation guidelines for affective computing and gamified elements in early childhood learning, as the open question is not whether or not empathic agents and gamification will be useful, but rather how to implement these elements effectively to make applications engaging, reduce negative emotions and enhance learning outcomes.