

# Playing, Moving and Designing with Data: Exploring Young Students' Data Literacy Skills in Embodied Classification Games

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# MOTIVATION & CONTEXT

**Data literacy** = key competence *for all* in the AI era



**Lack of** motivating & accessible **educational designs**  
for introducing **Data Literacy in K-12**



**Our goal:**

*Design and evaluate an **educational embodied game** which integrates **multimodal interaction** and **end-user development** for data classification*





# : An online tool for classification games

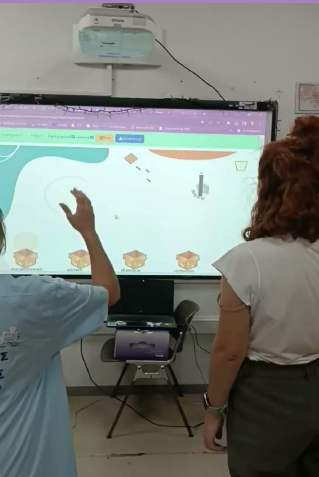


Open-source &  
web-based



Editable  
Classification  
Games

## 2 levels of user engagement



Intuitive &  
physical  
engagement  
with data

**PLAY**  
**Classify**  
**falling objects**

**Hand Tracking**  
**Voice Recognition**

**MODIFY / DESIGN**

**Block-based  
programming  
&  
Data editing**

Deeper  
engagement  
data handling &  
programming



# THEORETICAL BACKGROUND

## Data Literacy in K-12

- != Data science
- Competences: collecting, evaluating, transforming data
- Need to be included in curricula

## Constructionism

- Learning by making, tinkering, sharing
- End-user development (EUD) tools for education
- Game design = a context for engaging with complex ideas

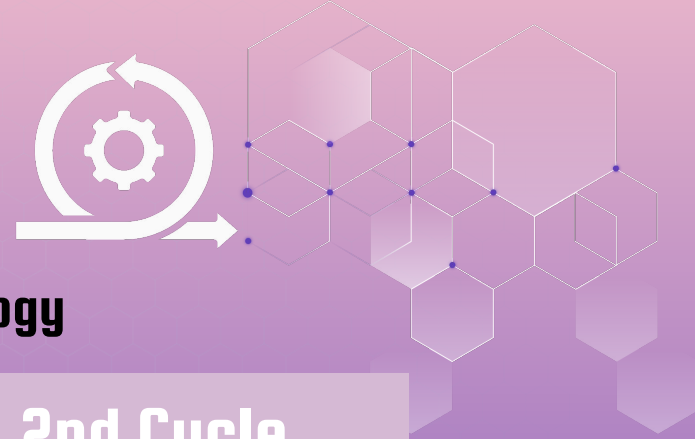
## HCI & Embodied Learning

- Embodied cognition: learning through sensorimotor action
- Gestures & voice → more natural user interfaces
- Fosters collaboration & critical reflection

# METHODOLOGY

## DESIGN-BASED RESEARCH

**Iterative, user-centered methodology**



### 1st Cycle

#### Early SorBET

- Only 1 gesture detected
- simple design mode
- 8 students in pairs aged 14-17 y.o.

### 2nd Cycle

#### Advanced SorBET

- dual-hand detection
- voice recognition
- Blockly programming custom commands
- 4 students in pairs aged 13-15 y.o.

# DBR CYCLES & INTERVENTIONS

## 1st Intervention

Play - Edit - Share the  
“App Game”

## 2nd Intervention

Play “How Long for Degradation”  
& “Fruit Ninja” games

Remix- Extend & Share

Iterative  
refinement

01

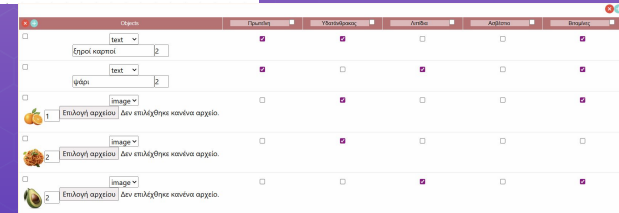
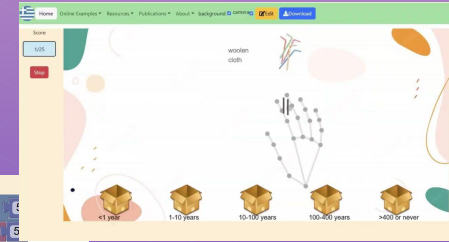
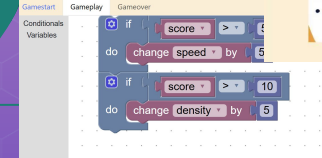
03

02

- Gameplay observations & logs
- Discussions & interviews
- Student-created artifacts

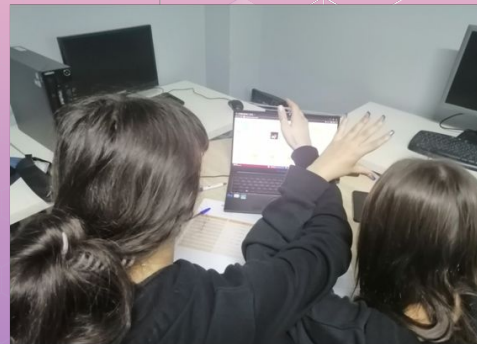
## Data Analysis

Qualitative Analysis  
Recommendations

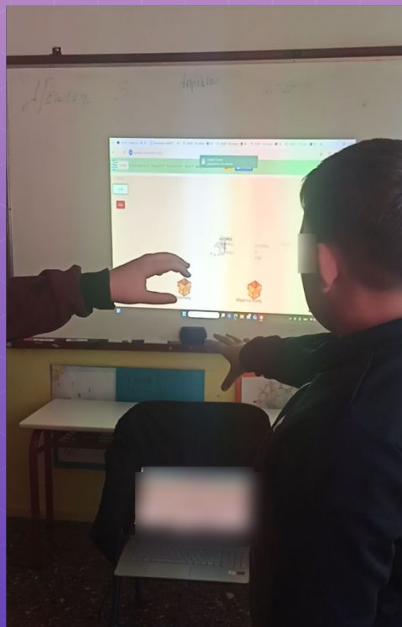




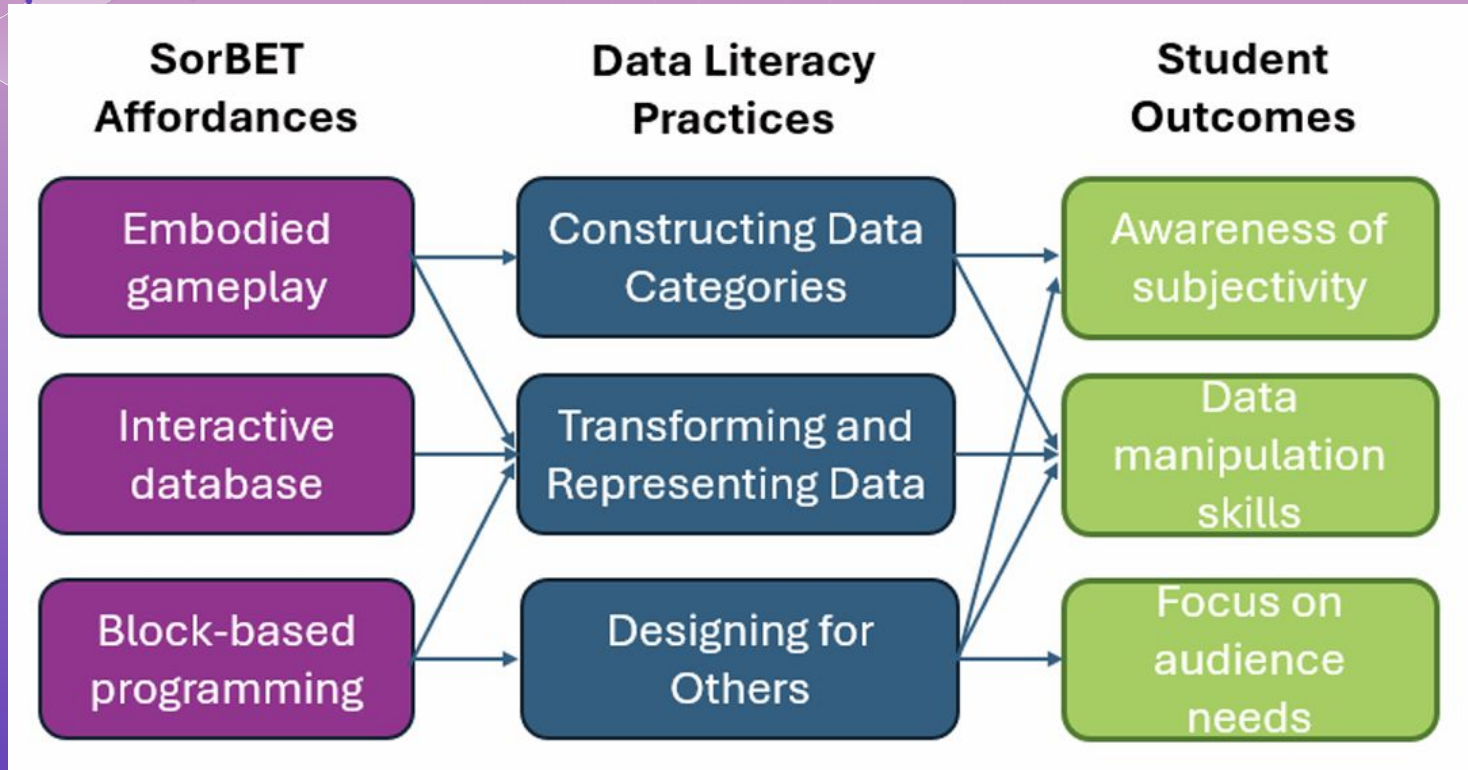
## 1st Intervention



## 2nd Intervention



# FINDINGS: Mapping SorBET's Affordances to Data Literacy Practices and Student Outcomes







# FINDINGS BASED ON TOOL AFFORDANCES

## EMBODIMENT

- Dual-hand gestures fostered **dynamic collaboration**
- Urged **discussions** about **data validity**
- Shift from helper-player → **co-players**
- Voice commands = **playful + strategic** layer



# FINDINGS BASED ON TOOL AFFORDANCES

## END-USER DEVELOPMENT

### → Negotiating Classifications

- ◆ Students **questioned category boundaries**
- ◆ From “fixed truths” → “**contestable processes**”

### → Designing for others

- ◆ Showed awareness of **dataset usability & clarity**
- ◆ From self-centered → **audience-aware** design
- ◆ **Simplifying** datasets, adjusting labels for **clarity**
- ◆ Emergence of **ethical data design practices**

## Example Dialogue (Cycle 1 – AppGame)

**Student A:**

*“Why is Instagram **only** in Communication? It’s also for photos, videos... actually **for everything!**”*

**Student B**

*“Yeah, and Zoom should be under Online Teaching, **that’s why we mostly use it for,** not just Communication. We should **create a new category** for that.”*

## Example Dialogue (Cycle 2 – Degradation Game)

**Student A:**

*“This plastic bottle should go in **Never.**”*

**Student B:**

*(quickly drags it into “30–200 years”) “No, it goes here!”*

**Student A:**

*“Wait, but **aren’t plastics forever?**”*

**Student B:**

*“**Do not generalise!** Plastic bottles are made with thinner plastic now. **The game says differently, look!**”*

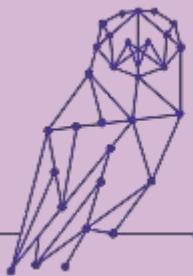


# DISCUSSION

# & FUTURE WORK

- Data literacy as active, social, embodied practice(?)
- Enhance critical view of data and expression of ideas
- Larger populations
- Out - of - school settings e.g. classifying data in museums
- Curriculum alignment

**Key contribution: treating classification as designable & contestable**



# CHIGREECE CHAPTER

Connect. Engage. Inspire.

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# THANK YOU

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