Tangible and Embodied Algebra Games

Master‘s Project Digital Media

Winter Term 2018/19

Project Supervisors

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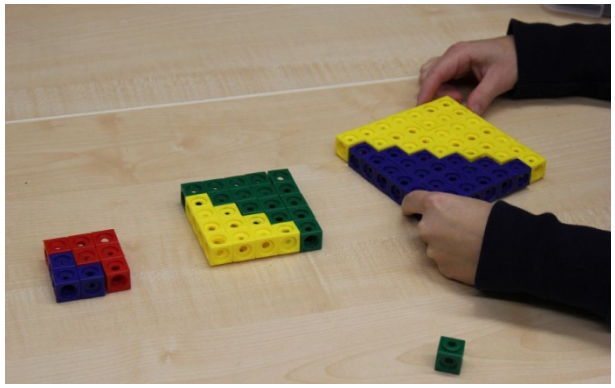
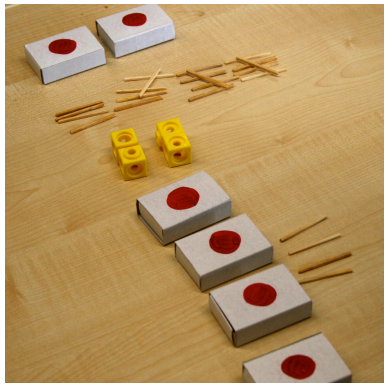
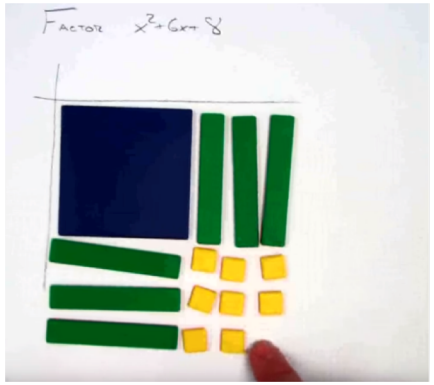
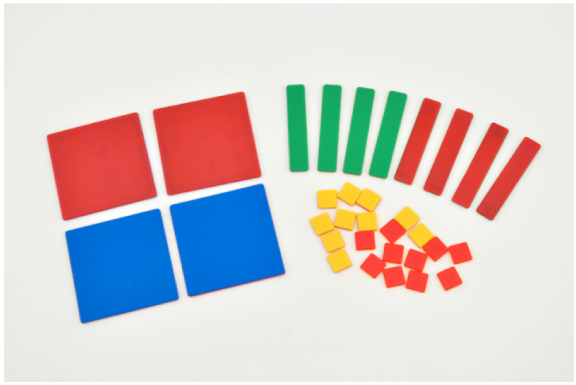
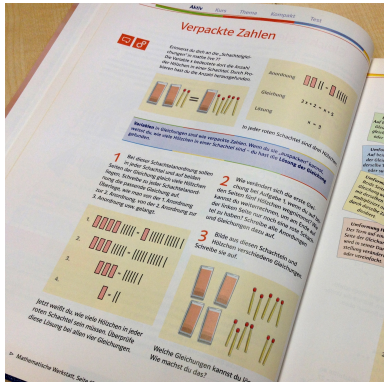
Motivation: Multimodal Learning

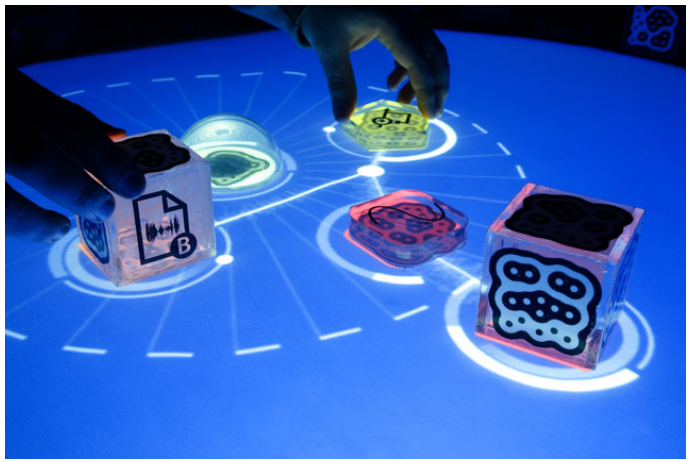
- e.g. Learning Algebra with Physical Objects



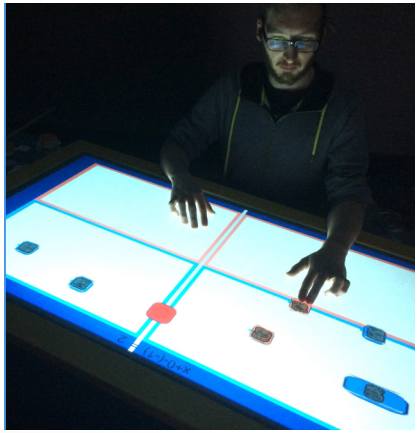



Using Tangibles & the Body for Interaction



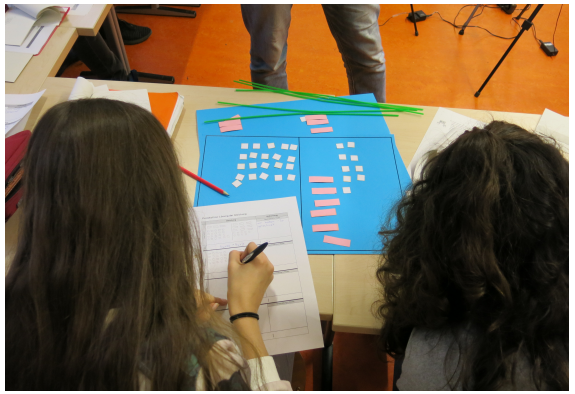
Topic: Tangible and Embodied Algebra Games

- Tangible and Embodied Algebra Games have the potential to
  - make algebra learning more fun!
  - to allow new ways of learning through multimodal interaction
  - support group interaction and peer learning
  - allow guidance and error tracking
  - strengthen the understanding of math



Application Areas / Target Groups

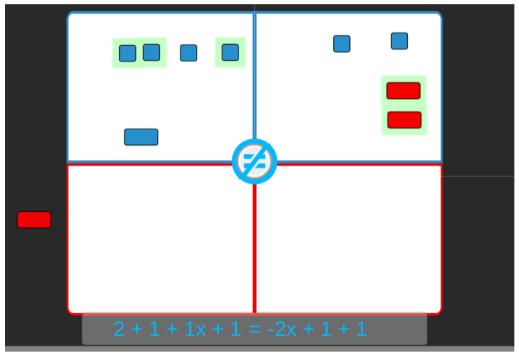
- Application Area:
  - Algebra Learning, e.g. Solving Equations
- Target Groups:
  - e.g.:
  - Pupils (in the class OR at home)
  - Students in the first terms
  - People who do not like math

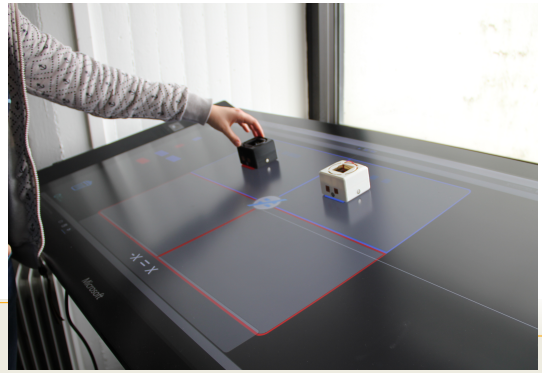


Project Focus: Multimodal Algebra Learning

Three main aspects / areas:

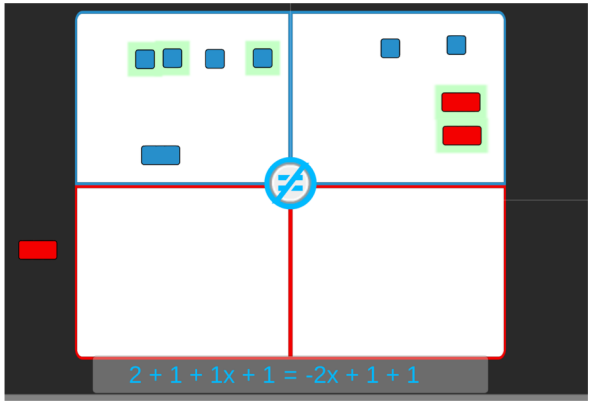
- Games that motivate the users and provide direct feedback
  - Human-centered design
- New tangible devices and embodied interaction
  - Enhance the detection of errors during the execution of the exercises
- Adapt the games to the users needs
  - Based on the student's knowledge
  - Manual / Semi-Automatic / Automatic Adaptation





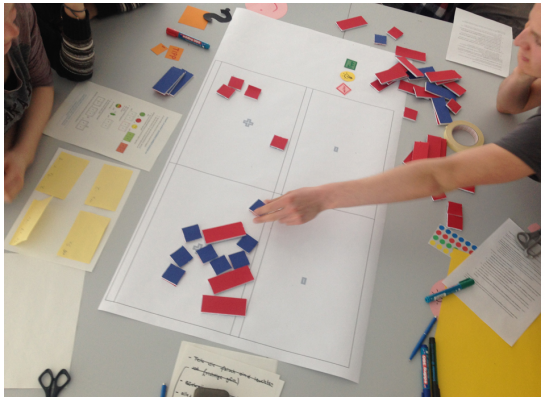
Research Questions

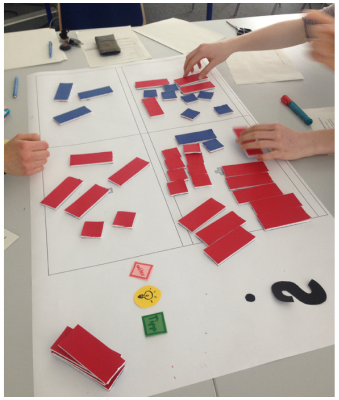
- Beyond Gamification: Generative Serious Games
  - Non-repetitive gameplay without big budgets
- Novel interaction techniques
- Novel learning experiences
- Next-generation tools for teachers
  - Direct feedback / interaction possibilities
  - Body-based exercise recording

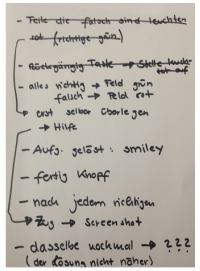


Human-Centered Design Approach

- Early on: Meetings and discussions with researchers in math education, teachers, math students, or pupils.
- Fast, iterative prototyping
- Regular workshops
- Many small focus group evaluations for iterating the design
- Bigger and controlled evaluations for scientific questions







Preparatory Course

"Entertainment Computing"

- Lecture (6 ECTS)
- Summer term 2018
- Theoretical and practical approach
- Mandatory for all project members
- Dates & times TBA soon on dm.tzi.de/teaching

Master's Project

"Tangible and Embodied Algebra Games"

- Full-time (30 ECTS) winter term 2018/19
- 4 days a week, Oct 18 – March 19
- Attendance expected at least 3 days a week
- Agile model (SCRUM)

Requirements

- Commitment
- Enthusiasm for topic area
  - Computer Games / Serious Games
  - Interaction and Interface Design
  - Machine Learning / AI
  - Physical Computing / Digital Fabrication / Arduino
  - Human-Centered Design Methodology / Evaluation
- Creativity
- Work by scientific method
- Willing to research, design, code, experiment

Learning Objectives

- Human-centered research & development
- Human-computer interaction, interaction design, natural user interfaces
- Computer Game Technology, AI & ML Techniques
- Physical Computing, Digital Fabrication