Group 6: The Wearable Learning Platform

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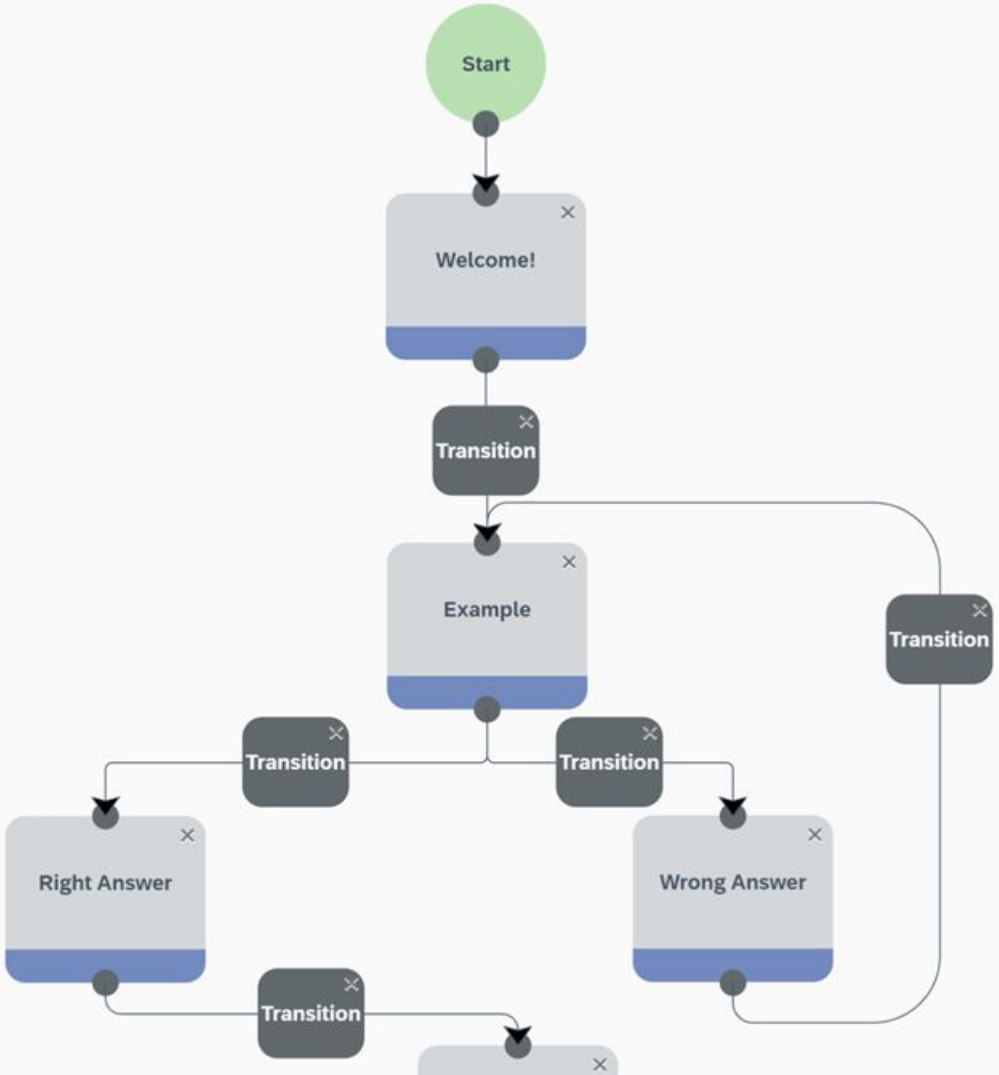
Games For Learning

- Game-based learning is great way to learn a new subject, collaborate in groups, and increase participation among students
- But what about having students design their own games?
  - Students can build on and challenge their existing knowledge
  - Make connections between their ideas and the real world
  - Problem posing
  - Practice **Computational Thinking (CT)**

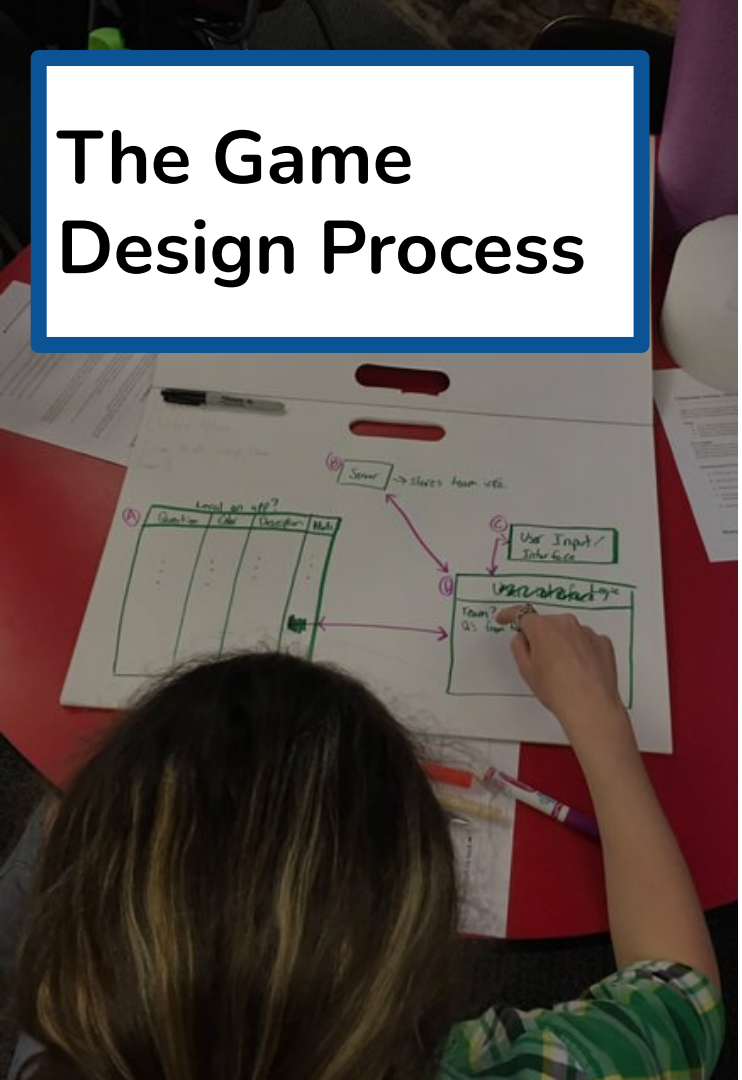
The Wearable Learning Platform

Wearable Learning Platform: What is it?

- Web-based app for game creation
- Teaches math and CT skills
- Game creation: Finite State Machines (FSMs)
- Create, manage, and play physically active and social multiplayer games
- Do not need any programming experience



The Game Design Process



- First play games on WL, then design their own
- Express their game design ideas as drawings and narrations on booklets
- **“state”** boxes represent game screens on a phone
- Arrows or **“transitions”** represent inputs to transition from one state to another

The Game Design Process (cont.)

- **Game Editors**
  - Program the games using WL's drag-and-drop, FSM-based programming language
  - Run and debug the games
- **Game Players**
  - Play the games and reinforce their subject knowledge
- **Game Managers**
  - Browse the platform to find any open-access games complete with instructions and materials
  - Choose and start games from any device with WiFi access
  - Generate a PIN that can be used by the entire classroom

Identifying Characteristics in Game Design

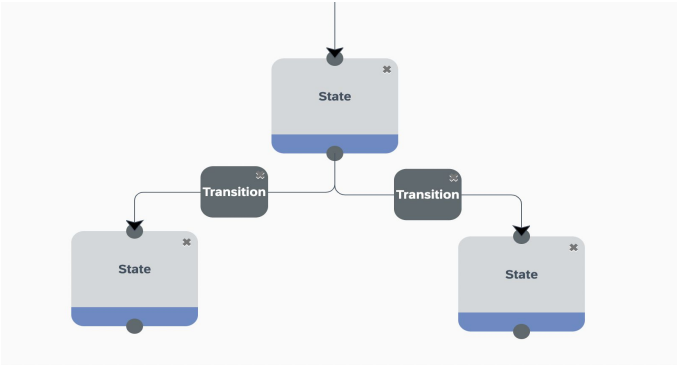
- Games are stored in JSON representation
- Previously, researchers made a coding guide and a coding scheme to analyze booklets
- Purpose: to use the qualitative analysis to further understand students' processes of CT development
- We want to see what domains in the coding scheme can be extracted from the JSON data

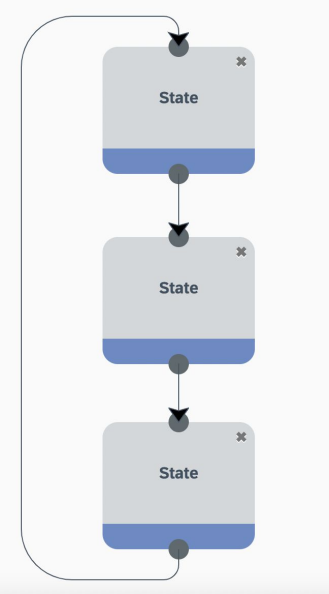
Research Questions

1. How can we automate the data analysis process?
2. What kinds of game-design characteristics can we extract from the FSM database that go in accordance with the coding manual?
3. How can we extract qualitative information from the FSM database?

Proposed Solution

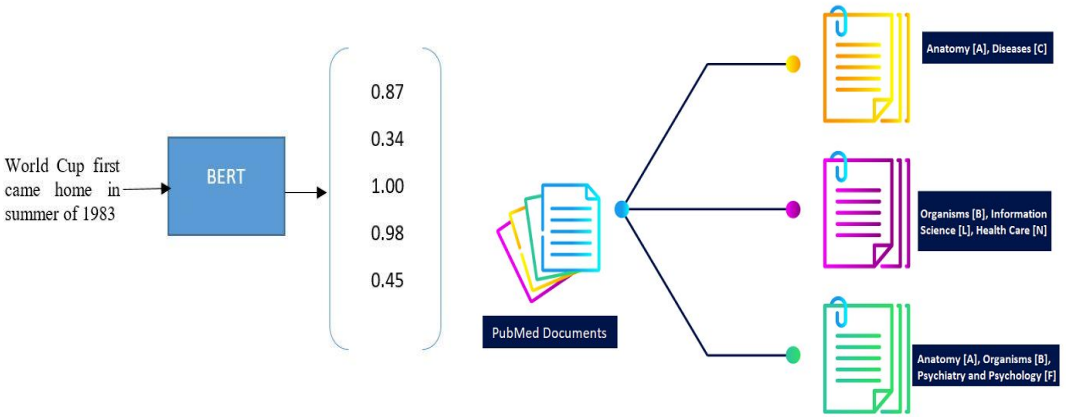
- Some attributes are names, state count, state ID, computational concepts (loops, conditionals)
- Those attributes can be analyzed using a program... (counting, finding)





Proposed Solution

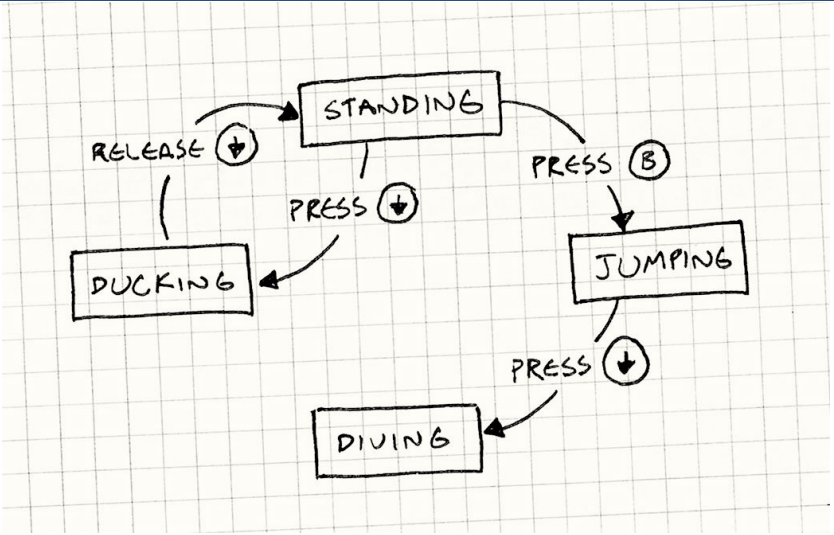
- Using BERT, a machine learning model, to extract special keywords from the description text
- Using a multi-label text classification model to determine the features of the games

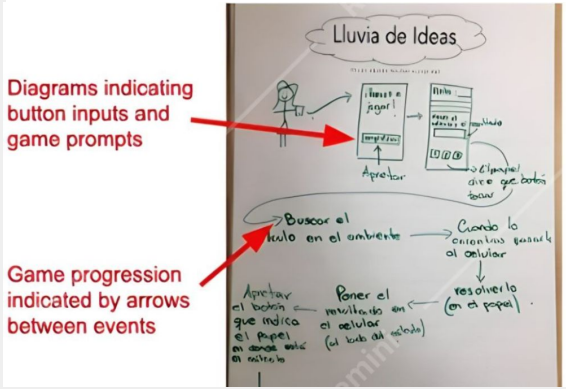


Evaluation Plan

1. Manual Analysis
2. Machine Learning Model
3. Further Analysis

Manual Analysis





Diagrams indicating button inputs and game prompts

Game progression indicated by arrows between events

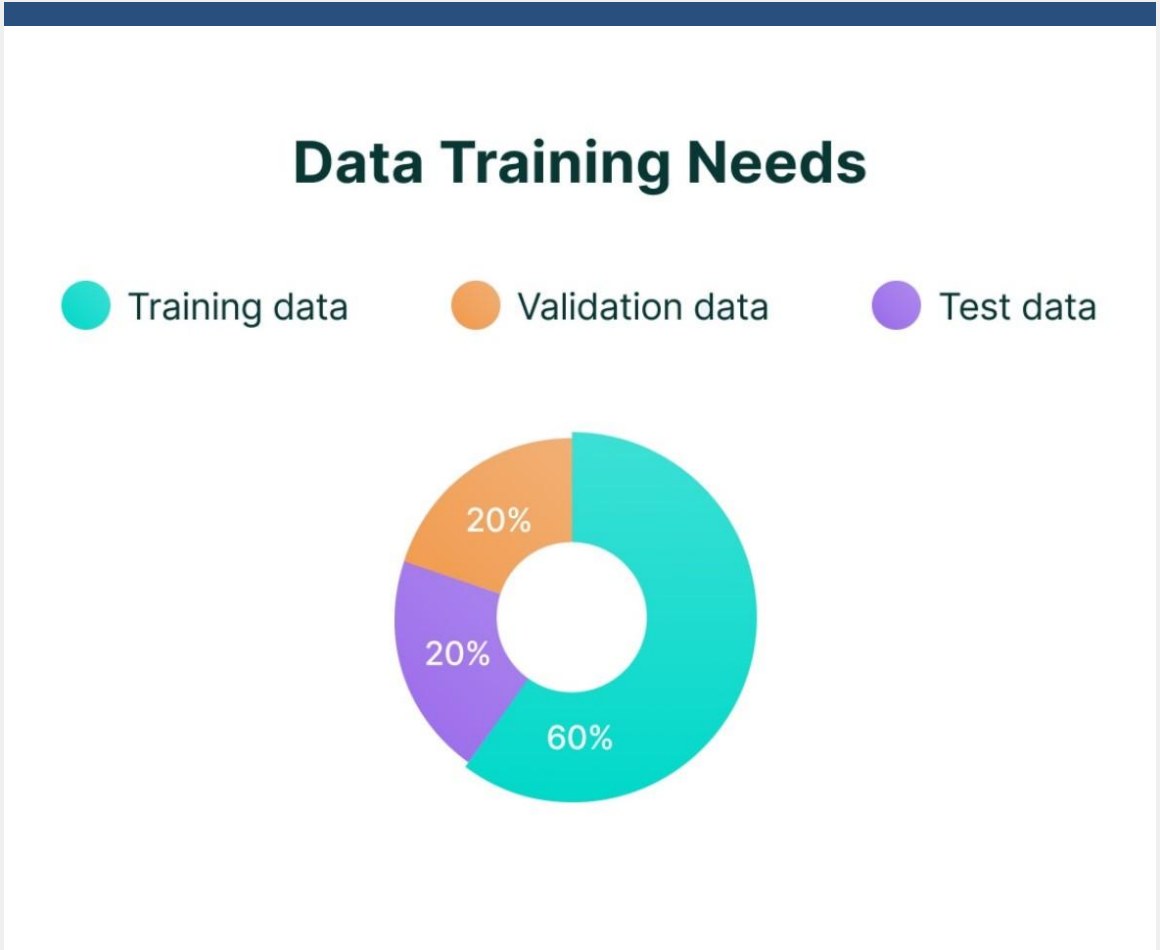
Boxes/circles indicate **states**, arrows indicate **transitions**

This FSM diagram indicates "correct" and "incorrect" states after a question

Manually Analysis

- **Extracting keywords** from text
- Put them into **categories**: Geometry characteristic, Math operation, etc.
- **Ground truth dataset** for the classification machine learning model

Machine Learning Model



Machine Learning model

- **Validate the accuracy** by cross checking with manually extracted data
- **The higher** the accuracy - **the better** the classification model

Further Analysis

- **Automate** the process of classifying children's game design!
- **Shared aspects** in children's computational thinking: Process Difficulty, Mathematics Utilization, Pictorial Representation, etc.
- Understand human even more!

Thank you for listening!