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2023

Developing a Culturally-Responsive Coding Scheme for Game Design

Sai Gattupalli
University of Massachusetts Amherst

Developing a Culturally-Responsive Coding Scheme for Game Design

Comprehensive Defence Presentation

11/29/2023

Scholar:
Sai Gattupalli
STEM Learning Technologies PhD Candidate
Math, Science and Learning Technologies (MSLT)
Department of Teacher Education and Curriculum Studies (TECS)

Committee Chair:
Ivon Arroyo, Ed.D.
Committee Members:
Beverly Woolf, Ph.D., Ed.D.
Torrey Trust, Ph.D.
Betsy McEneaney, Ph.D.
Francisco Castro-Norwood, Ph.D.

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WearableLearning.org

ALT Lab
Advanced Learning Technologies Lab

Outline

Sections covered (15min):

Research Questions

Methodology

Data Sources

Analyses and Results

Introduce Consolidated Coding Scheme

Discussion and Future Work
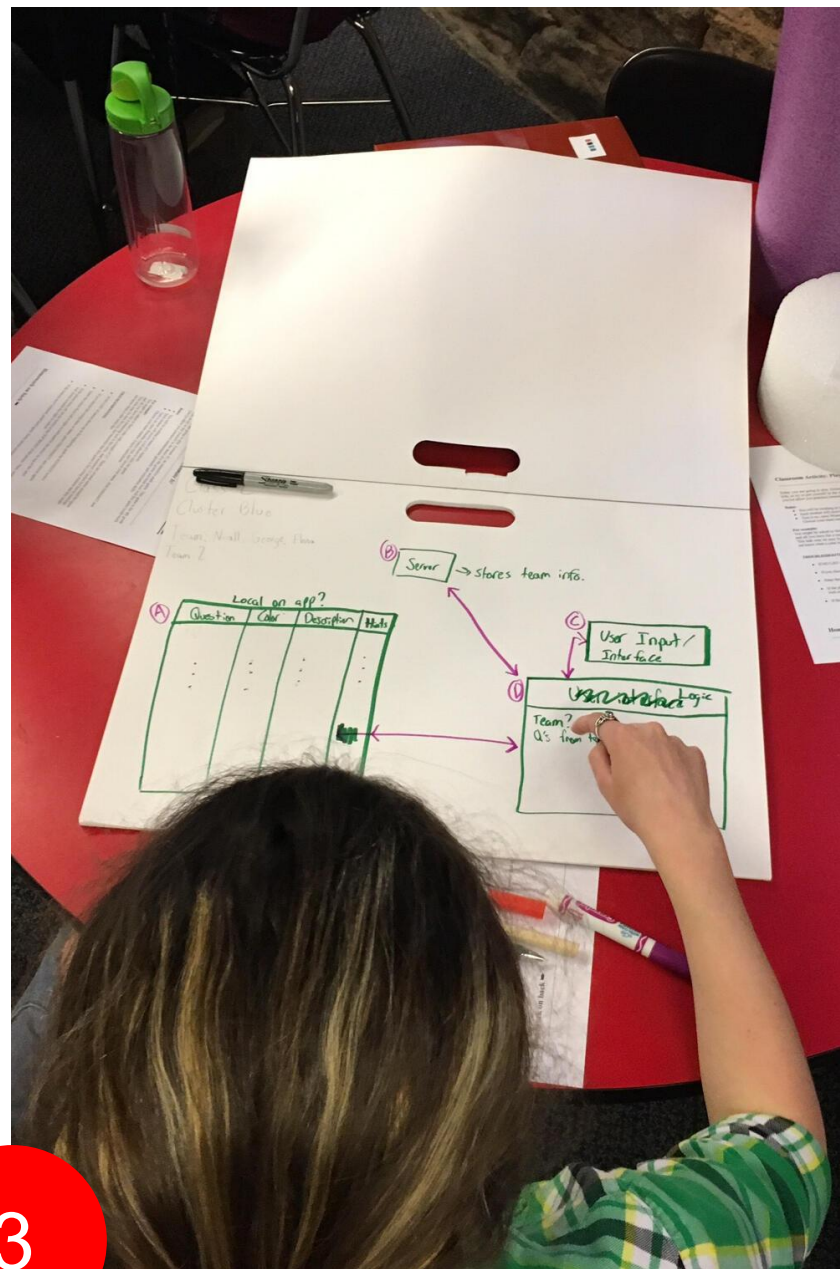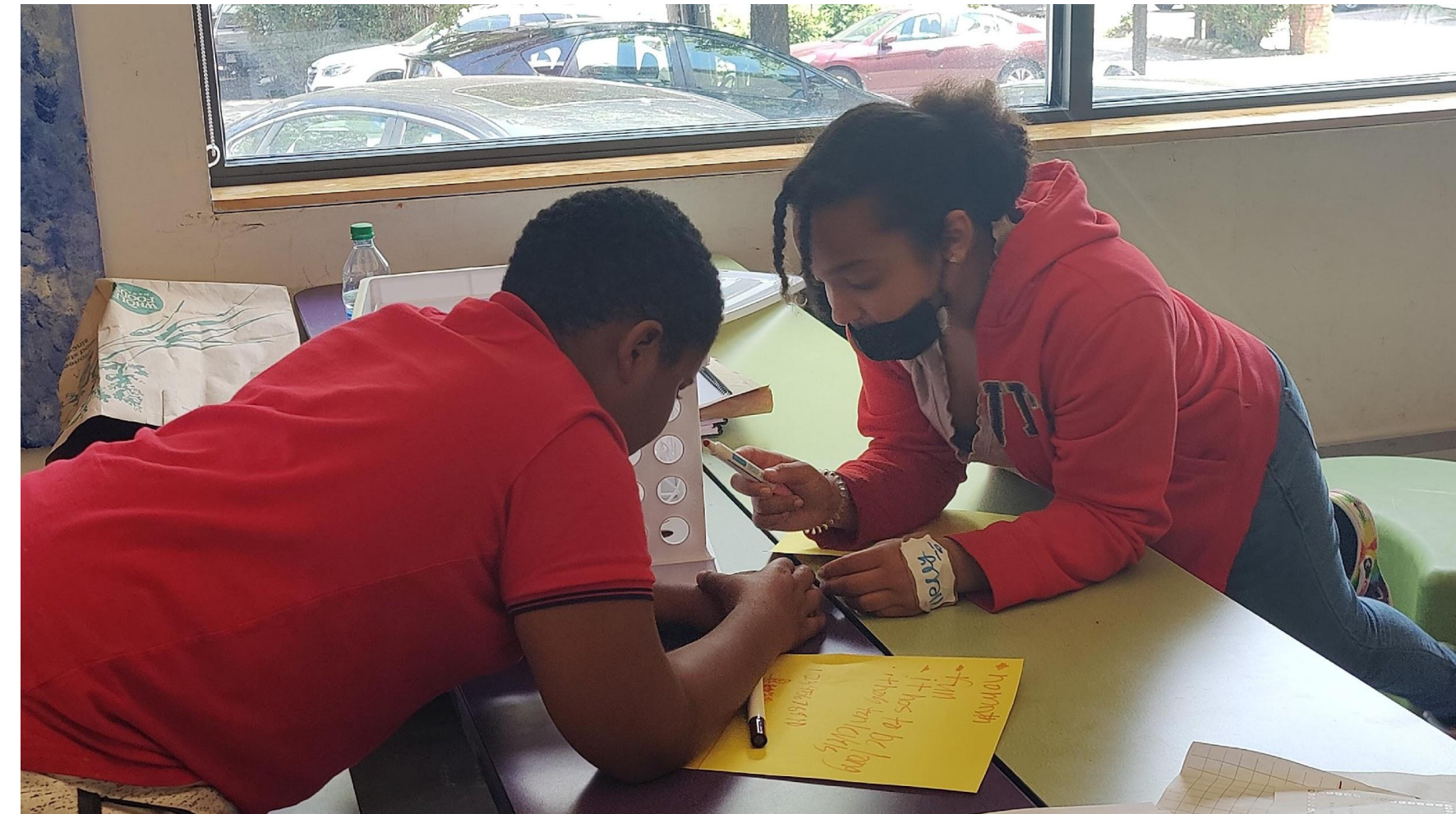
Sections not covered:

Literature review

WearableLearning edtech platform
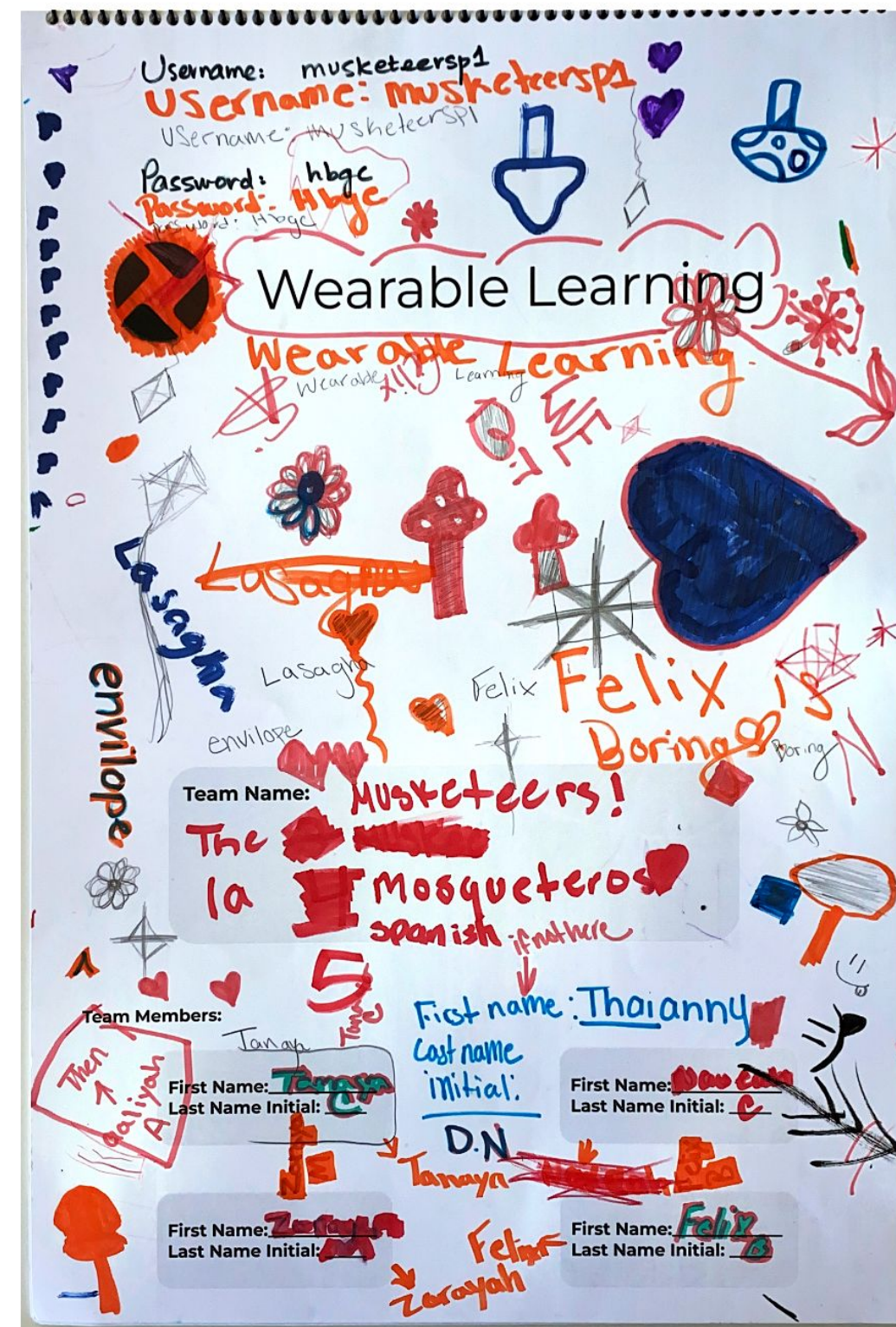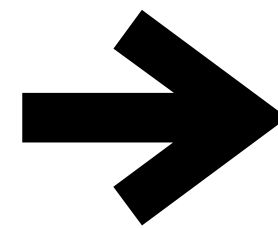
The WL 6-stage Computing Curriculum

Limitations

Learners engaged in WL Game Design Process. **Top left**: Holyoke, MA. **Top right**: Boston, MA. **Bottom left**: Cordoba, Argentina. **Bottom right**: Jammikunta, India.

Blank booklet

US
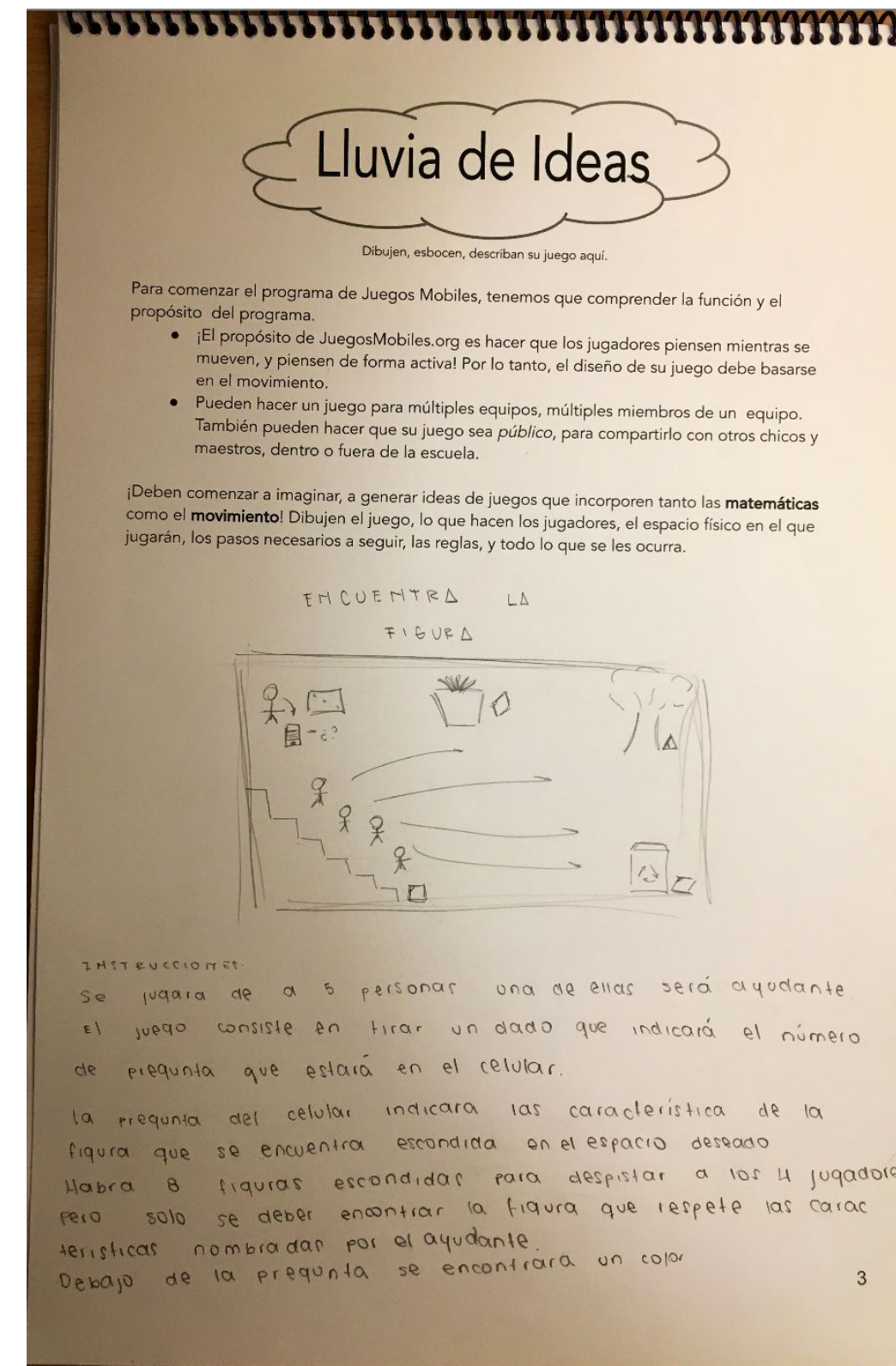
Argentina
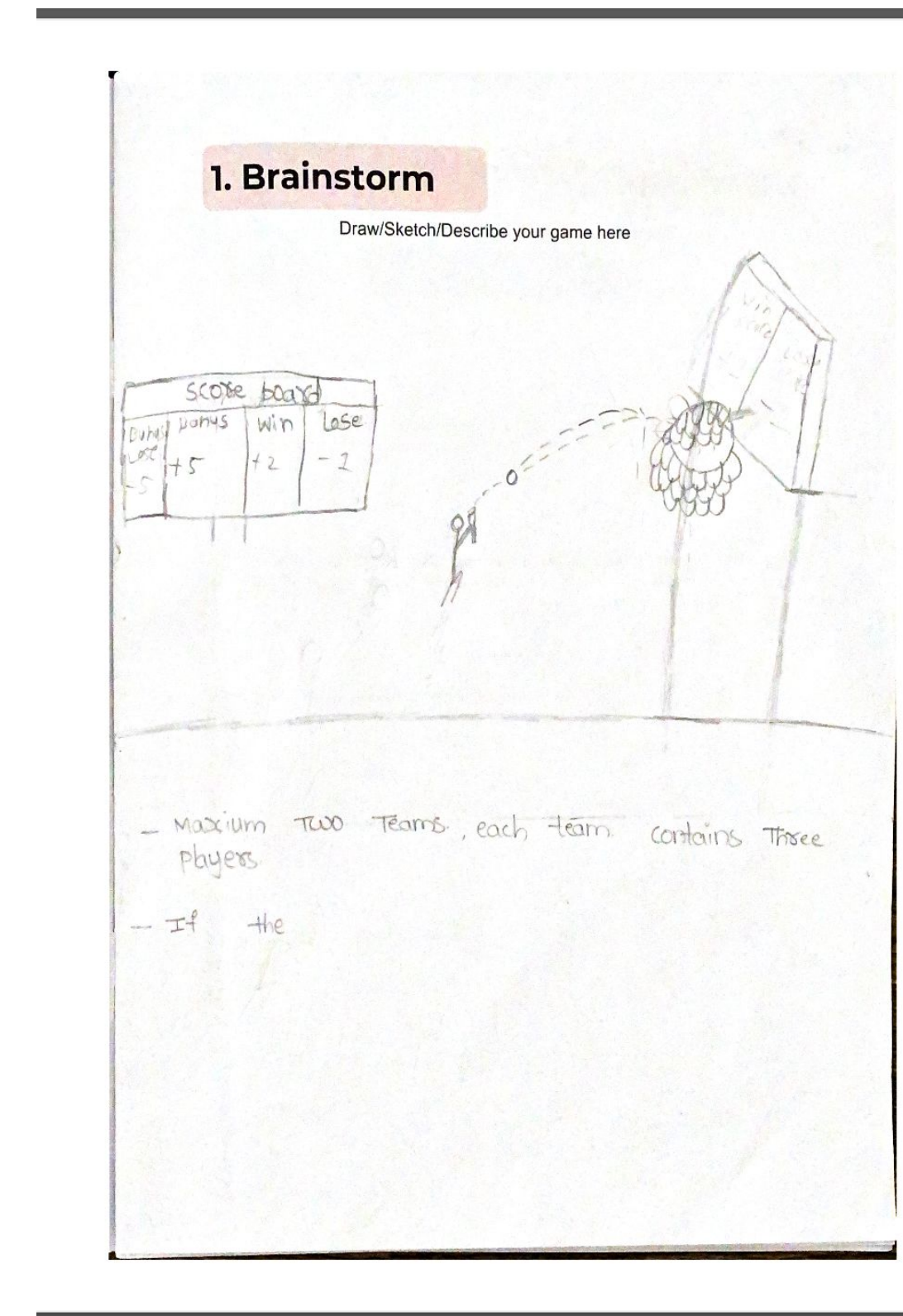
India

Full artifact dataset available on request.

Culture and Cultural Signatures

is the total sum of

```
Values
```

```
Beliefs
```

```
Aesthetic Standards
```

```
Culture
(Pusch, 1979)
```

```
Linguistic Expressions
```

```
Patterns of Thinking
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Behavioral Norms
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Styles of Communication
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```
Ways of Living
```
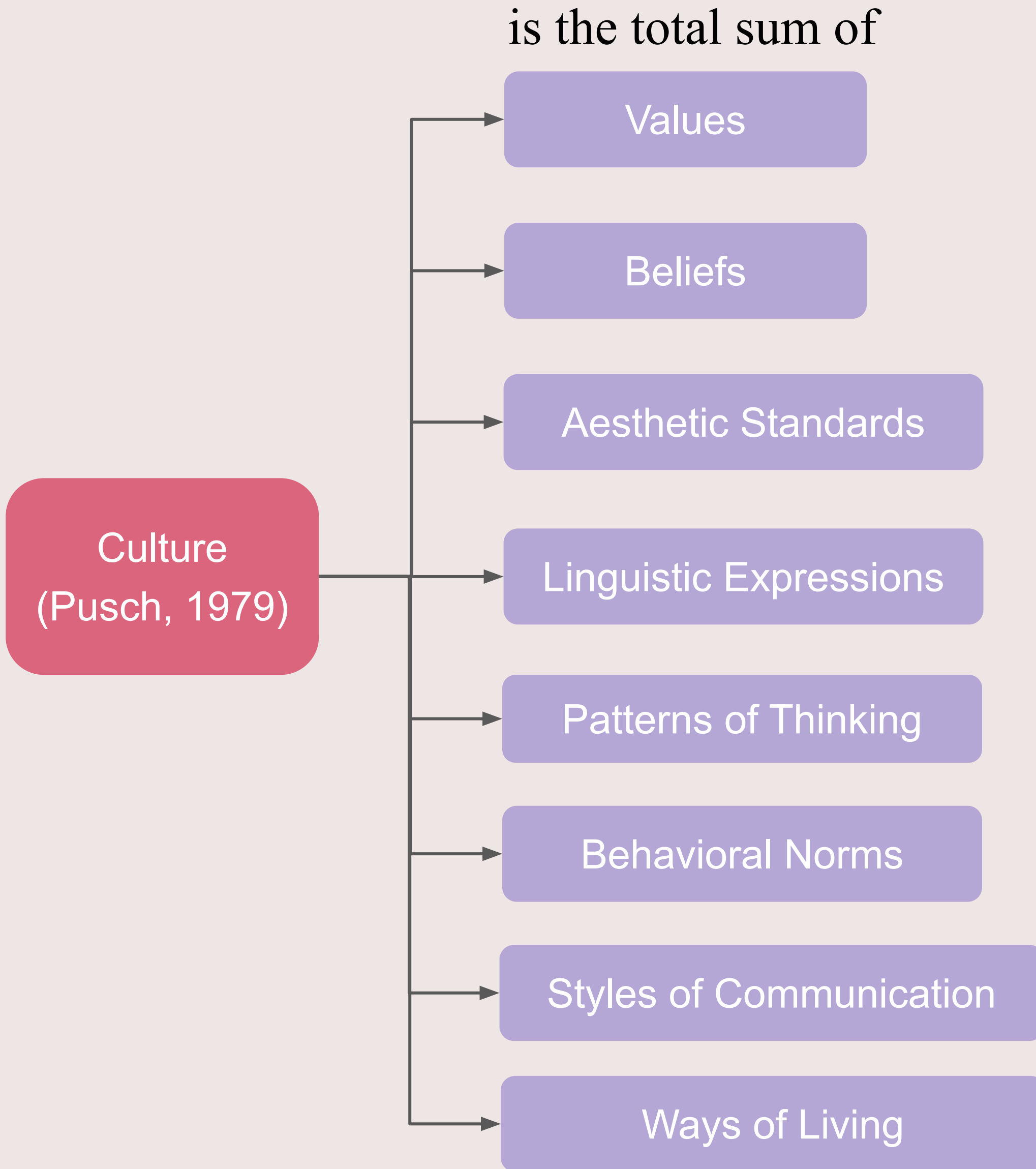
The 8-dimensions of *Culture*

Cultural signatures refer to the unique expressions, artifacts, or practices that reflect the cultural identity, values, and perspectives of an individual or group. They are observable manifestations of culture revealed consciously or unconsciously.

Cultural signatures are "socially meaningful" (Bednar et al., 2010, p. 408)

In this work, *cultural signatures* describe identifiable **traces** of students' cultural backgrounds, experiences, and identities reflected in the WL game design artifacts.

Research Question

This research seeks to advance culturally-responsive computing education (Eglash et al., 2013) by creating an instrument to systematically analyze manifestations of students' cultural contexts within the collaborative artifacts they produce using the WL curriculum learning activities. With an aim to develop an analytical "tool" to identify, categorize, describe and study *cultural signatures* in WL game design *artifacts*, the RQ becomes:

RQ: How can Pusch's seminal framework of cultural dimensions inform systematic analysis methodology to decode students' localized cultural contexts, worlds views, and self-conceptions reflected through their collaborative game designs using the WearableLearning education technology across 3 countries?

Methodology

- **Qualitative grounded theory** approach

- Similar to **Cultural Awareness Scale (CAS)** and the **Cultural Competence Assessment Scale (CCAS)** which are instruments to help instructors gauge culture (Kumlien et al., 2020; Campinha-Bacote, 2002)

- Conduct **systematic investigation** of cultural representations in *game design artifacts* using Pusch's comprehensive multicultural education framework, which encompasses **8 cultural dimensions**.

- Uniquely concentrates on *cultural signatures* manifested in physical booklet artifacts

- Pusch's framework provides **inclusion criteria** for coding WL *cultural signatures*; acts **as rubric**

- **Abductive approach** utilizing both **deductive** and **inductive** strategies in tandem enables new theoretical insights to **emerge organically** from the data while **also guided** by existing **constructs** (Fereday & Muir-Cochrane 2006)

- Inductive - aimed at **building theories from data**

- Deductive lens **anchors a priori facets** (i.e. Pusch's predefined cultural categories as an anchor)

- Emergent understanding of culture's role from visible evidence in WL *artifacts*

- Cultural categories induced from student artifacts are catalogued in a comprehensive coding sheet repository detailing identified markers within work samples, here

Definitions from Literature and Inclusion Criteria for Coding

```
Culture
(Pusch, 1978)
```

Values — • Represents traditional symbols, activities, objects, local sports, etc.

Beliefs — • Portrayal of cultural principles and ideologies, including importance/presence of family, individualism vs collectivism, collaboration, competition, activities promoting values, etc.

Aesthetic Standards — • Includes cultural visuals, characters, decorations, emoji designs, portrayals of beauty, etc.

Linguistic Expressions — • Usage of local idioms, phrases, dialects

Patterns of Thinking — • Reflects problem-solving approaches, hint systems, encouragement cues, other game play characteristics

Behavioral Norms — • Depictions of roles based on gender, social rules, religion

Styles of Communication — • Use culturally specific language, gestures

Ways of Living — • Overlaps w/ *Values* and *Beliefs*; Elements of daily life, sports, activities, or customs

Participants and Data Collection

- Table 1 provides overview of key details for 3 countries

- Total participants N= 257; middle school kids; in teams of 4 to 5

- From 3 different countries:
  - Argentina: 3 private schools from Cordoba
 - India: 1 public school from Jammikunta and
  - US: Boys and Girls Clubs from Holyoke and Boston

- Same WL computing curriculum was administered at all 3 sites

- As part of curriculum activities, learners design mobile math games by writing and drawing on artifacts (i.e. paper booklets)

- Data collection total artifacts = 68.

- Random sample of 8 *artifacts*, from each country

- n=24 artifacts become data sources

- Unit of analysis is the booklet

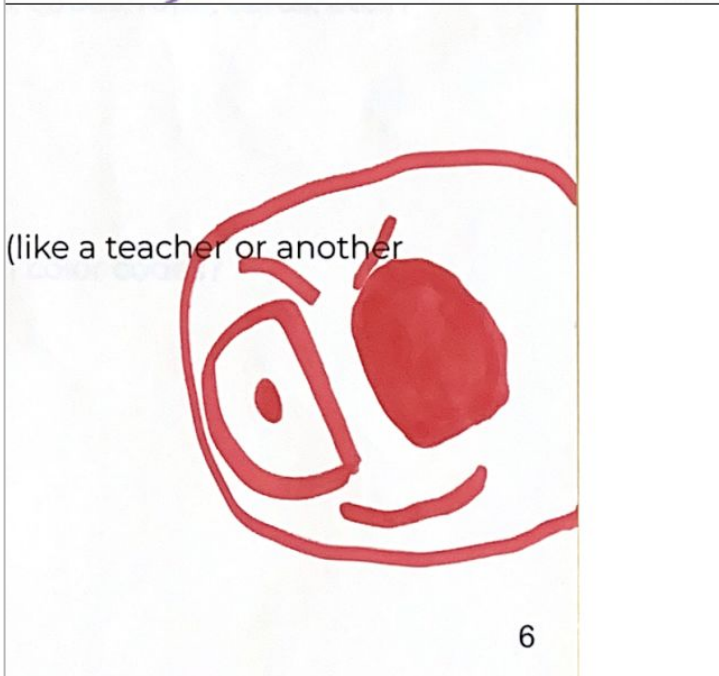| Nationality	India	US	Argentina
Grades	6-7	5-8	6-7
Setting	Classroom	Afterschool	Classroom
Participant Count	43 participants (23 boys, 20 girls)	61 participants (25 Boston, 36 Holyoke; gender N/A)	153 (gender N/A)
Number of Teams (unit of analysis)	13	15	40
Student teacher ratio	1:60	1:15	1:30
Medium of instruction	Telugu, English, Hindi, Urdu	English	Spanish and English
Language of WL Curricular Booklet	Telugu and English	English	Spanish
Economics	Parent income approximately $55-$95/month	N/A	N/A
Edtech	2 laptops per school, 1 STEM tinkering lab per school	1 laptop per child, furnished STEM lab, media production and video game studio.	N/A

Table 1 : Participant demographics

Data Sources
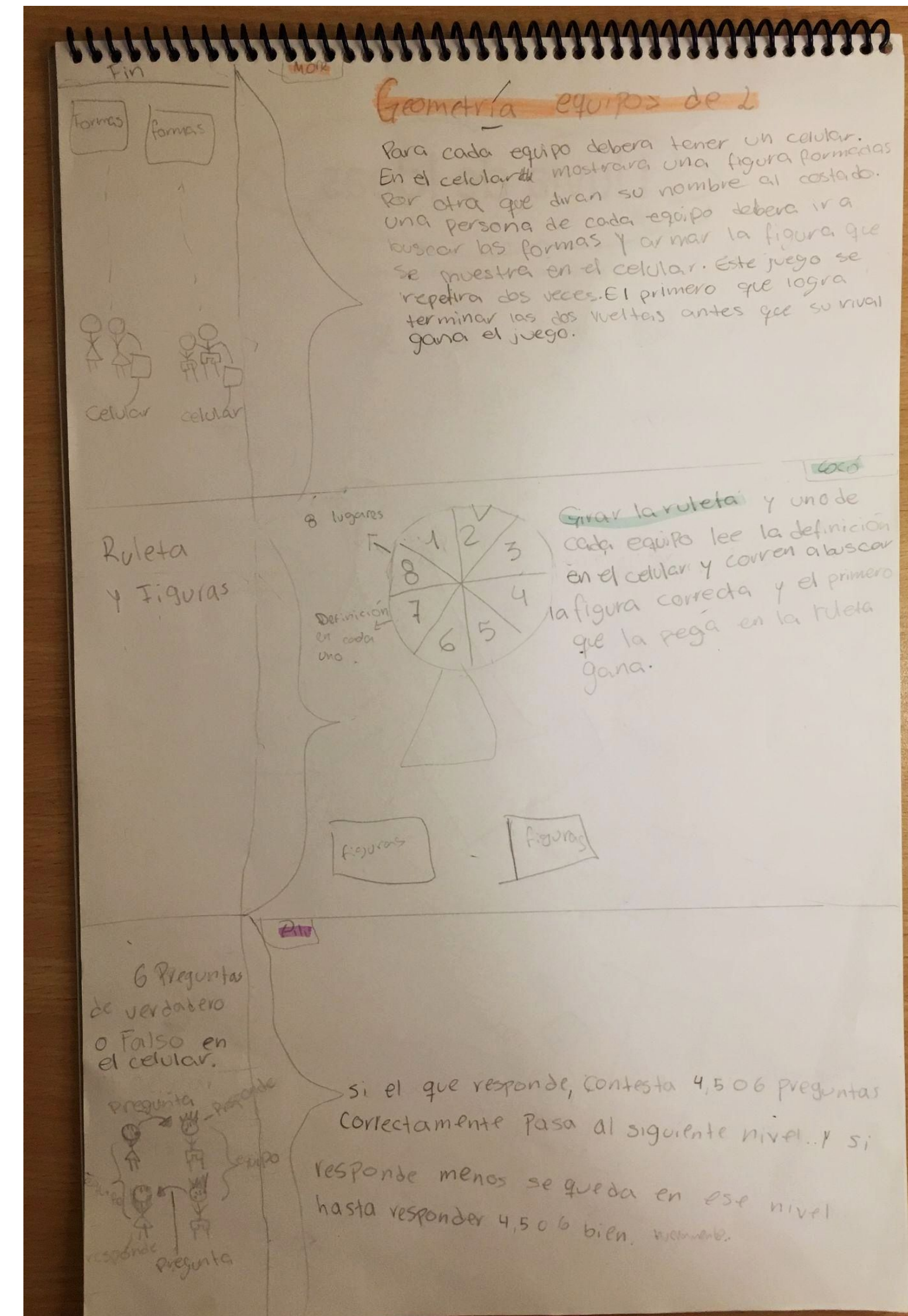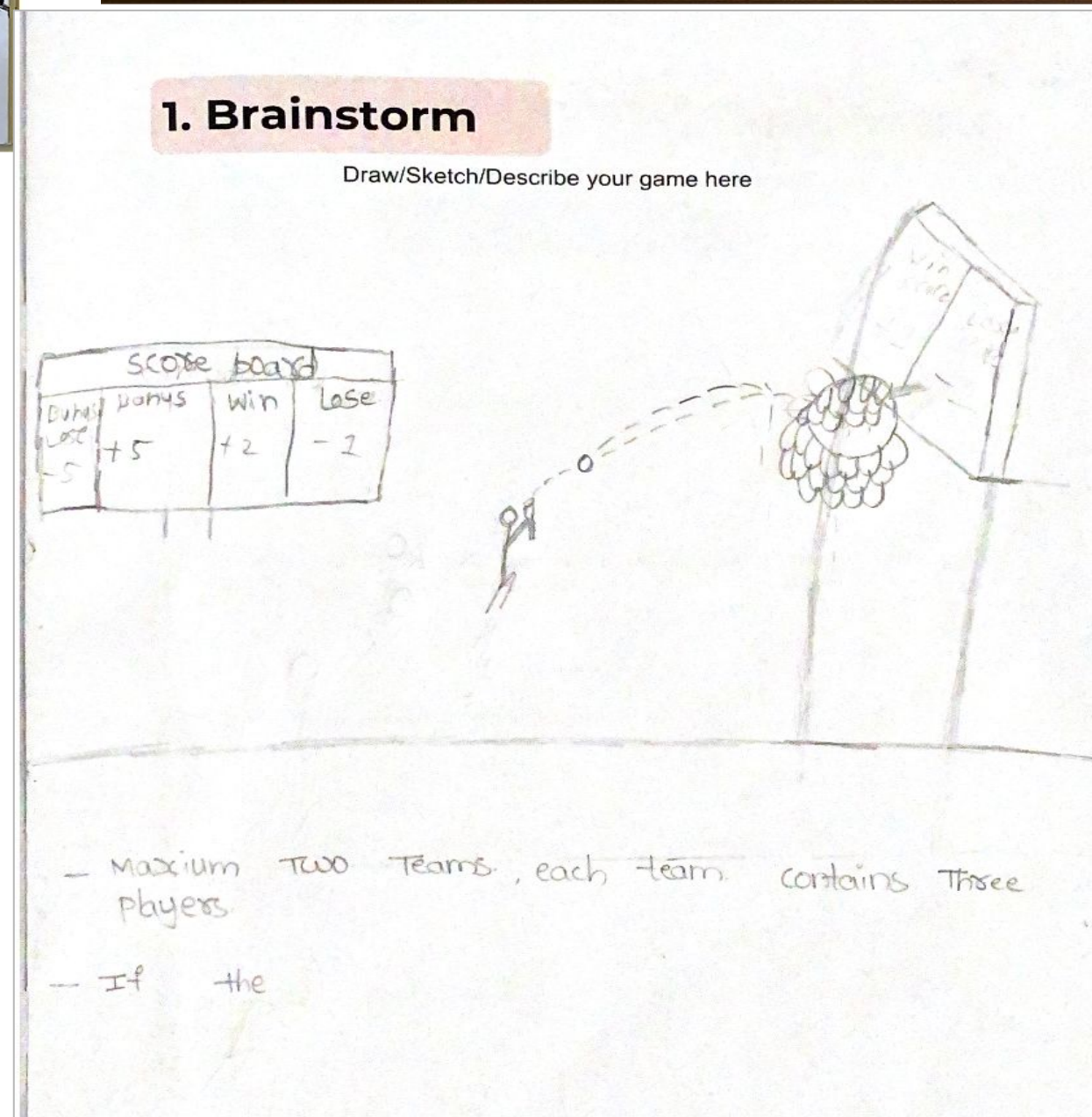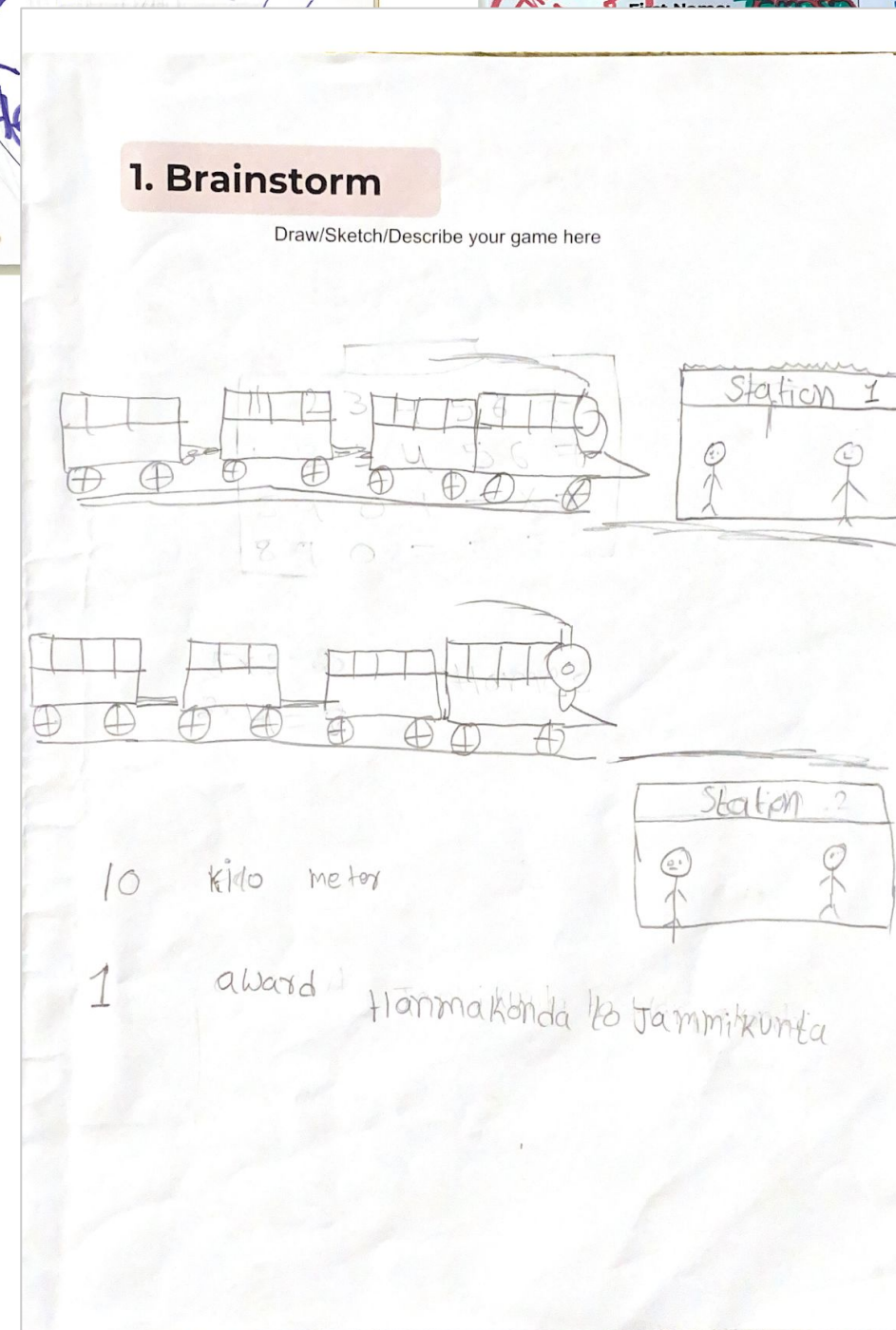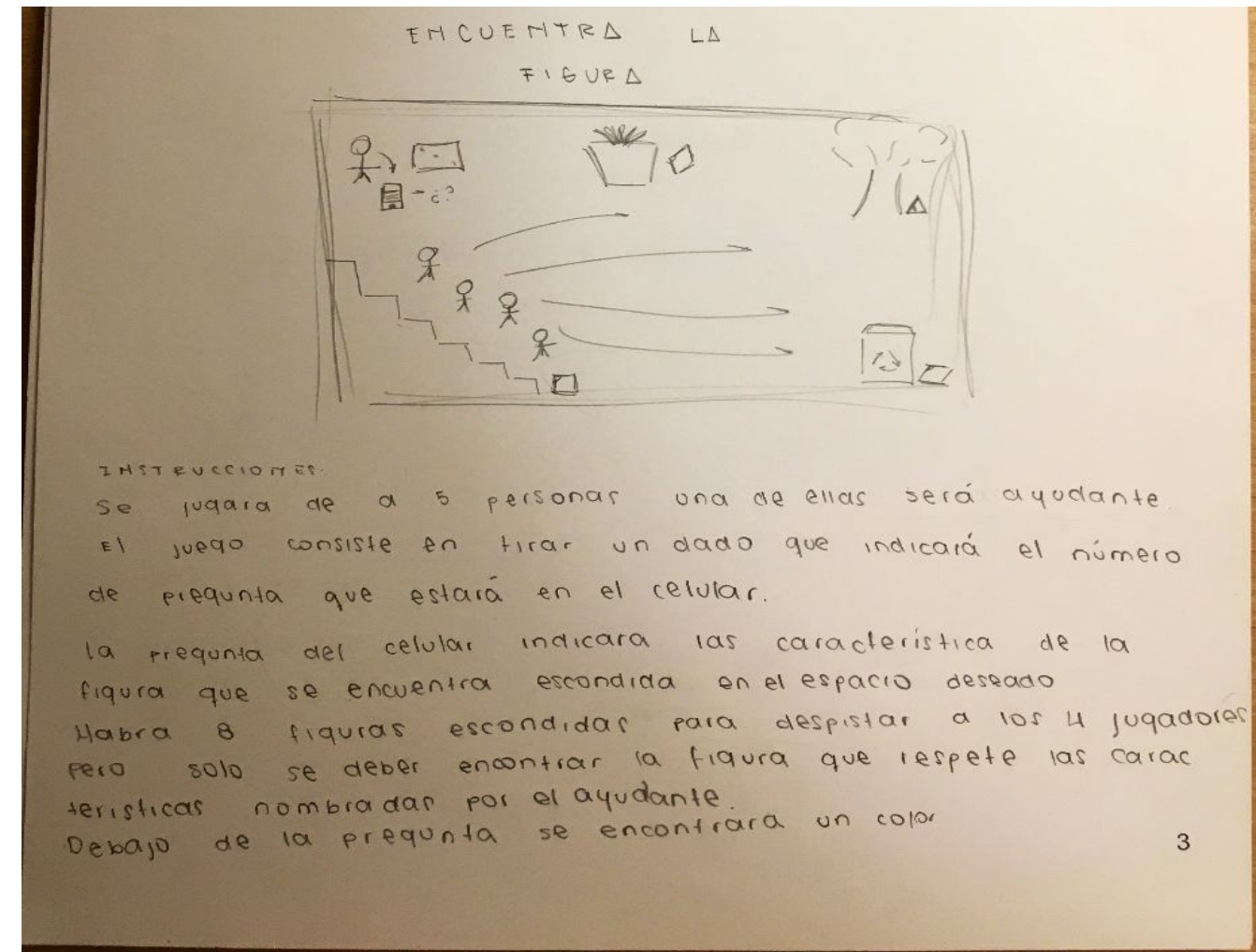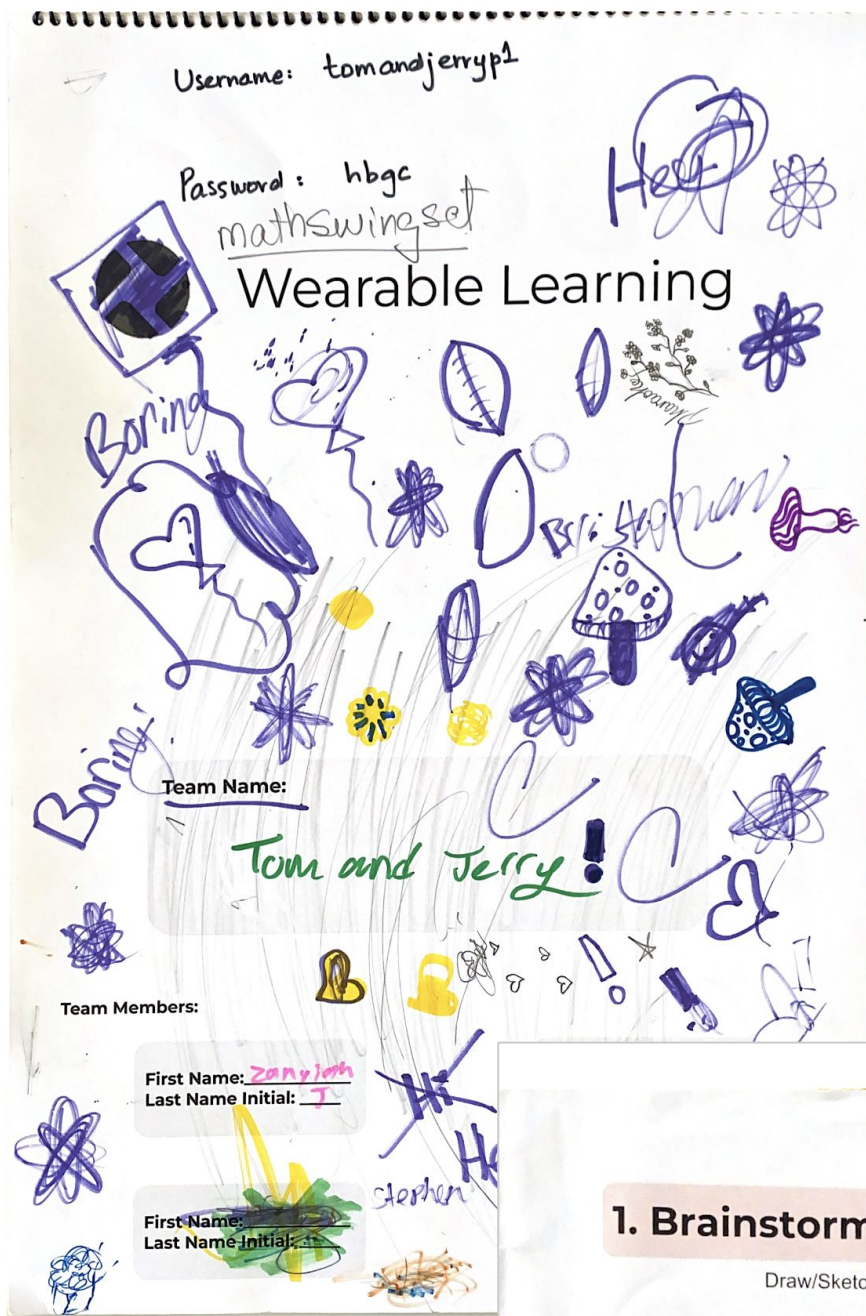
Analysis and Results

Grounded Theory Approach:

- Changes composition of existing coding scheme; introduces new dimension

- Emphasis on data-driven analysis, evolving organically from detailed, descriptive data

- Continuous comparison and integration of concepts forming a grounded theory

Presence of all *cultural dimensions*:

- Recognition of the significance of each *cultural dimension* (Pusch, 1979), regardless of frequency

- Some part of actual game play ideations; some are unrelated to game play

- Descriptive labels brought value to understanding individual variations in *cultural dimensions* across artifacts from 3 countries

your mom
is calling

Name your
mom maghisicent

what the .userNam

(like a teacher or another
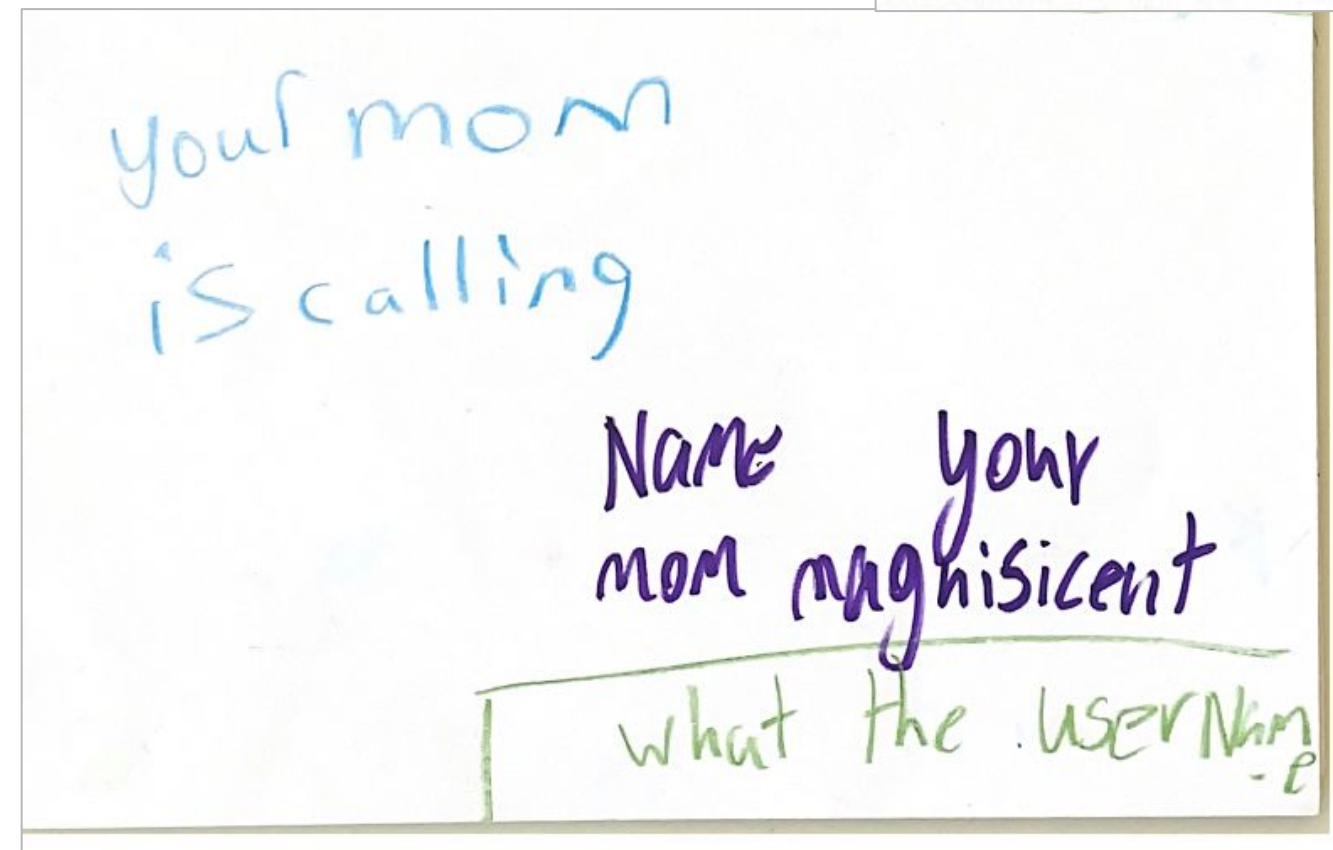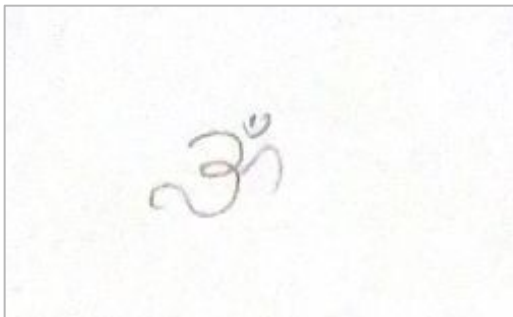
8 Cultural Dimensions and Examples Evident in Dataset

Culture (Pusch, 1978)

Dimension	Example
Values	Traditional sports (cricket, badminton, basketball) and symbols (om and emoji)
Beliefs	Role of authority (umpire, game facilitator, referee); Gender dynamics (girls working in same-gender groups); Importance of scoring/points systems
Aesthetic Standards	Use of emoji, multimedia; Decorative visual elements and character representations
Linguistic Expressions	Local dialects, slang phrases, and sports terminology
Patterns of Thinking	Hint systems, structured gameplay, math usage and relevance, and difficulty levels
Behavioral Norms	Self-organizing by gender, rule-following in games, depictions of competition
Styles of Communication	Visual signaling/gestures, Collaborative illustrations, instructional phrasing, motivational feedback
Ways of Living	Depictions of daily activities and customs, References to cultural foods/cuisine, transportation modes

Results: Frequency Analysis of *Cultural Dimensions*

Cultural Dimension (Pusch, 1979)	Entries (non-empty cells out of 24)	Percentage (%)
Values	19	79.17
Beliefs	22	91.67
Aesthetic Standards	17	70.83
Patterns of Thinking	12	50.00
Behavioral Norms	23	95.83
Styles of Communication	16	66.67
Linguistic Expressions	6	25.00
Ways of Living	22	91.67

Table 2: The percentages represent the proportion of non-empty entries out of a total of 24 for each cultural dimension. This table provides a clear representation of how frequently each dimension is mentioned or utilized in the dataset.
Behavioral norms, *beliefs*, and *ways of living* emerge as the most frequently (top 3).

Need for Consolidation

- To ensure no *cultural dimension* is overlooked or undervalued

- A comprehensive model aiming to recognize the significance of each *cultural dimension*

- Address overlap in definitions and with the original coding scheme

  (Ottmar et al., 2017)

- A simplified model, with fewer categories can lead to clearer, more interpretable results

- Systematic and streamlined subcategorization for enhanced depth and clarity of cultural

  dimensions

  - Methodically merging cultural dimensions into well-defined subcategories to achieve a

    deeper, more nuanced understanding while ensuring clarity and precision in the research

    analysis.

- Final 3 categories (*Values and Beliefs*, *Aesthetics Expressions,* and *Communication Styles*)

  integrate alignments within Pusch's facets

- Consolidation of dimensions was methodologically driven by need to simplify dataset and

  address inherent overlaps
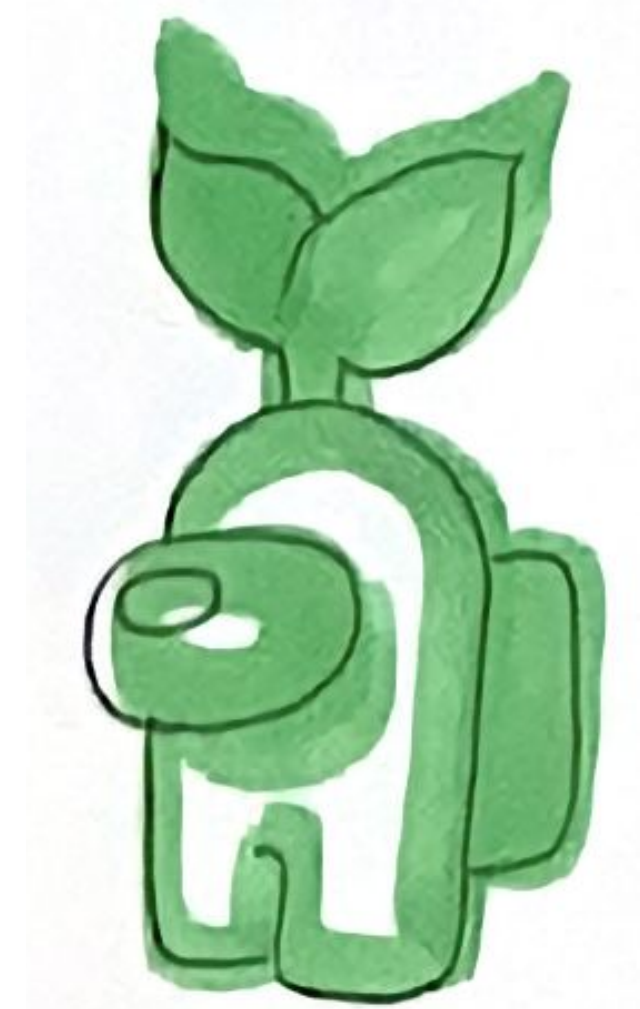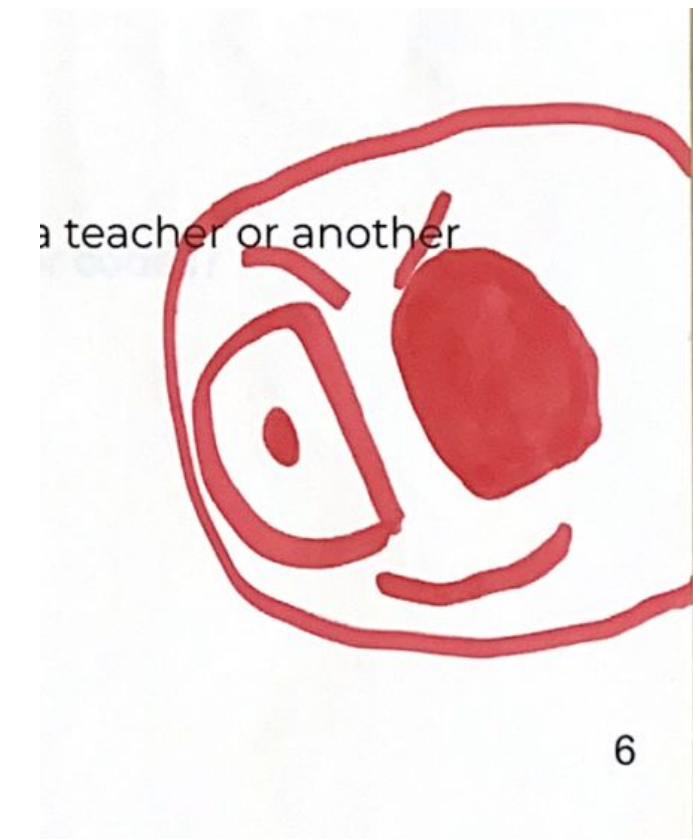
Systematic Consolidation into 3 Salient *Cultural Signatures*
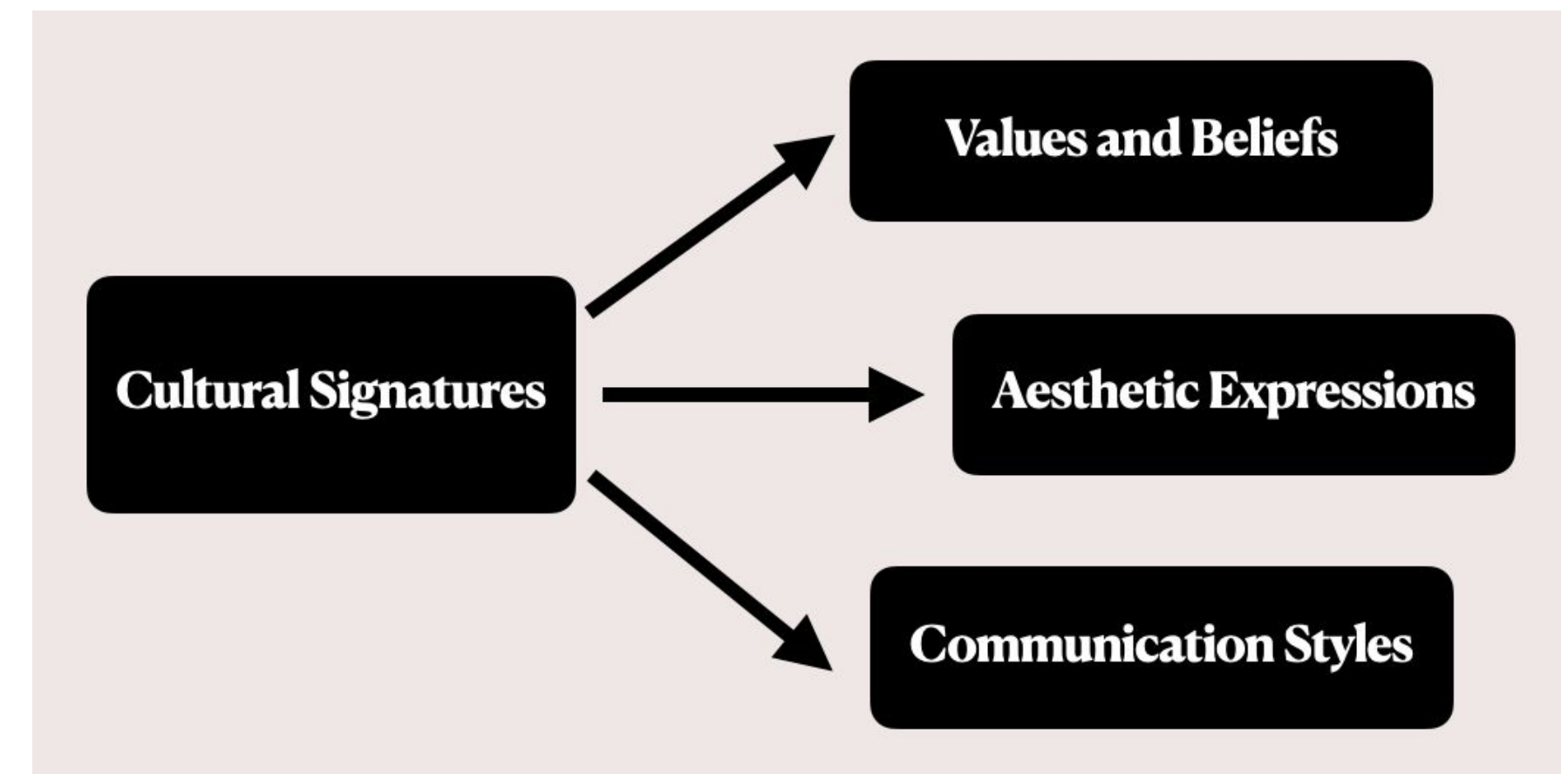
Values and Beliefs

- Encompasses *Values*, *Beliefs*, *Behavioral Norms*, and *Ways of Living* cultural dimensions due to significant overlap observed in their manifestation within game artifacts.

- Represents principles, ideologies, traditional activities, and symbols reflecting students' cultural perspectives and contexts (Hofstede, 2010).

Aesthetic Expressions

- Encompasses *Aesthetic Standards*

- Highlights visual mediums students use to convey culture

Communication Styles

- Encompasses *Linguistic Expressions*, *Patterns of Thinking* and *Communication Styles*

- Captures verbal and non-verbal facets including language use and social dynamics

The *Cultural Signatures* Module

Adapting Coding Guide Descriptors for *Values and Beliefs*

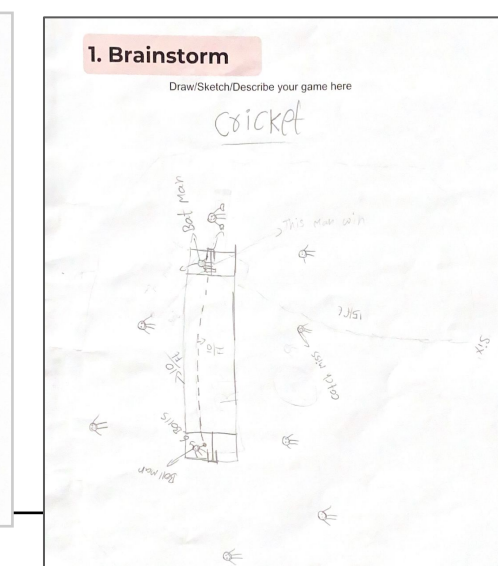| Values and Beliefs		
Description:		
This category encompasses representations of traditional activities, symbols, roles, and dynamics widely recognized in literature. It is recommended that coders be familiar with the cultural context of the students producing the artifacts. Add a place for the coder to self-report their own identity/positionality of the researcher. Ask them: Have you lived a foreign country?		
Inclusion Criteria: ● Traditional sports and games (e.g. video game references, cricket, basketball, soccer) ● Religious symbols and icons (e.g. om, cross, video game characters,) ● Depictions of gender roles and dynamics ● Portrayals of collaboration, competition or social interaction		
0 - None of the above inclusion criteria are present on the artifact.	**1** - One or more cultural *Values and Beliefs* are present but **NOT** part of the game functionality.	**2** - One or more cultural *Values and Beliefs* are represented, and they **ARE** part of the game i.e., integrated into the game design or rules.
If you selected **1 or 2**, write the words, symbols, activities, roles, or dynamics observed, and include screenshot if possible. Specify instances where elements repeat.	Example: **1. Hindu "Om" symbol on cover page** **Among Us video game character on page 2**	Example: **2. Basketball game between two teams with scorekeeping.** **2. Cricket match between two teams.**
If you selected **0**, skip to the next item.		

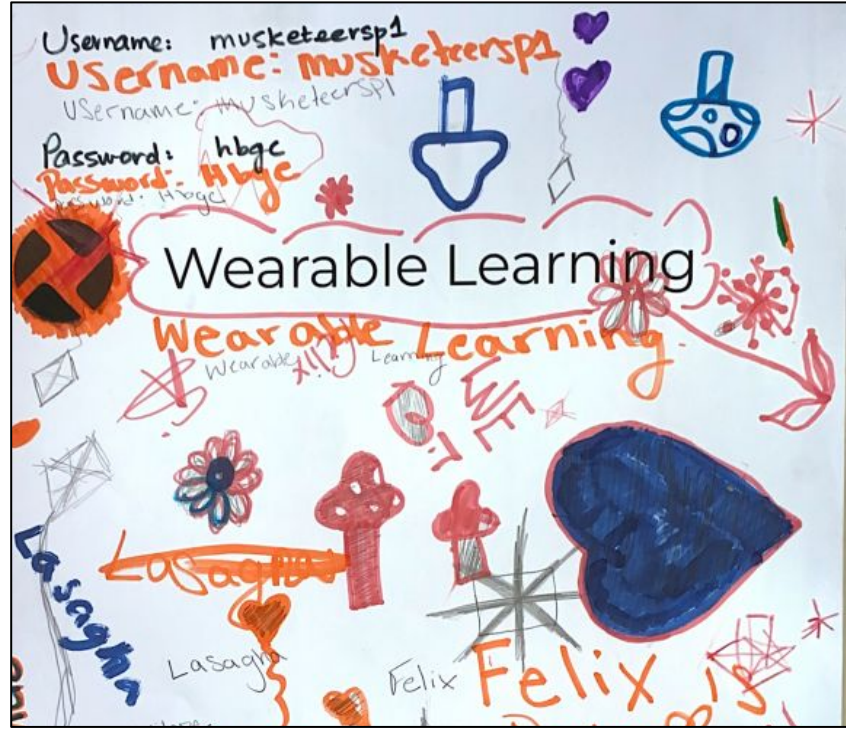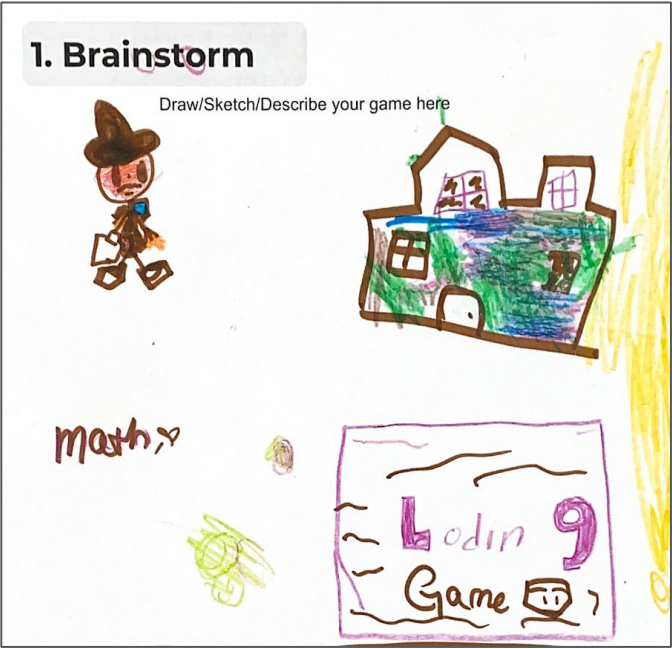# Adapting Coding Guide Descriptors for *Values and Beliefs*
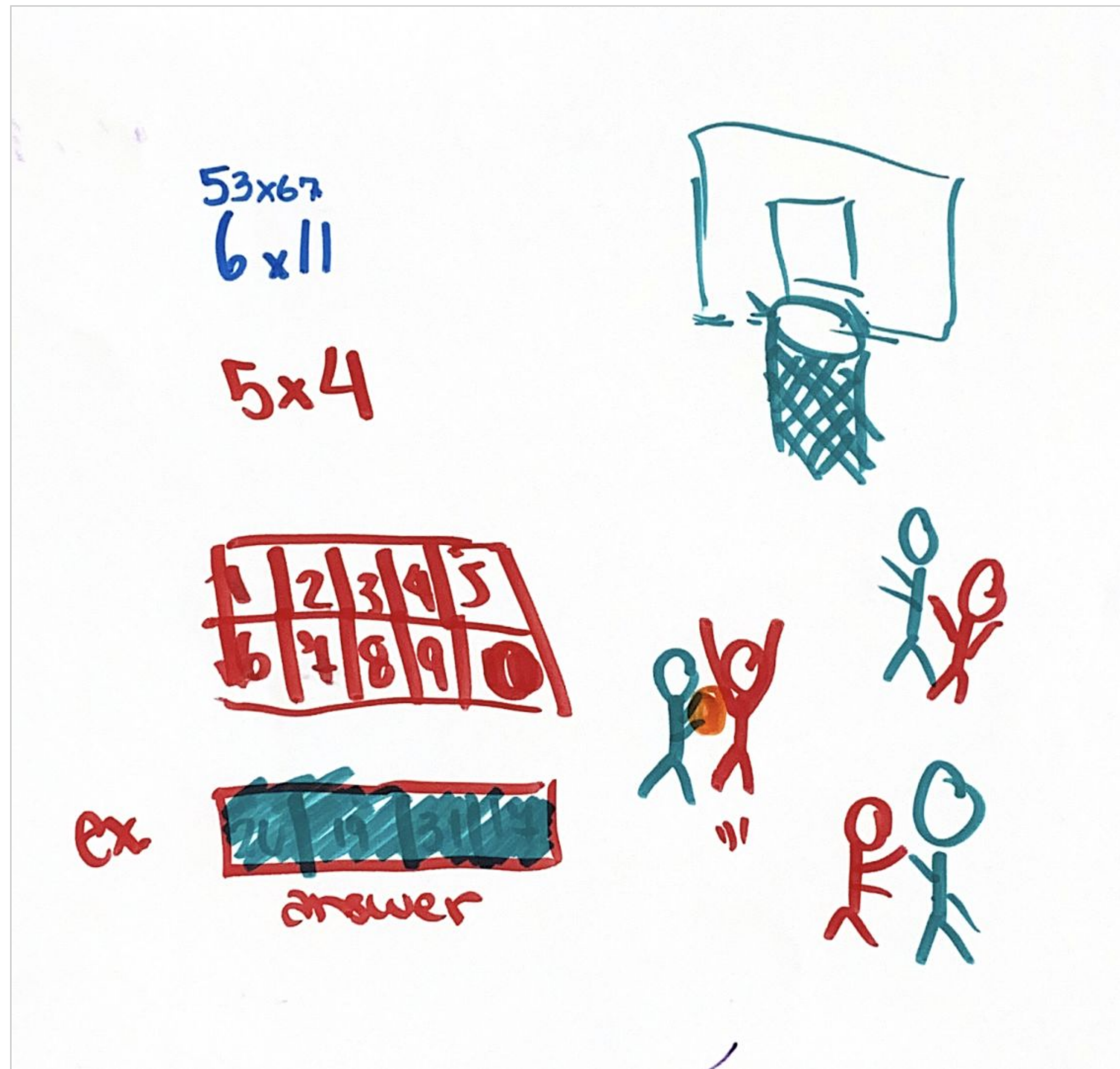
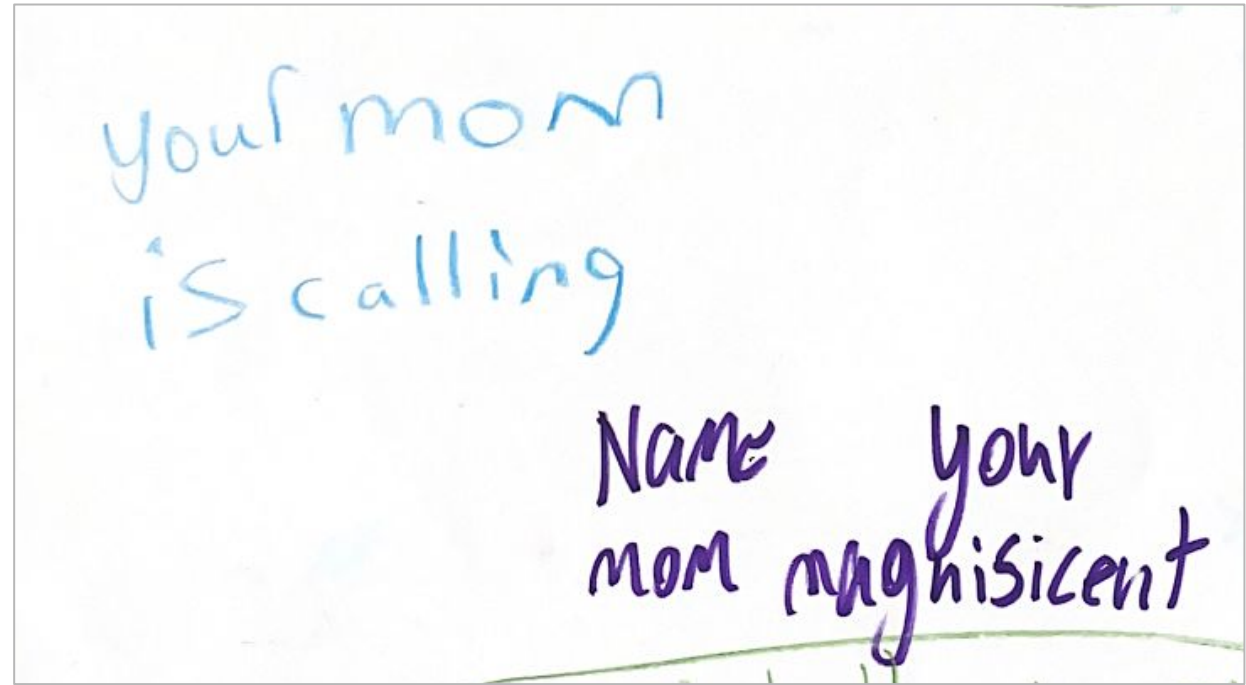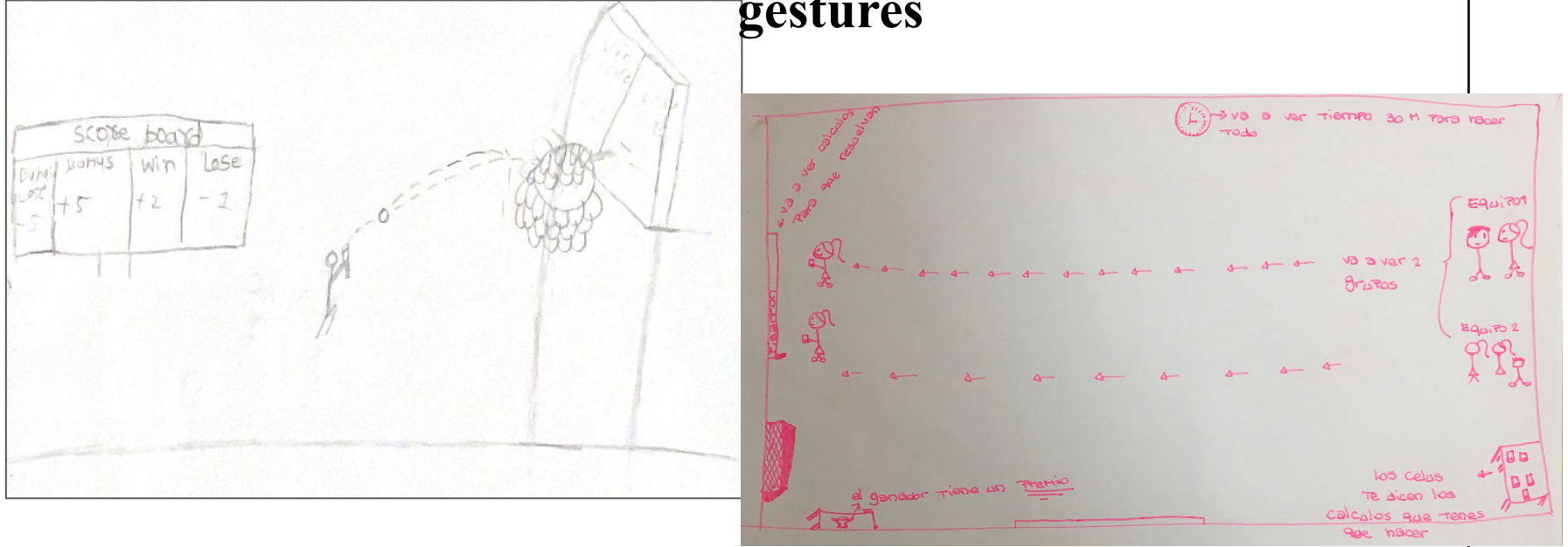**Basketball game between two teams with scorekeeping.**
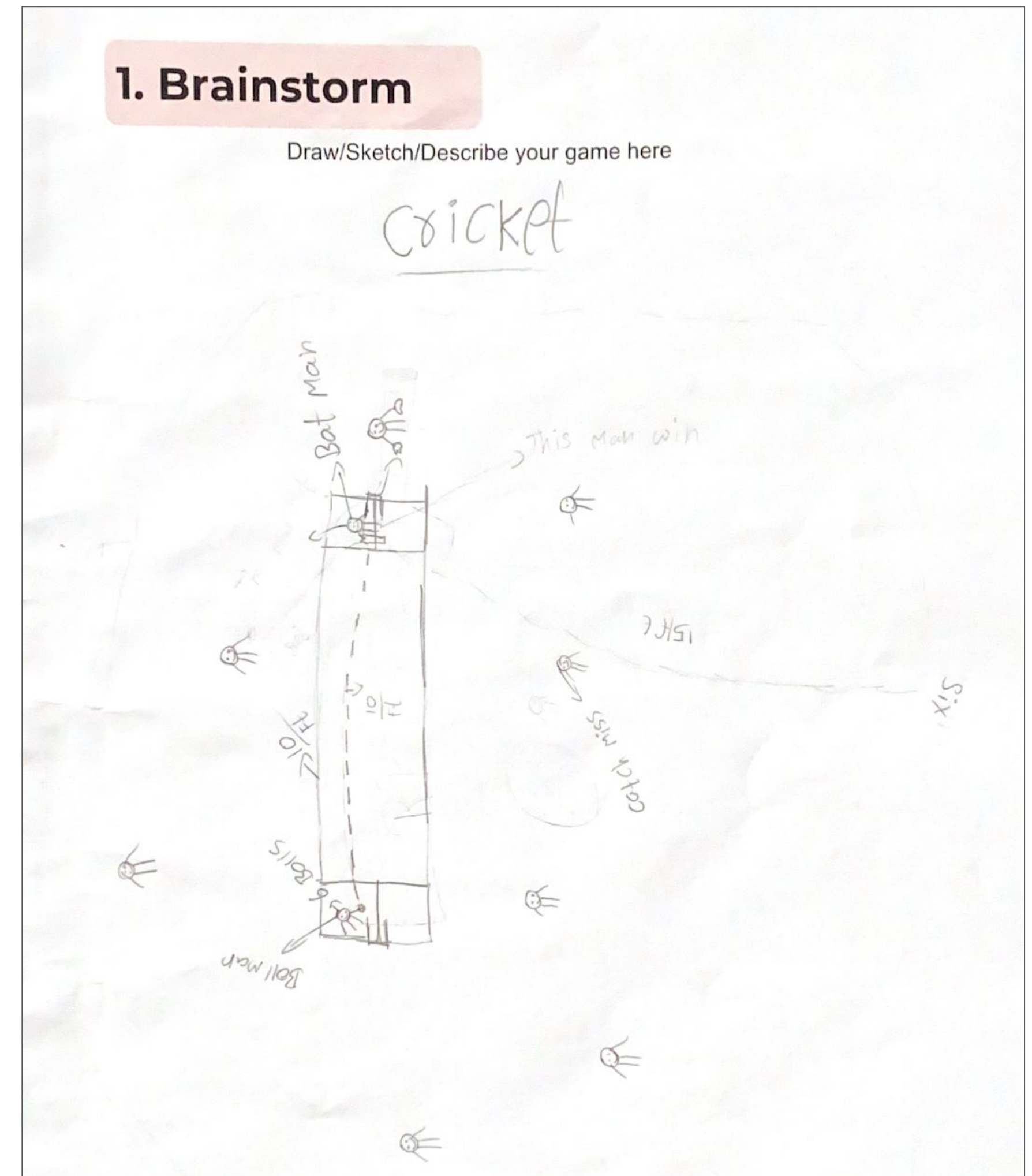
Cricket pitch showing sixer length and two competing teams.

Results: Coding Guide Descriptors for *Aesthetic Expressions*

Aesthetic Expressions

Description:

This refers to representations of visual elements and artistic choices present across all pages of the artifact.

Inclusion Criteria:

- Visual decorations (e.g. drawings of emojis, borders, textures)

- Character representations (e.g. avatars, player figures, roles)

- Environmental depictions (e.g. objects, scenes)

- Other designs, patterns, drawings

0 - None of the above visual criteria are present.	**1** - One or more cultural *Aesthetic Expressions* are present but **NOT** part of the game functionality.	**2** - Visual elements **ARE** part of game functionality.
If you selected **1** or **2**, briefly describe the *aesthetic expression(s)* observed. Include screenshots if possible. Specify instances where elements repeat.	Example: **1. Emoji drawings on front page** 	Example: **2. avatars on page 2 in The Lost File and Family Funeral mystery math game.**
If you selected **0**, skip to the next item.		

Results: Coding Guide Descriptors for *Communication Styles*

Communication Styles		
Description: This refers to verbal and non-verbal cultural communication elements including language, terminology, illustrated interactions, and gestures.		
Inclusion Criteria: • Use of localized language (slang, phrases, idioms, words and expressions) • Use of Instructional phrasing, hint and feedback systems, commands and directions, motivational cues, etc • Scoreboards and scorekeeping, home-away competitive labels, etc • Depictions of explanations, collaboration and gestures		
0 - None of the listed communication elements are observed.	**1** - One or more present but **NOT** part of game functionality.	**2** - One or more communication elements **ARE PART** of the game functionality.
If you selected **1** or **2**, briefly describe the *communication style(s)* observed and include screenshots if possible. Specify instances where elements repeat.	Example: **1. Local phrases on page 2** 	Example: **2. Cricket scoring panels depicted** **2. Depictions of collaborations and gestures**
If you selected **0**, skip to the next item.		

Introducing the new WL *Cultural Signatures Module*
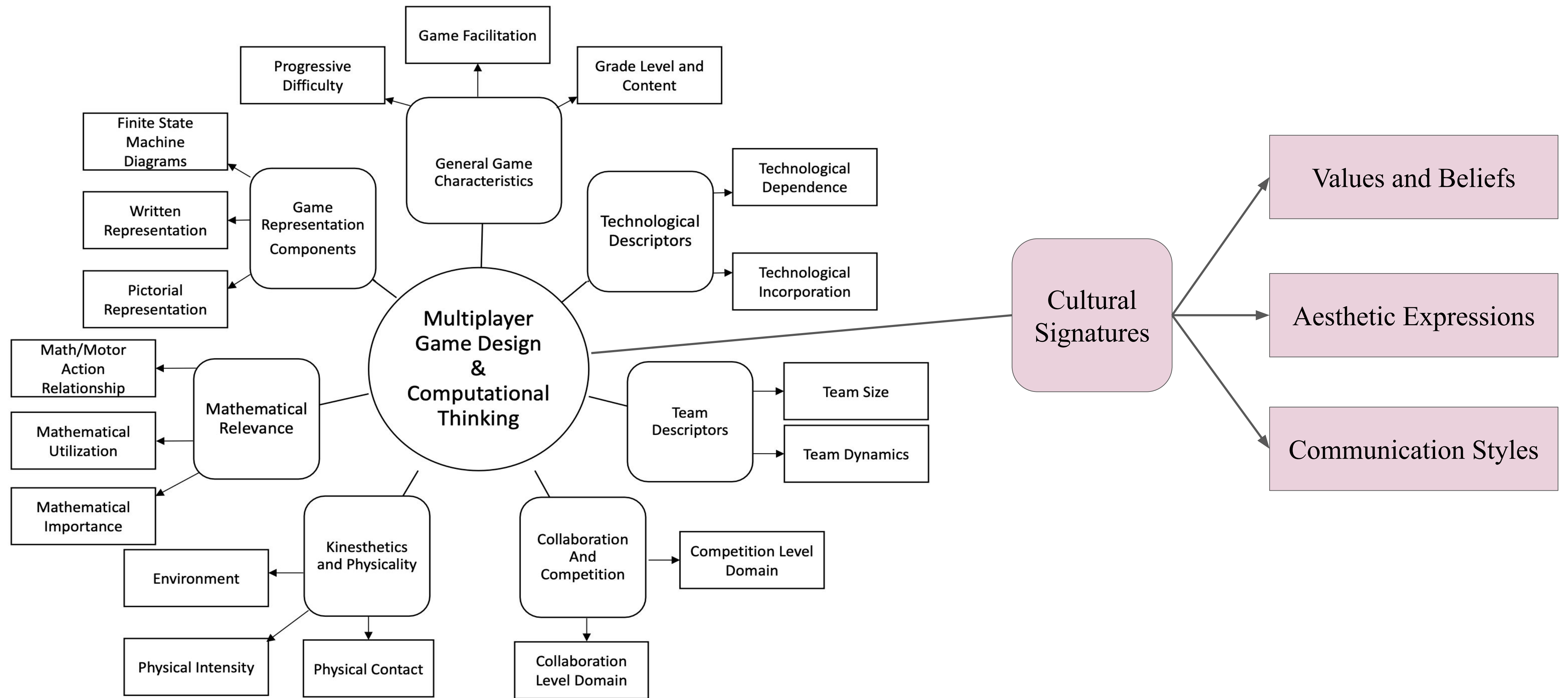
The 8 domains of the *Culturally-Responsive, Multiplayer Game Design and Computational Thinking Coding Scheme*.

Discussion and Future Work

- Findings reveal students embed cultural perspectives in game designs using WL. Coding scheme provides systematic tool to identify localized nuances in game design education.
- Using culturally- "flavored" instruction and curricular materials, we can make games more meaningful, approachable, familiar, and less alienating - this research makes it possible (educators making deliberate design choices)
- WL is a fun and physical learning technology. This research helps make this learning experience more meaningful by creating a sense of belonging.
- Could improve learner participation, encouragement and interest in computing; including female participants
- Insights can inform future iterations of WL digital learning platform to align with cultural contexts (i.e. localization)
- Contributes to culturally-responsive computing education and curriculum development (Eglash et al., 2013; Leonard & Sentance, 2021)
- Test scheme reliability via inter-rater coding statistic
- Conduct focus groups and interviews to further explore cultural meanings (Kitzinger, 1995) in WL artifacts
- As WL teacher training resource on inter-cultural and cross-cultural integration (extension of Smith et al., 2022)
- Researchers interested in CT education may find research potential in understanding CT growth between booklets in standard and flavored formats

End of Presentation. Thank you and open for discussion.

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Backup slide: Systematic Examination of Artifacts

	Team Name	Country	Booklet	Original Game Yes/No	Linguistic expressions	Values	Beliefs	Aesthetic Standards	Patterns of Thinking	Behavioral Norms	Styles of Com...
2	Hackers	IN	1			use of traditional sports (cricket); usage of traditional symbols om, use of means of local transportation	Group dynamics	character representation, Art and Symbolism, Agency,	generalization, score board, outdoor preference, operations and algebriac thinking	Team sportsmanship, respect for spiritual symbols	Use of sports-s language and t (cricket)
3	Rockstars	IN	2			use of traditional sports (cricket)	Group dynamics, Role of authority	character representation, Art and Symbolism	score board, outdoor preference, operations and algebriac thinking	Team sportsmanship, respect for authority figures in facilitator role	Use of tradition specific comma instructions
4	Thagadhalladu Girls Team	IN	3			use of traditional sports (badminton), use of traditional symbols om	Group dynamics, Role of authority	character representation, Art and Symbolism,	outdoor preference, basic operations	Team sportsmanship, respect for authority figures in facilitator role	Use of basic m terms and oper (Batminton)
5	Five Out (all girls team)	IN	4			use of traditional sports	Group dynamics, Social stratification, Role of authority	character representation, Art and Symbolism	outdoor preference, progressive levels,	Team sportsmanship, competition, respect for authority figures in facilitator role	Use of progres terminologies (sports)
6	Rowdy	IN	5			use of traditional sports	Group dynamics, Role of authority		outdoor preference,	Team sportsmanship, respect for authority figures in facilitator role	Use of outdoor terminologies (
7	7th boys	IN	6			use of traditional sports (badminton)	Group dynamics, Role of authority	character representation, Art and Symbolism	outdoor preference,	Team sportsmanship, respect for authority figures in facilitator role	Use of sports-s commands and (Batminton)
8	Raistar	IN	7			use of traditional sports (cricket)	Group dynamics, Role of authority	character representation, Art and Symbolism,	outdoor preference,	Team sportsmanship, respect for authority figures in facilitator role	Use of tradition language and t (cricket)
9	Indian boys	IN	8			use of traditional sports (cricket)	Group dynamics, Social stratification, Role of authority	character representation, Aesthetics, Beauty Standards, Art Appreciation		Team sportsmanship, competition, respect for authority figures in facilitator role	Use of culturall aesthetic-relate symbols (heart decoration, mu
10	La Mosqueteros	US	9			use of cultural symbols (emojis)	Group dynamics, Role of authority	Interplay of Art and Technology, Sign and Symbol Usage, Nature Appreciation	geometry, Inclination towards randomness or probability (usage of dice)	Usage of common cultural symbols (emojis), competitive behaviors, respect for facilitator role,	Use of culturall popular phrase ("yas queen", h
11	Tom and Jerry	US	10		"yas queen",	use of traditional games (swing set), usage of video game characters	Group dynamics	Interplay of Art and Technology, Sign and Symbol Usage, Vocab usage,	Inclination towards logical reasoning and problem-solving	Usage of common cultural symbols (emojis), team cooperation, competitive behaviors	Use of gaming popular langua heart emoji)
12	Mortal Gorilla	US	11		References to Mortal Kombat game,	use of adventure sport parkour; and use of cultural symbols (emojis)		Art Appreciation, Character Representation	geometry, progressive levels, linear equations	Usage of common cultural symbols (emojis), competitive behaviors	Use of emojis a sports languag
13	Two Pretty Girls and Boy	US	12	yes		use of traditional sports (hopscotch), usage of cultural symbols (emojis)	Role of authority	pretty girls, Art Appreciation, Use of Symbols and Icons	algebriac thinking	Usage of common cultural symbols (emojis), competitive behaviors, respect for facilitator role	Use of mathem and popular cu (hang math, en
14	Hang Math	US	13		"I am drepressed and emo too"	Use of decorations, and emojis	Group dynamics,	Art Appreciation, Use of Symbols and Icons, Character Representation	number operations, progressive levels, number operations; video game elements "5 lives, lose 1 life"	Cooperation and competition in team sports	Use of competi specific langua
15	Azul	US	14			decorations, basketball	Group dynamics, Role of authority	Art Appreciation, Use of Symbols and Icons, Character Representation		Cooperation, competition, and respect for authority figures in facilitator role	Use of coopera specific langua
	The Last File and	US	15	Yes		decorations, heart emoji	Group dynamics,	Art Appreciation, Use of		Cooperative behavior in team	Use of coopera

Full dataset available on request.

Backup Slide: Culturally-relevant computing education and why code for Culture?

- Culture fundamentally shapes how students learn, communicate and express themselves (Vygotsky, 1979)

- Coding for culture allows us to create localized, culturally-relevant learning experiences that resonate with students' unique backgrounds (Dunn & Marinetti, 2007)

- Students' cultural perspectives and identities are reflected in the games they design - currently not being considered

- Analyzing these cultural signatures in game artifacts provides insights into students' learning processes

- Enables us to discern cross-cultural differences and commonalities in CT teaching and learning

- Cultural analysis augments our understanding of how to best teach core computing competencies and skills across global contexts

- Supports iterative refinement of educational platforms (i.e. WL) to align with cultural needs of diverse users

- Provides a model for integrating culture within technical fields like CS education

- Allows educational technologies to celebrate students' cultural diversity, not just teach content

- Fosters culturally-responsive and inclusive learning environments that drive better learner engagement and motivation

Backup slide: Elements of Analysis

This comprehensive definition from Pusch's work on multicultural education training provides the framework for examining culture in this research.

It encompasses **8 cultural aspects:**

- *Values*

- *Beliefs*

- *Aesthetic Standards*

- *Linguistic Expressions*

- *Patterns of Thinking*

- *Behavioral Norms*

- *Styles of Communication*

- *Ways of Living*

A multidimensional view of culture guides the analysis of how students manifest their cultural contexts in WL game design artifacts.

Culture is "the sum total of ways of living, including values, beliefs, aesthetic standards, linguistic expressions, patterns of thinking, behavioral norms, and styles of communication which a group of people has developed to ensure its survival in a specific physical and human environment" (Pusch, 1979).

This definition becomes the foundation for my research.

Backup slide: Prior Work using Pusch's

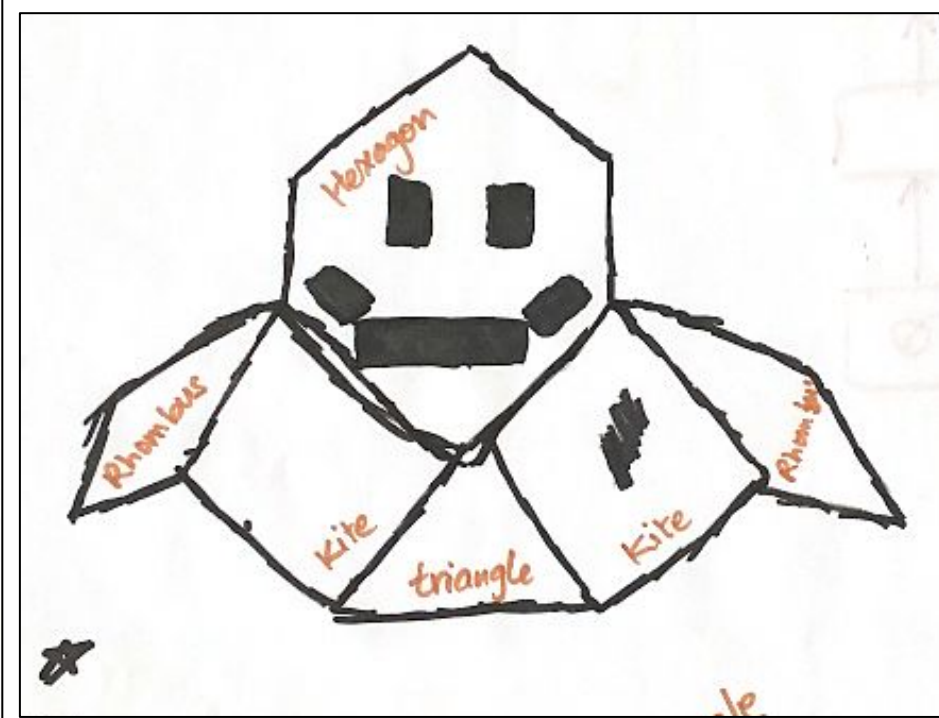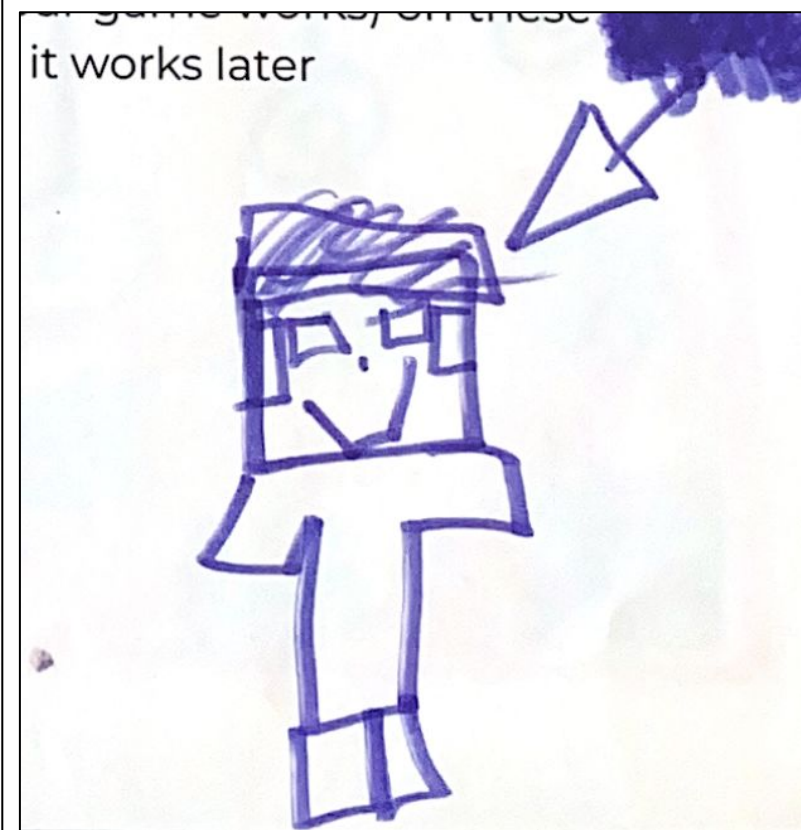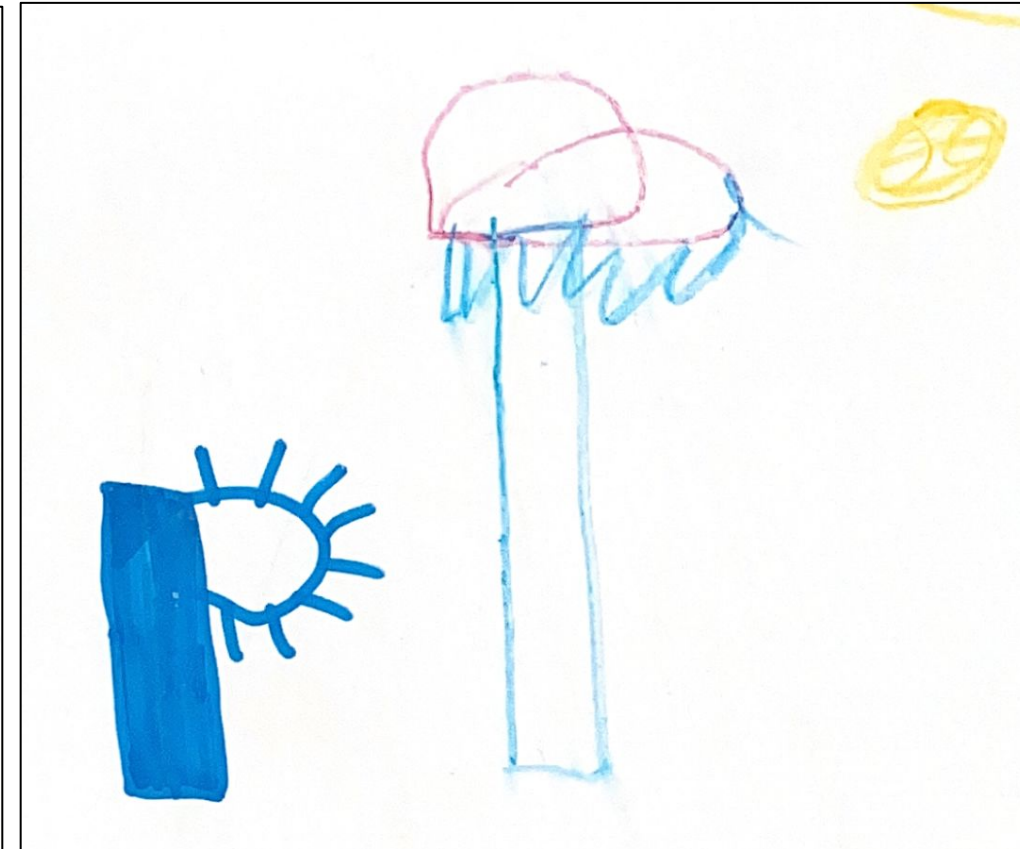Prior work using Pusch's definition of Culture:

- Deardorff (2006) designed assessment methods for inter-cultural competence.

- Wan (1999) studied challenges of diversity in education and how to help students with different home cultural backgrounds to become successful learners.

- Chisholm (1994) focused on the need for the multicultural preparation of preservice teachers; proposed teaching methods and strategies to meet the needs of diverse student populations.

Backup slide: Multiplayer Game Design and Computational Thinking Coding Scheme

Current Coding Scheme (Ottmar et al., 2017)
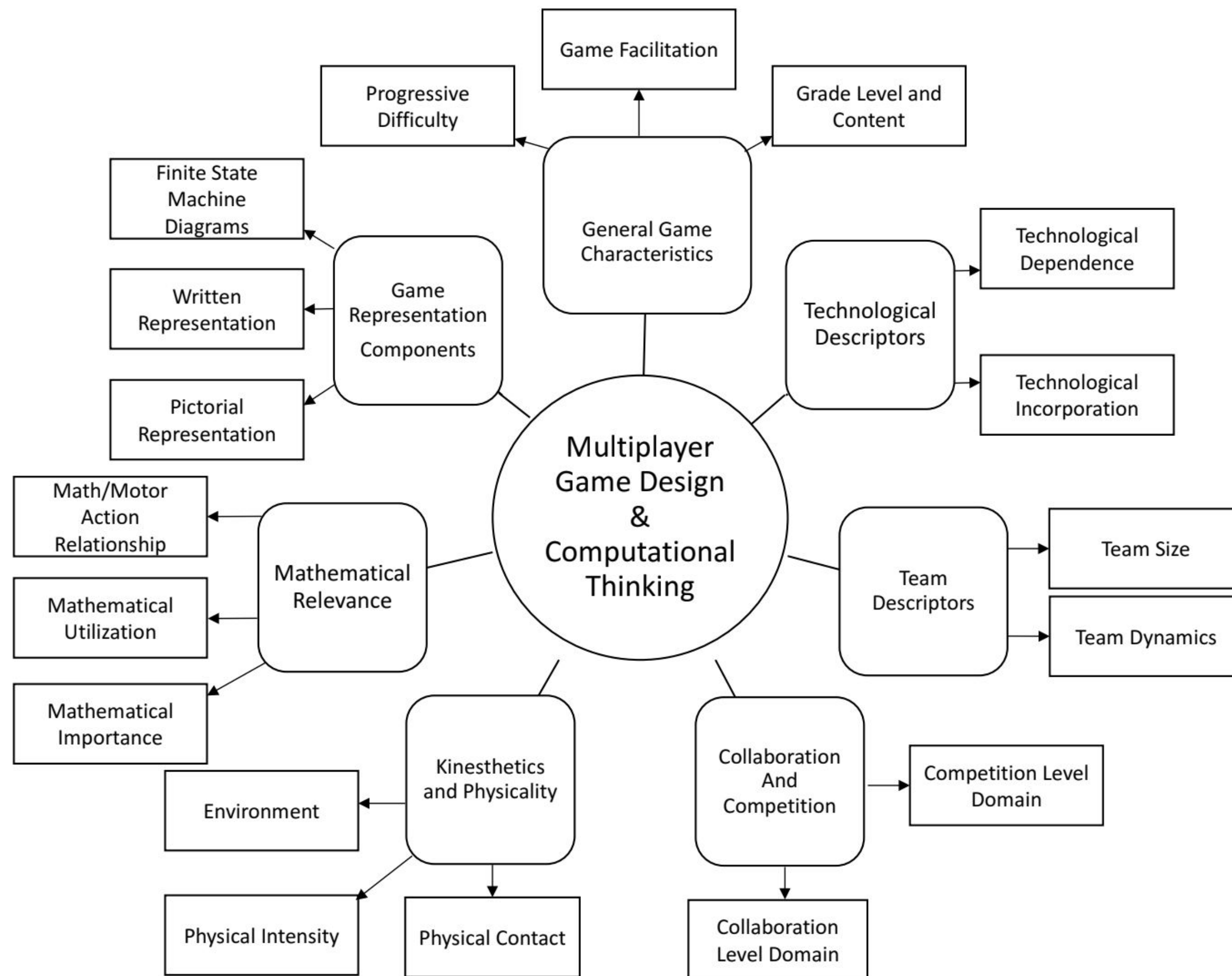
- Assesses computational thinking (CT) demonstrated in game design artifacts

- Analyzes game designs and finite state machines qualitatively

- Seeks to understand students' CT development processes

- Evaluates active learning benefits of physically embodied game technologies

- Focuses on 7 domains: *Game Characteristics, Technological Descriptors, Team Descriptors, Collaboration and Competition, Kinesthetic and Physicality, Mathematical Relevance & Game Representation Components.*

- **Does not account for cultural contexts and influences** - Focus of my research

Cultural Signatures in WearableLearning Education Technology