

FOCUS OF THE PROJECT

Commercial games could provide a vital, engaging home-school connection to support children's mathematical learning. Our interest is in understanding what scaffolding and approaches parents used to support young 4 to 5 year old children in their mathematical reasoning and game play strategies. Our work could lead to guides and recommendations for parents to playfully engage in mathematical thinking with their children.

Research questions investigated include:

- Which scaffolding and instructional techniques and approaches were effective and successful at promoting mathematical reasoning and game play strategies?; Which hindered or shut down game play and mathematical reasoning?
- At what point did parents fade or remove their instructional support and scaffolding techniques?
- What forms of mathematical reasoning were exhibited by young children in game play and/or scaffolded by parents?

PROJECT BACKGROUND

- PAC MAN research partnership between the Faculty of Education at the University of Alberta and the Telus World of Science Edmonton (TWOSE) Lab Quest Program.
- This project is part of a larger pilot research study exploring how university researchers and a science centre could collaborate on making research process public.
- The project also explored how a common data set could be viewed from multidisciplinary perspective, merging research on parenting, motivation and mathematical reasoning in game play with children and adults.

CONCEPTUAL FRAMEWORKS

Analysis of videos are grounded in:

- Sociocultural theory of learning (Vygotsky, 1978) where knowledge is actively constructed by learners through social interactions with others, objects, and the environment through meaningful interactions.
- Zone of Proximal Development (ZPD) where more capable 'experts' provide instructional approaches or scaffolding to assist the novice/learner to solve a problem at a higher level.
- Thinking mathematically (Mason, 2010) as the processes that are important in developing mathematical reasoning, including: visualizing, looking for patterns, formulating conjectures, justifying claims, working systematically and strategically, specializing, and generalizing.

RESEARCH DESIGN

Preliminary Data Collection Process:

- Video data was collected over 2 weekends (Saturday and Sunday) by the research team
- Participants included parent-child pairs or small groups (parent-children) playing games

Intake process:

- Parents gave consent and completed an information sheet about family in terms of mathematics, parenting and motivation
- Condition of game play was timed for 8 minutes in 'Race the Clock' or untimed in 'Take Your Time'
- Participants were videotaped while playing the mathematical games with their child(ren)

Current Project Video Selection for Analysis:

- 126 of the recorded videos were filtered by age with a focus on 4 to 5 year old children
- 35 videos were selected and reviewed for instances of parent scaffolding and instructional techniques
- 15 videos were selected for further analysis

GAME PLAY

Commercial games were selected because they:

- Relied on mathematical reasoning to develop winning strategies or to solve puzzles collaboratively.
- Can be used as pedagogical tools for scaffolding and teaching.
- Act as cultural artifacts that are a familiar part of the parent and child culture in North America.

RESEARCH DESIGN

Preliminary analysis revealed the following scaffolding techniques used by parents to support children's mathematical thinking, game play moves and strategies:

- Verbal Cues
- Gestures
- Modelling Moves and Strategies
- Referencing Visuals/Pictures
- Asking Problem Solving Questions

Time	Parent Evidence	Parent Scaffolding Code(s) Modelling, Questions, Pictures/Visuals, Verbal Cues, Gestures	Subcode(s) Moves/Strategies, Thinking	Time	Child Evidence/Change
0:17	Mom prompting boy that they're going to play a game and reads rules to boy.	Activating background knowledge	Thinking		
1:12	Mom asking boy if he knows how to play TTT, like this game	Questions	Thinking		
1:17	Mom showing with hands the different ways a line can be made, vertical. Gets boy to pick colour and sort them	Gestures			
1:33	Mom pointing out that the gobblers are different sizes	Verbal Cues Verbal Cues	Thinking Thinking		
1:58	Mom explaining how to win explains boy needs to get all 3 blue in a row. Pointing on the board with hand and telling him diagonal and explaining what diagonal is, and across. Mom touching each square as she shows what to do	Gestures	Moves/Strategies		
2:33	Mom points out a trick about gobbling the pieces. Has boy look at the pieces he has and tells him to look that they are not the same size. Mom ask him out of the pieces he has which one could he use to gobble (medium and large)	Verbal Cues Gestures	Moves/Strategies Moves/Strategies		Interactions

Figure 1. Example of Parent Scaffolding Techniques Used in Mathematical Game Play

FUTURE ANALYSIS

Subsequent analysis aims to connect specific scaffolding techniques and approaches with children's mathematical thinking they express.

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