The call to back-to-the-basics has highlighted mastering the fundamentals of mathematics with an emphasis on arithmetic. Viewing mathematics as more than an emphasis on numbers, we consider reasoning as basic to mathematical thinking and learning. Games, specifically commercial abstract strategy games, in mathematics class have the potential to broaden the purpose of school mathematics to invite students to experience joy in mathematical thinking and learning (NCTM, 2020). Even though games develop meaningful understanding of mathematical ideas, they are devalued in compulsory schooling and remain under researched (McFeetors & Palfy, 2018; Reid, 2002b).

This study focused on spatial and logical reasoning as elementary students played Santorini. The study’s aim was to examine how students’ interactions with Santorini occasions enactment of spatial and logical reasoning.

Design-based research methodology (Cobb et al., 2003; McKenney & Reeves, 2012); games used as interventions Project length: 2 years Participants: Grades 4-6 (Edmonton + Calgary schools) Preliminary findings: From a 60-minute session/week for 5 weeks of Santorini gameplay with 44 students Data collection: Reflection sheets, videos, photos and researchers’ field notes Data analysis: Use of SR and LR wheels (Figure 1a & b) to code student actions and utterances

Students engaged in co-enactment of spatial and logical reasoning (SLR) to develop effective strategies. We share three student examples to demonstrate the co-enactment:

1. Locating & Exploring (Grade 5)
Exploring the game and understanding where to locate pawns. Figure 2a shows the intentional board set-up. B1 and G1 located in corners, and B2 and G2 located close by. Students explored the game rules and strategies in relation to location of their pawns. Figure 2b shows Grey locating G1 and G2 close to corners where as Blue ‘sticking to the opponent’ and placing their B1 and B2 adjacent to Grey. SLR was co-enacted in initial exploration of Santorini where locating workers was critical to learning the game rules.

2. Pathfinding & Analyzing (Grade 6)
Pathfinding involves understanding and navigating through space to reach a destination. In Santorini, pathfinding was seen as students mentally and gesturally interacted with the board, analyzing the levels, directions and (un)available spots to move their pawns. Figure 3a shows Blue analyzing potential moves of the opponent. G1 only had one viable path (red arrow). Blue moved B1 down a spot and constructed a dome in the adjacent space (Figure 3b). Blue analyzed possible pathways for both players and successfully trapped G1 in the top right corner.

3. Sectioning & Modifying (Grade 4)
Sectioning divided the game board into different areas for strategic play. Modification was seen as students altered their gameplay in response to the opponents moves. In Figure 4a, Blue noticed G2 entering the section on the left. Blue sealed off the section using additional domes (Figure 4b). Grey modified the gameplay by using the two-tower strategy which involves constructing two adjacent towers to step up to the third level for a win (Figure 4c). Both players modified their strategies in different sections of the board, with G2 successfully reaching the third level (Figure 4d)

Figure 1a. Spatial Reasoning Wheel
Figure 2a
Figure 2b

“One of our characters is close to our opponents, and [the other] in our own corner” (Blue)

“One worker has to be close to the opponents’ workers, the other should be in our own private area” (Grey)

Figure 3a
Figure 3b

“The corners are more useful, so you can create a mini zone”

“Have your own little section”

“There is a way I can win”

“Create a mini zone”

“Have your own little section”

“There is a way I can win”

“Create a mini zone”