The purpose of this study was to examine mathematical learning when children interacted with digital math games, and the role of design features in the affordances of the digital games.

Digital games can enhance learning when compared to non-game conditions (Clark, Tanner, Smith, and Killingsworth, 2016). Digital games can also promote mathematical flow, a state of completely focused motivation, which impacts learning by mediating enjoyment and performance (Pavlas, 2010). Digital games provide affordances for players to interact with the games. Affordances are defined by Burlamaqui and Dong (2014) as: “cues of the potential uses of an artefact by an agent in a given environment” (p. 13). Very few studies have focused on the affordances of digital games.

The overarching research question was: What is the role of design features in the affordances of Grade 4 digital math games?

This study used an exploratory convergent mixed methods design (Creswell & Plano Clark, 2011). Forty-Four children participated in the study. Each child participated in a clinical interview and completed a pretest, interacted with three digital math games on an iPad, responded to interview questions after each game, and completed a posttest. Each game contained a different math topic. Researchers analyzed pre and posttest quantitatively using t-tests. Researchers analyzed video data from two camera sources (i.e., GoPro camera, wall-mounted camera) using open and axial coding (Saldana, 2016) to qualitatively determine students awareness of design features, helping and hindering features, and math connections.

The results of the quantitative analysis showed significant growth between the pre and posttest for two of the three games (Motion Math Zoom and Angle Asteroids.) Students also showed gains on the third digital game (Chicken Coop Painter) however, these were not significant. The control test items showed no gains.

The results of the qualitative analysis showed that a variety of design features, aligned with Clark et al.’s (2016) meta-analysis on digital games, contributed to the affordances of the digital games. Overall, 94% of children in the study were aware of design features in the digital games. For example, 77% of children identified helping features and 48% of children identified hindering features, although these percentages were different for each of the digital games. Additionally, 71% identified mathematics connections within the digital games. For example, a child was aware of features within Motion Math Zoom when they said, “When you got something right, they [the characters] would do something different and they would do tricks and stuff. If you zoomed out there were just one kind of animal and then if you zoom it comes different ones.” A child who reported a hindering feature when stated: “When you tried to zoom in or zoom out, it kind of doesn’t work sometimes.”

These results suggest that when children make math connections in a digital game this can reduce children’s cognitive load and allow them to better connect with the mathematics in the game.