EFFECTS OF UNIVERSALLY DESIGNED SERIOUS GAMES STUDENTS' FRACTION KNOWLEDGE

This experimental study investigated the impact of a fraction game created with an equitable designed framework on students' fraction knowledge. Results revealed significantly improved fraction knowledge for students who played the game on two measures. Games that promote multiple means of access, expression, and representation can positively impact student outcomes.

INTRODUCTION

Serious games are shown to improve cognitive function and serve as platforms for students to build and internalize knowledge (Tokac et al., 2019). Summaries of gaming research have identified the potential of games to enhance STEM content accessibility and increase collaborative problem-solving and exploration. Despite the positive results, systemic issues of access, such as the inability to have access to and agency over tools or representations students use to learn or express knowledge, is prevalent in many digital mathematical games. In this paper, we report on the impact of a digital fraction game on fourth graders' fraction knowledge. Universal Design for Learning (UDL), a design framework that calls for multiple means of access, representation, and expression, grounded the game's creation.

METHODS AND ANALYSIS

Eighty-six students in the western United States took place in the study. Students were matched in pairs and then randomly assigned to a study or a control group. Fraction knowledge was measured with a curriculum-based measure and a measure of students' fraction schemes (Wilkins et al., 2013). A 2-way multivariate analysis of variance (MANOVA) measured differences between the study and control groups on the two dependant variables over three time points. Game analytics evaluated whether game play predicted changes on the dependant variables.

RESULTS

Results revealed significant differences on the CBM and fraction schemes in favor of the study group. Furthermore, gameplay time significantly predicted improvements in fraction knowledge. Results will be further unpacked in session.

References

Tokac, U., Novak, E., & Thompson, C. G. (2019). Effects of game-based learning on students' mathematics achievement: A meta-analysis. *Journal of Computer Assisted Learning*, *35*(3), 407-420.

Wilkins, J. L. M., Norton, A. & Boyce, S. J. (2013). Validating a written instrument for assessing students' fractions schemes and operations. The Mathematics Educator, 22(2), 31-54.