Using Digital Technologies to Redress Inequities for ELLs

Summary

This study examined the question, 'What is the impact of a digital math intervention on secondary ELL students' mathematical capabilities and perceptions of their future possibilities?' The hypothesis was that through its direct effect on increasing students' math ability and its indirect effect on increasing students' perceived math self-efficacy, the digital intervention affects students' perceptions of their functionings and future possibilities.

A path analysis, with qualitative data nested into the design, was used to analyze the conceptualized relationships. The study was conducted with 50 ninth-and-tenth- grade Hispanic students in a Colorado high school, over 6 months: ***HELP Math for ELL and Special Needs*** *was the digital intervention used. The following conclusions were drawn from the data:*

- **HELP Math** significantly increased secondary Hispanic ELL students' math ability and their perceived math self-efficacy.
- ELL students with the lowest initial math ability and perceived math self-efficacy spent more than three times the amount of time using **HELP Math** than other participants and showed larger increases than their peers in both their math ability *AND* math self-efficacy.
- Math ability and self-efficacy intertwine to develop ELL students' capabilities; as students' math achievement improved, steep growth in perceived math self-efficacy occurred.
- An independent-samples *t*-test showed that the difference in students' pre-post math scores were significantly higher for the **HELP Math** group ($M = 4.58$, $SD = 5.07$) than for the comparison group ($M = 2.09$, $SD = 5.51$), $t(73) = 3.13$, $p = 0.002$. This represents a medium effect size of 0.46.
- A paired samples *t*-test that indicated that using **HELP Math** significantly increased students' perceived math self-efficacy between MSES pre- and posttest, $t(49) = 8.33$, $p < 0.001$. This represents a very large effect size of 0.91, however, no control group was used as a comparison.
- Results indicated that the mathematics posttest and the math self-efficacy (MSES) posttest were significantly and positively correlated ($r = 0.523$, $p = .000$).
- An analysis was conducted of students' achievement gains against the time spent in various sections of the program by viewing the **HELP Math** logs of students with the greatest and smallest performance gains from Mathematics pretest to posttest. The average ratio of use of the Instruction Section (28% of time) to Quizzes (28% of time) was 1 to 1. The students ($n = 5$),

who gained more than the average from pre- to posttest, showed a ratio of 1.6 to 1, whereas the students (n = 5), who gained less than the average, had a 0.9 to 1 ratio.

- The dynamic relationship between math ability and students' perceived math self-efficacy was analyzed. The results showed that students with the lowest initial math ability (measured by the previous year's Mathematics CSAP) and the lowest initial perceived math self-efficacy (measured by the MSES pretest) used the technology-based intervention more than other participants (3:1) and showed larger increases in both their math ability (80% versus 36%) and perceived math self-efficacy (254% versus 46%), as a percentage of their initial math and MSES scores respectively.

  The findings of this analysis, in conjunction with the results of both the correlation and regression analyses, suggest that as math ability improves, steep growth in perceived math self-efficacy occurs (i.e., the slope of students' trajectory is steeper as math ability improves.

- Embedding scaffolds in digital content empowered ELLs to take control of their own learning, suggesting digital interventions aimed at closing the academic achievement gap, which acknowledge students' diverse needs and incorporate targeted supports that directly address students' requirements, may have a greater likelihood of successfully improving the achievement and capabilities of ELL students.

- Empowering and supportive digital environments can help overcome barriers to ELL learning. Those students, who may have been previously excluded from learning math due to language barriers or through missing prerequisite mathematics knowledge may have found, in **HELP Math**, an engaging means of instructional support that mitigated their initial disadvantage with respect to learning math and gave them confidence in their ability to learn.

- Through its direct effect on increasing students' math ability and its indirect effect on increasing students' perceived math self-efficacy**, HELP Math** affected students' perceptions of their future possibilities. Eighty-nine percent of the students interviewed understood that a connection between math and their future possibilities existed, of which five students identified more than one connection. More than three-quarters of those students who saw a connection believed the connection to be instrumental in nature, citing central themes including use in construction, run my own business, get a better job, make more money, do things around the house, and go to university.

For more information regarding this study, please contact Dr. Barbara Freeman:

barbarafreeman1@comcast.net

www.helpprogram.net

NOTE: This summary is taken from, "*Using digital technologies to redress inequities for English language learners in the English speaking mathematics classroom*," a peer- reviewed international journal article by Dr. Barbara Freeman; *Computers and Education*, published by Elsevier; doi:10.1016/j.compedu.2011.11.003