Teaching Pre-Algebra and Algebra Concepts to Community College Students Through the Use of Virtual Manipulatives

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Target Course: Prealgebra and Algebra

Intervention: virtual manipulatives

Abstract:
The project tested the effectiveness of virtual manipulatives (http://nlvm.usu.edu) on the performance of students in the two gateway courses: pre-algebra and algebra. The project also investigated the impact of virtual manipulatives on the students’ attitudes toward mathematics and confidence in doing mathematics. Two faculty members from Hostos Community College (Hostos) and Bronx Community College (BCC) taught both the control and the experimental groups. The students were randomly assigned to their sections by their respective mathematics departments in their respective campuses. While the control group learned mathematics through traditional teacher-centered lectures, the experimental group learned the same topics by using virtual manipulatives, i.e., manipulating colored blocks and fraction pieces on computer screens. The research project obtained mixed results as far as the students’ performance in mathematics was concerned. For the Hostos pre-algebra classes, the experimental group outperformed significantly the control group in all five assessments (p < .05). By contrast, BCC pre-algebra control group performed significantly better than the experimental group in all the five assessments (p< .001). Contributing factors for the control group’s better performance over the experimental group were time effect (8:00 am class vs. 10:00 am); age effect (younger students vs. mature students); student preparation (inadequately prepared vs. better prepared students). For the Hostos algebra classes, the experimental group showed a statistically significant performance than the control group in one of the four assessments (p < .05). For the BCC algebra classes, the experimental group had a statistically significant performance than the control group also in one of the four assessments (p < .05). The qualitative data, however, confirmed our hypotheses that virtual manipulatives were useful for students learning basic mathematics concepts. Students expressed this usefulness clearly in their reflections, in face-to-face interviews and through their responses in the Fennema-Sherman questionnaires on attitudes toward mathematics and confidence in doing mathematics. The faculty researchers conclude that virtual manipulatives are more effective for students learning pre-algebra rather than algebra. Further research is needed to determine the longer-term benefits of using virtual manipulatives for learning basic mathematics concepts.