

Students' Engagement with a Function Vending Machine Applet

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The purpose of this study is to examine the ways students engaged with a Vending Machine applet designed to problematize common misconceptions associated with the function concept. Findings indicated a need to redesign the applet to further disrupt students' misconceptions of the concept of function. Design decisions for the redesigned applet and the new version will be shared.

Keywords: Functions, Calculus, Teaching with Technology

Research has revealed common misconceptions that persist among undergraduate students with respect to the definition of function (Vinner & Dreyfus, 1989), use of function notation (e.g., Oehrtman, Carlson, & Thompson, 2008) and connections between function representations (e.g., Dreher & Kuntze, 2015; Stylianou, 2011). Hence, we designed and studied the ways that undergraduate students, all who have completed Calculus I, from six universities engaged with an applet designed to test and improve their understanding of the function concept.

The Vending Machine applet (<https://ggbm.at/qxQQQ7GP>) is a four-page GeoGebra book. When the user presses a button (input), one or more cans appear in the bottom of the machine (output). Students are asked make conjectures about why the machines are or are not functions. These machines were designed to provoke dilemmas (Merizow, 2009) with the students' common function misconceptions to lead them toward a robust understanding of the function concept such as students' use of the term "unique" when describing outputs of functions, misunderstanding of what represents an element in the range, and misidentifying horizontal lines as non-functions.

Method & Results Summary

To answer our research question, How do undergraduate students engage with a vending machine applet designed to provoke dilemmas with their understanding of the function concept?, we analyzed screencasts from 123 students that completed the vending machine assignment. Results showed that even after engaging with the applet, many students applied their previous understandings of the function concept to each of the machines and continued to demonstrate two misconceptions that we had intended to disrupt: 1) a horizontal line (each button returning the same can of soda) as not representing a function and 2) what represents elements in the range (a button consistently producing two identical cans).

Conclusion

Despite our Vending Machine applet's intended design to provoke dilemmas related to students' understanding of function which we hoped would promote reflection and ideally deepen students' understandings related to the function concept, we found that many students continued to apply their common misconceptions when engaging with the machines. Based on these results, we have redesigned the applet and will share how the new design arose from our analysis of the students' engagement with the applet.

References

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