Preparing to Teach Mathematics with Technology
Examining Student Practices

Is this Vending Machine FUNCTIONing Correctly?

Lara L. Dick
Bucknell University

Allison W. McCulloch
UNC Charlotte

What are some common understandings of function that your students have?

What is a function?

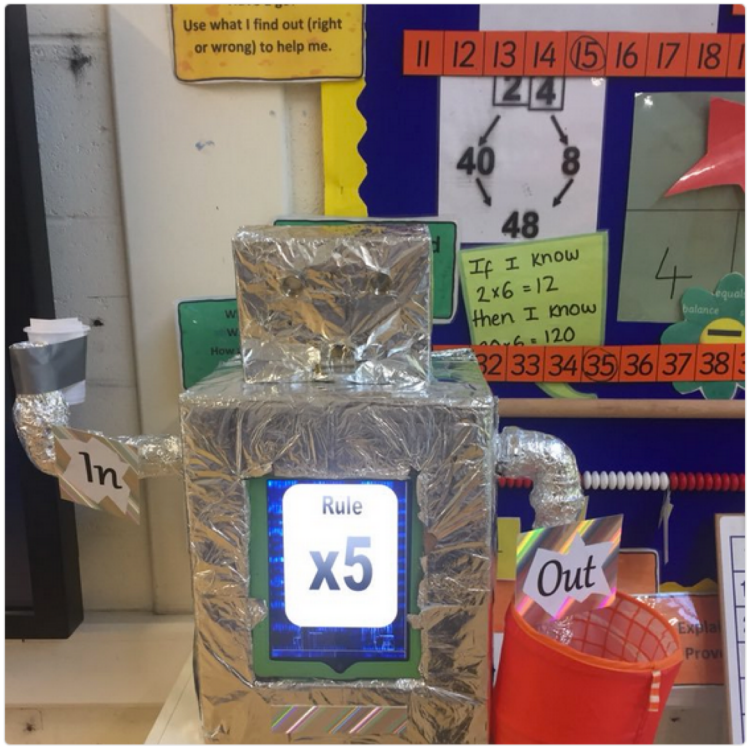
Teaching the Concept of Function

How might you introduce the concept of function to 8th graders who have never heard the term before?

Mr Elliman
@MrElliman

Follow

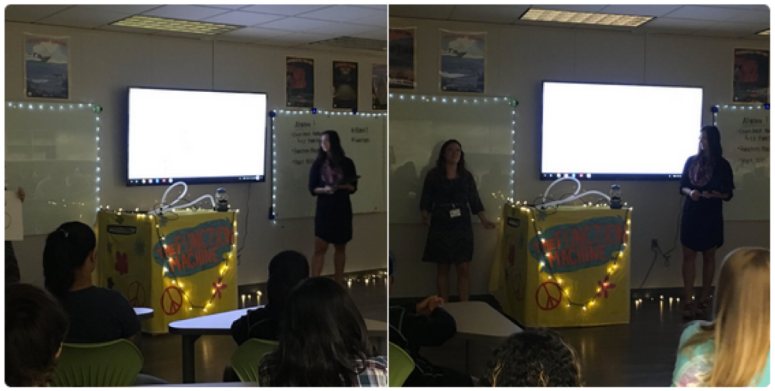
Looking forward to introducing my maths class to Funky the Function Machine today!



DSHS ELL
@sciotoELL

Follow

Discovery learning with the Function Machine in Algebra I today! Figuring out input/output patterns and even seeing what happens when the machine breaks! #IrishNation #theDublinDifference

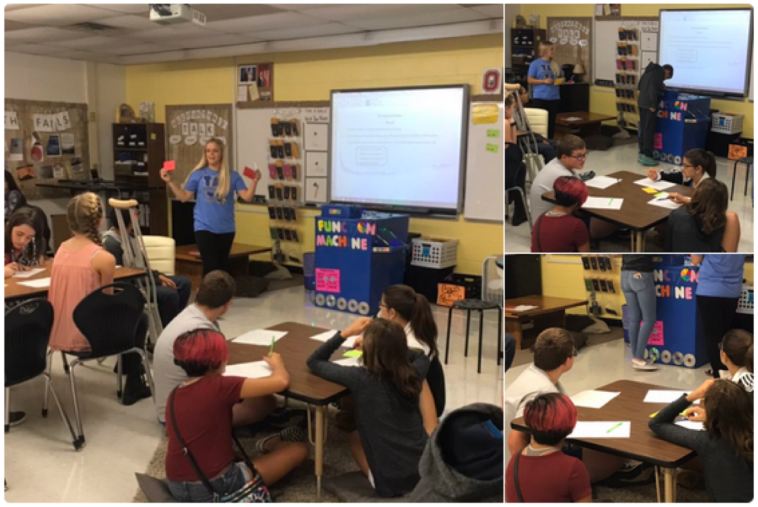


5:46 AM - 22 Aug 2018

Steven Tartt
@Lions_Admin

Follow

Miss Grossman @grossmanmath makes learning fun & highly engaging using her mystical, magical function machine to explore relationships between inputs & outputs @GahannaMSWest.



9:27 AM - 31 Aug 2018

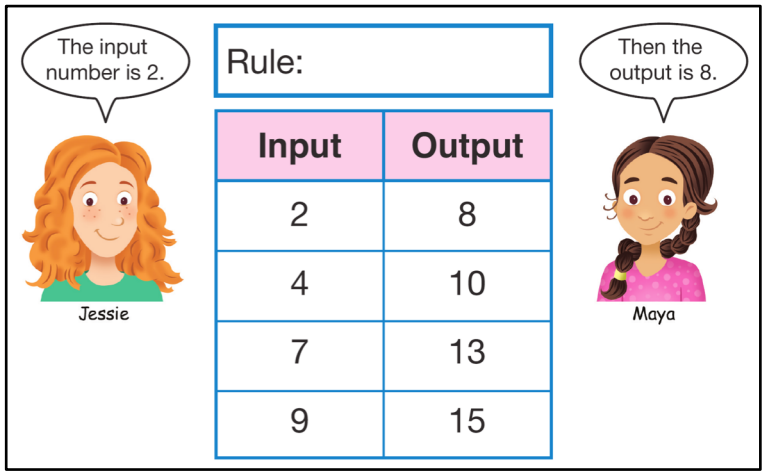
Tori Cox
@ToriTeachesMath

Follow

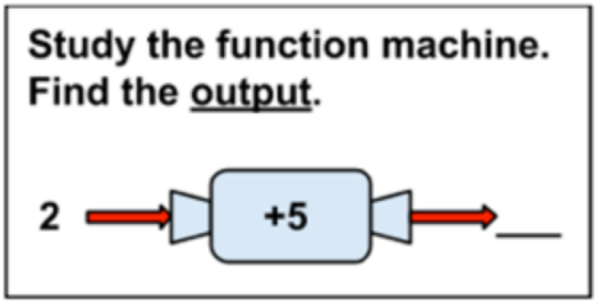
Ss played Number Tranformer Machine today by guessing the rule from inputs and outputs. Then I "broke" the machine w/ more than one output per input. I love this way of motivating the definition of a function #mtbos #iteachmath #teach180

2:01 PM - 24 Aug 2018

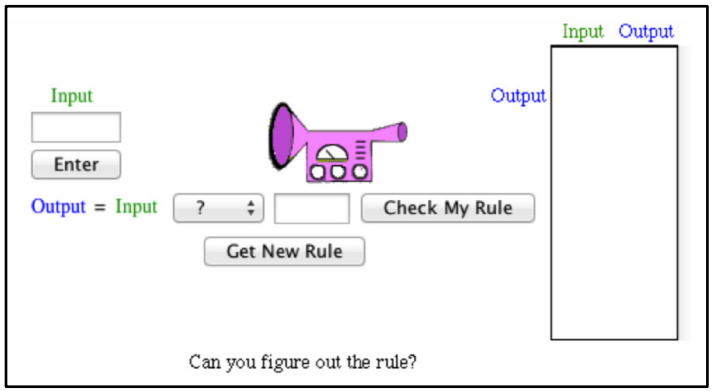
Function Machines



Math Trailblazers



Huinker (2002) MTMS



Shodor

“Guess My Rule” Function Machines

Pros

- A focus on inputs / outputs (independent / dependent)
- Requires one to recognize and describe a pattern
- Promotes connections between tables of values and algebraic expressions

Cons

- Emphasizes algebraic rules (and representations)
- Does not allow for examining non-functions

The Function Concept

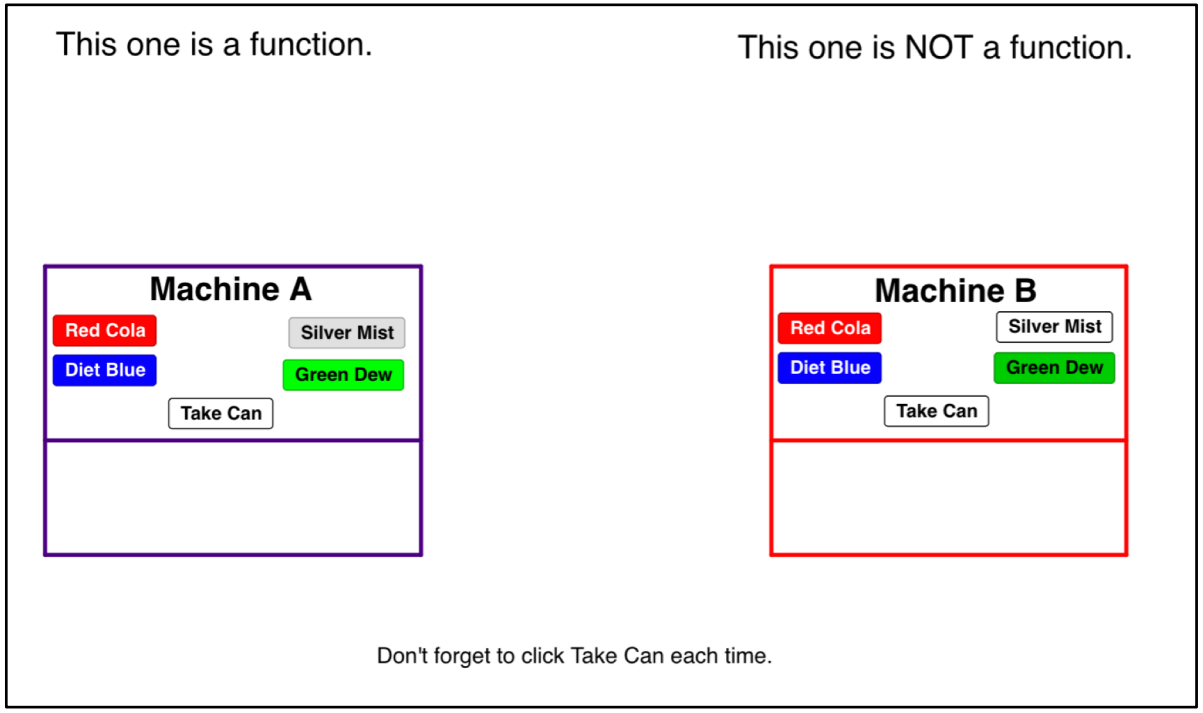
Essential Understandings:

- 1a – Functions are single-valued mappings from one set - the domain of the function - to another-its range.
- 1b – Functions apply to a wide range of situations. They do not have to be described by any specific expression.
- 1c – The domain and range of functions do not have to be numbers.

From NCTM Developing Essential Understandings of Expressions, Equations, & Functions (2011)

The Vending Machine Applet

go.uncc.edu/NCTMSD2019



What conceptions of function arose as you worked through the Vending Machine Applet Task?

How do you anticipate middle school students engaging with this applet?

Middle School Group One

Preparing to Teach Mathematics
with Technology
Examining Student Practices

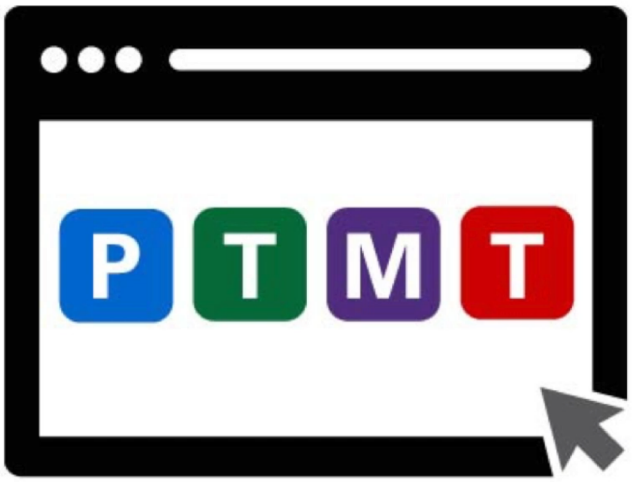
MIDDLE TENNESSEE STATE UNIVERSITY
UNC CHARLOTTE
ECU
NC STATE UNIVERSITY
NSF

Analyze Group 1's Thinking

How did Group 1 engage with the applet to decide which machine was or was not a function?

Explain Group 1's understanding of function. Use examples from the screencast as evidence to show how you know what they do or do not fully understand.

Middle School Group Two



Preparing to Teach Mathematics with Technology
Examining Student Practices

MIDDLE TENNESSEE STATE UNIVERSITY
UNC CHARLOTTE
ECU
NC STATE UNIVERSITY
NSF

Analyze Group 2's Thinking

How did Group 2 engage with the applet to decide which machine was or was not a function?

Explain Group 2's understanding of function. Use examples from the screencast as evidence to show how you know what they do or do not fully understand.

Compare and Contrast:
Focus on Essential Understandings

In what ways did the students' demonstrate their understanding of the essential understandings of the function concept?

In what ways might the applet have supported their development of these understandings?

Essential Understandings:

- 1a – Functions are single-valued mappings from one set - the domain of the function - to another-its range.
- 1b – Functions apply to a wide range of situations. They do not have to be described by any specific expression.
- 1c – The domain and range of functions do not have to be numbers.

What might you expect students would record as a definition for function after engaging with the Vending Machine Applet? Explain.

Using the terms “input” and “output” write a definition for function based on your exploration of the machines.

Function is when the input gives you a consistent output.

Consistent input and output and single relashinship that works for all factors.
Input - button pressed
output - can that came out

input can be different, but output is same for each input

Input → The button you press to recieve a can
Function → Input + Output = answer
Output → The can that comes out of the vending machine.

A function is when the input produces a predictable output

Final Thoughts

To develop an understanding of function that aligns with the essential understandings we believe…

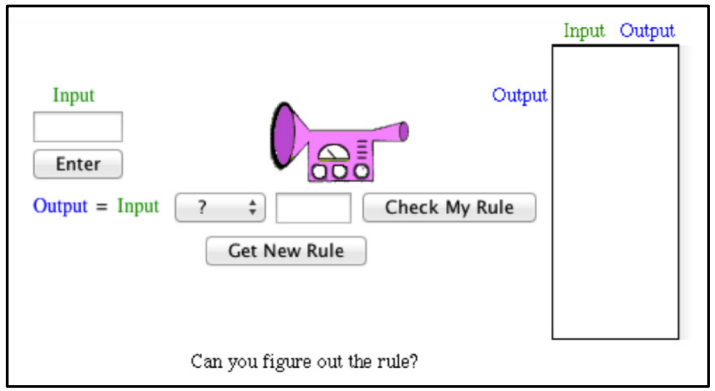
- It is important that students have opportunities to consider what is and is not a function
- It is important that students have opportunities to explore non-algebraic representations of function

The Vending Machine Applet is a novel and engaging way to address these needs.

You are welcome to use and share the app!

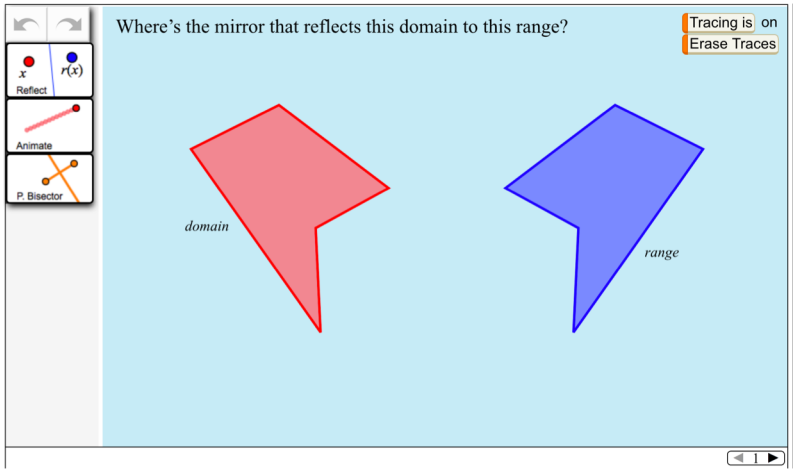
FYI…There is an accompanying paper that has been accepted to MTMS that will come out eventually. ☺

What would come next?



Guess my rule type tasks

Leveraging transformations to think about function



9:45 – 11:00 -- Sapphire CD

Making Connections between Geometric Transformations and Functions using Technology (and Dance!)

Preparing to Teach Mathematics with Technology
Examining Student Practices

Principal Investigators:

Jennifer Lovett, Middle Tennessee State University
Allison McCulloch, University of North Carolina at Charlotte
Charity Cayton, East Carolina University
Hollylynne Lee, NC State University

Consultant:

Lara Dick, Bucknell University

This project is supported by the National Science Foundation under grant DUE 1820998 awarded to Middle Tennessee State University, grant DUE 1821055 awarded to University of North Carolina at Charlotte, grant DUE 1820967 award to East Carolina University, and DUE 1820976 awarded to NC State University. Any opinions, findings, and conclusions or recommendations expressed herein are those of the principal investigators and do not necessarily reflect the views of the National Science Foundation.