

#### Example of Backward Transfer

Students	Students are	Students	Students are
learn about	tested on	learn about	tested on
Linear	👆 Linear 📙	Quadratic	Linear
Functions	<b>Functions</b>	Functions	Functions

#### Alex's Reasoning *Before* Learning **About Quadratic Functions**



#### Alex's Reasoning After Learning **About Quadratic Functions**



### Defining Backward Transfer

We define Backward Transfer in the following way: Backward transfer is the influence that learning something new has on a learner's prior ways of reasoning about a different or related concept. (Hohensee, Gartland, Willoughby, & Melville, 2020)

### Why BT Research is Important

- Sometimes BT can be unproductive (i.e., the new learning makes students' prior ways of reasoning less clear and/or less correct). We want to find ways to teach, that minimize or even eliminate unproductive BT.
- Sometimes BT can be productive (i.e., the new learning makes students' prior ways of reasoning more clear and/or more correct). We want to find ways to teach, that promote and maximize productive BT.

# **Contrasting Cases of Backward Transfer Involving** Linear and Quadratic Functions Charles Hohensee & Matthew Melville

## The Type of Research We Do

**Our Mathematical Focus:** We study how to teach quadratic functions so that the influences it has on students' prior ways of reasoning about linear functions are productive.

Summer Math Program: Much of this project is situated around running 2-3 week summer math programs, in which students learn about quadratic functions.



#### SimCalc MathWorlds for Computers Distance from Start of Race 🕨 🗹 Selected Function: Frog (gree 🕨 🔛 Step 03.70

#### **Our Research Question**

How will backward transfer effects (i.e., influences on prior ways of reasoning by new instruction) produced in an experimental setting (i.e., a summer math program) compare with backward transfer effects produced in a control setting (i.e., two business-as-usual classrooms)?

#### Our Research Project

Experimental Group: We gave a preand post-tests on linear functions to students in our summer math program  $(n_2=18)$ , before and after we taught them about quadratic functions, using an approach that emphasized covariational reasoning and used SimCalc MathWorlds. The students came from low-income ethnically-diverse populations.

**Control Group:** We gave the same preand post-tests on linear functions to 2 regular algebra classes ( $n_1=57$ ), before and after they learned about quadratic functions. The teachers taught the way they normally teach that topic. Both schools serve low-income, ethnically diverse populations.

### The Test We Used

B Study Phase 2 1) Two cars go on a road trip. The graphs show the gallons left in each car's gas tank for the distance driven. Please use the graphs to answer the questions below.	<text><text><text><text><text><text><text><text><text><text></text></text></text></text></text></text></text></text></text></text>
BT Study Prise 2 2) The table below shows the additional fee charged for additional MB of data used on your cell phone bill. Please use the table to answer the questions below. The difficient MB difficient fee charged if you use an additional 32MB of data? Please show all of your work. Additional MB difficient fee charged if you use an additional 32MB of data? Please show all of your work. Additional MB difficient fee charged if you use an additional 32MB of data? Please show all of your work. A the work of the problem. They were asked to determine how much someone would earn for working 43 hours. Explain how each student solved the problem. The student is solved a similar problem. They were asked to determine how much someone would earn for working 43 hours. Explain how each student solved the problem.	BT Study Phase 2   Initials:     1 The following table shows a fish's position from home over time as she swims. Please use the table to answer the questions below.     Image: A study of the fish is position from home over time as she swims. Please use the table to answer the questions below.     Image: A study of the fish is position from home over time as she swims. Please use the table to answer the questions below.     Image: A study of the fish is position from home over time as she swims.     Image: A study of the fish is position from home over time as she swims.     Image: A study of the fish is position from home over time as the swims.     Image: A study of the fish is position from home over time as the swims.     Image: A study of the fish is position from home over time as the swims.     Image: A study of the fish is position from home over time as the swims.     Image: A study of the fish is position from home over time as the swims.     Image: A study of the fish is position from home over time fish is possible.     Image: A study of the fish is possition for the fish is possible. </th

## What We Found

#### Three types of Changes in **Reasoning**:

- 1. Changes in the strategies students used (build-up vs abbrev build-up).
- 2. Changes in whether they thought a solution was possible or not possible.
- 3. Changes in the kind of solutions they found (specific vs general).



Res with reas

> Finding 2: We found that the changes in prior ways of reasoning for the experimental group were more in one direction than for the control group.

Res with ans Res with ans (this

> **Possible Explanations** The experimental group experienced a more consistent instructional focus on particular aspects of reasoning about quadratic functions (i.e., covariational reasoning) then the control group. That may have led to fewer backward transfer effects that were more consistently in a particular direction.



## What We Found (cont.)

Finding 1: We found far fewer changes in prior ways of reasoning in the experimental group than the control group.

	Experimental Group	Control Group
ponses from pre- to post-test changes in prior ways of soning	28%	50%

	Experimental	Control
	Group	Group
ponses from pre- to post-test changed from a general wer to a specific answer	0%	32%
ponses from pre- to post-test changed from a specific wer to a general answer was the correct answer)	44%	35%

#### Our Team

Link to video: <u>https://youtu.be/gJi2Nu5-HTU</u>