Backward Transfer Effects When Learning About Quadratic Functions

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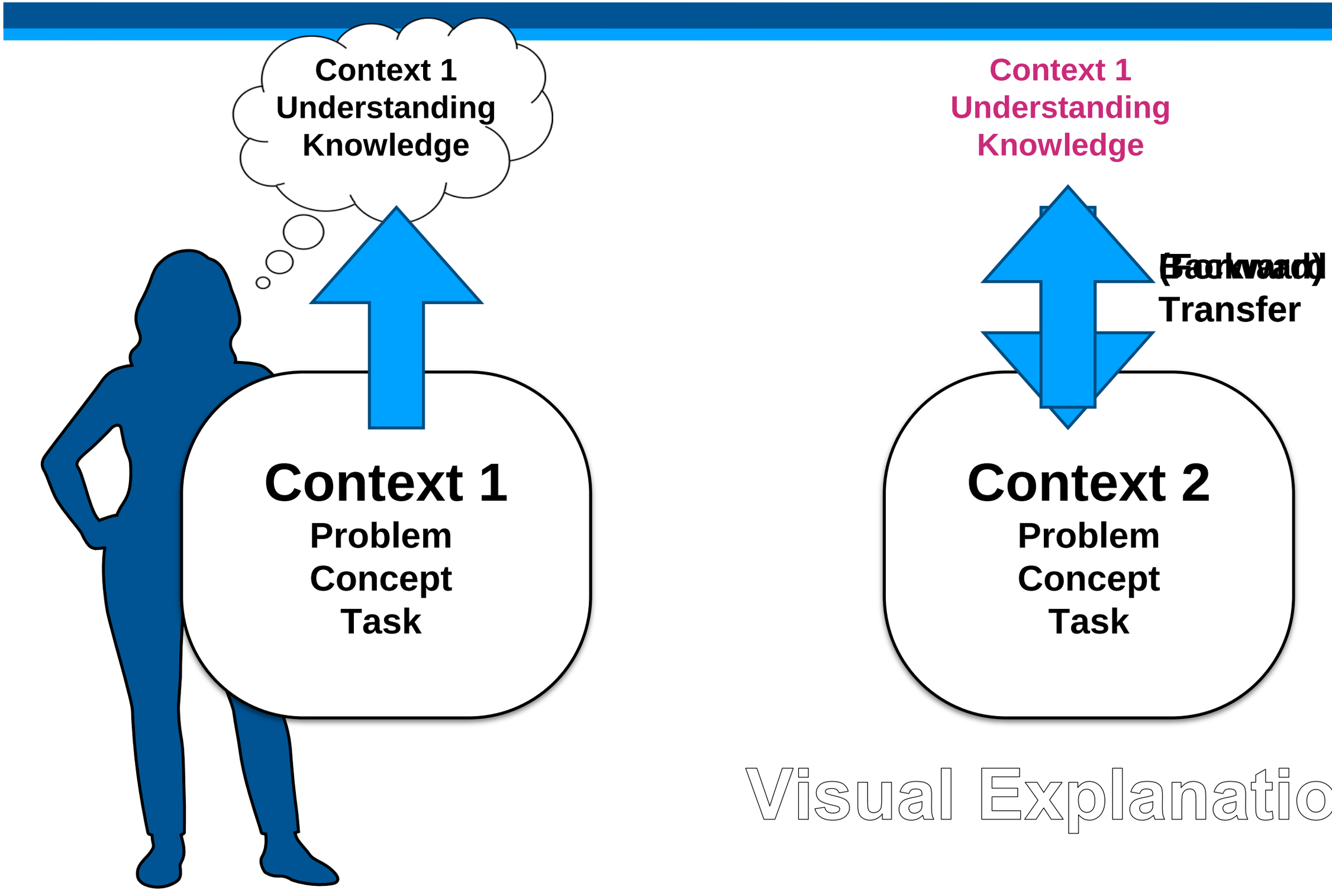
DRL 1651571

What is Backward Transfer?



Visual Explanation

Theoretical Grounding for Backward Transfer

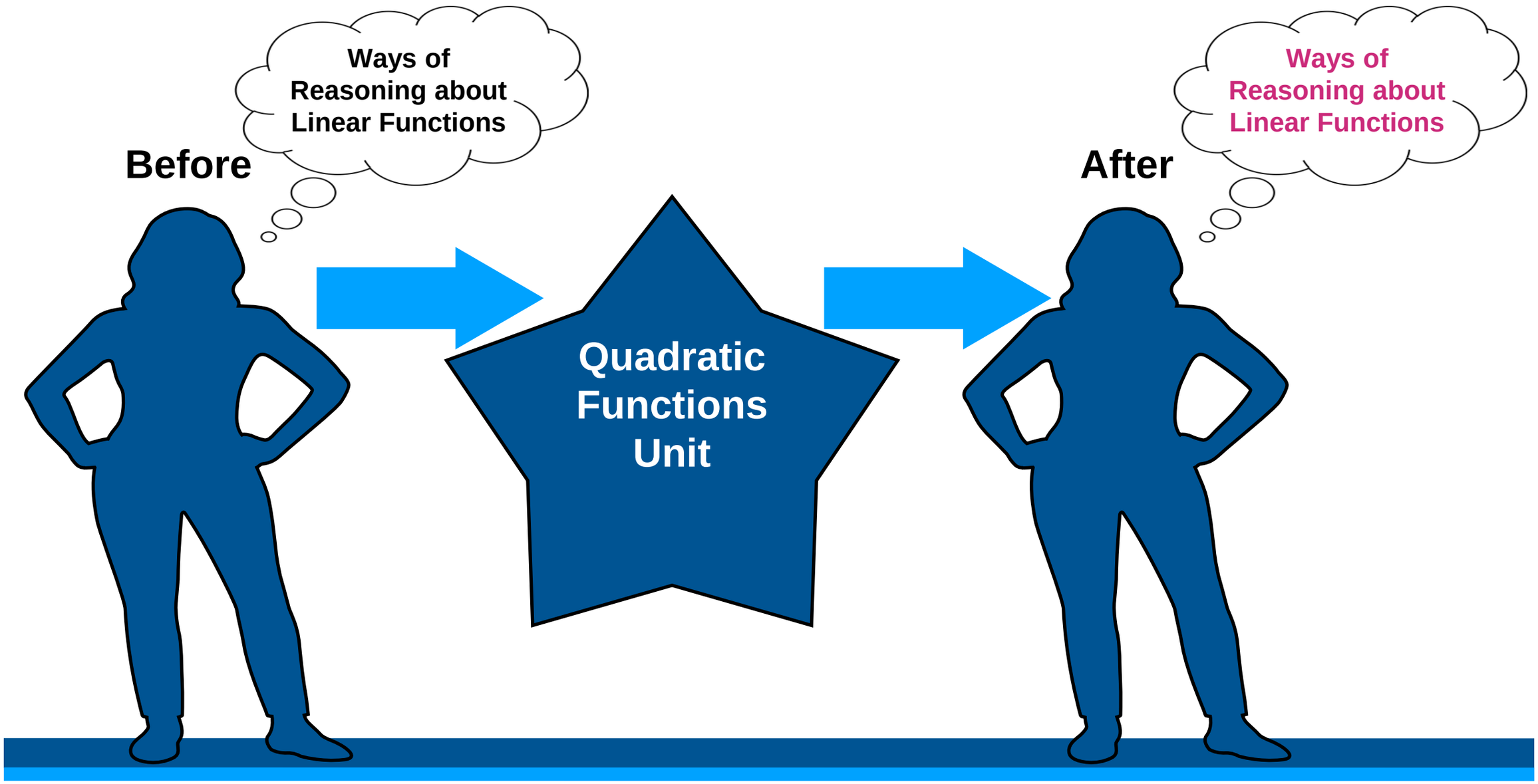
- We know there is a relationship between prior knowledge and new learning (e.g., Hiebert & Carpenter, 1992)

- “Learning a domain of elementary mathematics or science may entail changes of massive scope…creating *very large ripple effects through the system*” (Smith, diSessa, & Roschelle, 1993, p. 148, italics added)

Empirical Evidence of Backward Transfer Effects

Research Question

What kinds of changes in Algebra students' previously-established ways of reasoning about linear functions are observed after students complete a quadratic functions unit with their regular mathematics teacher?



Methods

Participants and Setting

- 9th and 10th Grade Algebra Classes
- Teachers = +8 years experience
- Quadratic Functions curricula focus on properties of graphs and symbol manipulation

Before

- Linear Function Pre-Assessment
- Clinical Semi-Structured Interviews

Intervention

Quadratic Functions Unit

After

- Linear Function Post-Assessment
- Clinical Semi-Structured Interviews

Methods

Initial Analysis

- Analysis of three students' assessments and interviews
- Descriptive narratives for each response for each student
- Coded each response using "partway between the a priori and inductive qualitative approaches" (Miles & Huberman, 1994, p. 61)
- Identified themes
- Presented themes to research team as a preliminary check

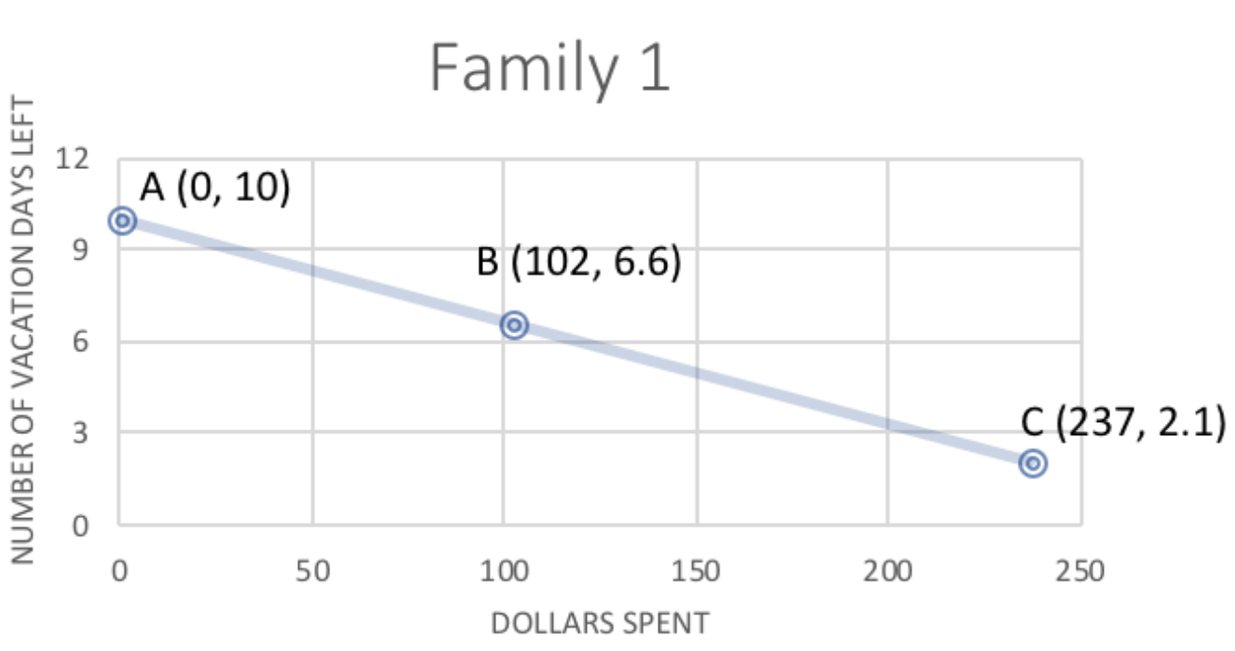
Results

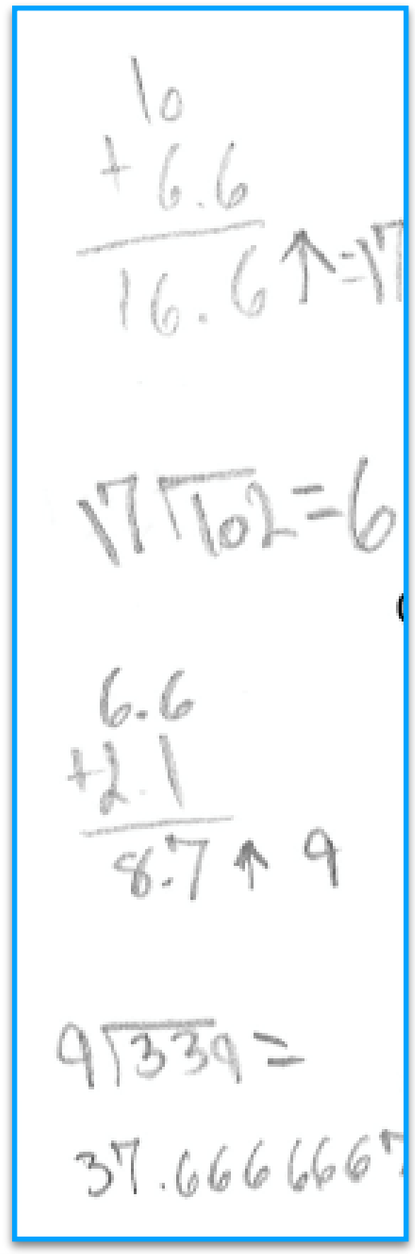
Changes in Ways of Reasoning about Linear Functions

1. Reasoning with and <u>without</u> Changes in Quantities

Phillip

Before Quadratics





es Family 1 plan to spend money at the same rate between

No, family 1 will spend mac money between points B and C

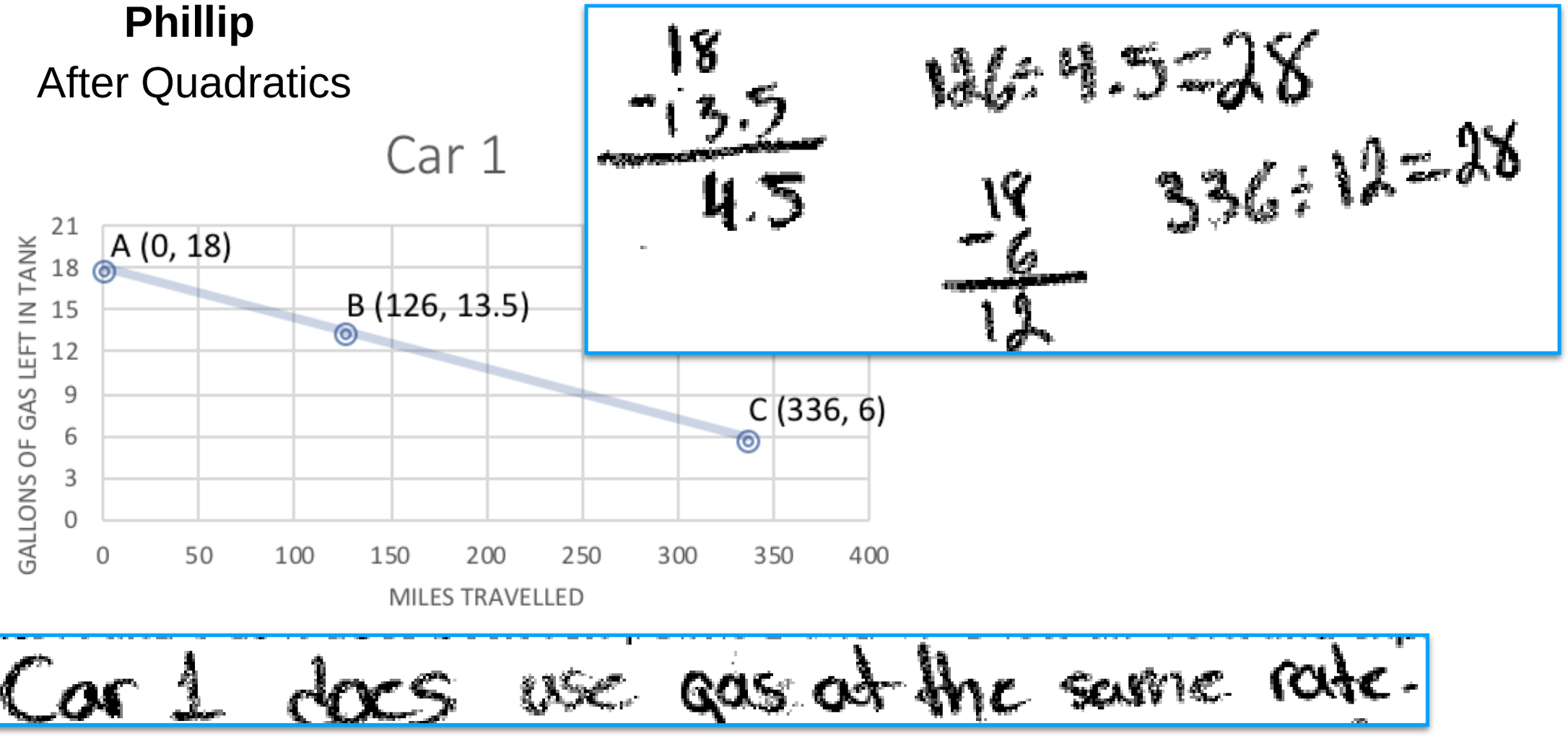
Results

Changes in Ways of Reasoning about Linear Functions

1. Reasoning <u>with</u> and without Changes in Quantities

Phillip

After Quadratics



Results

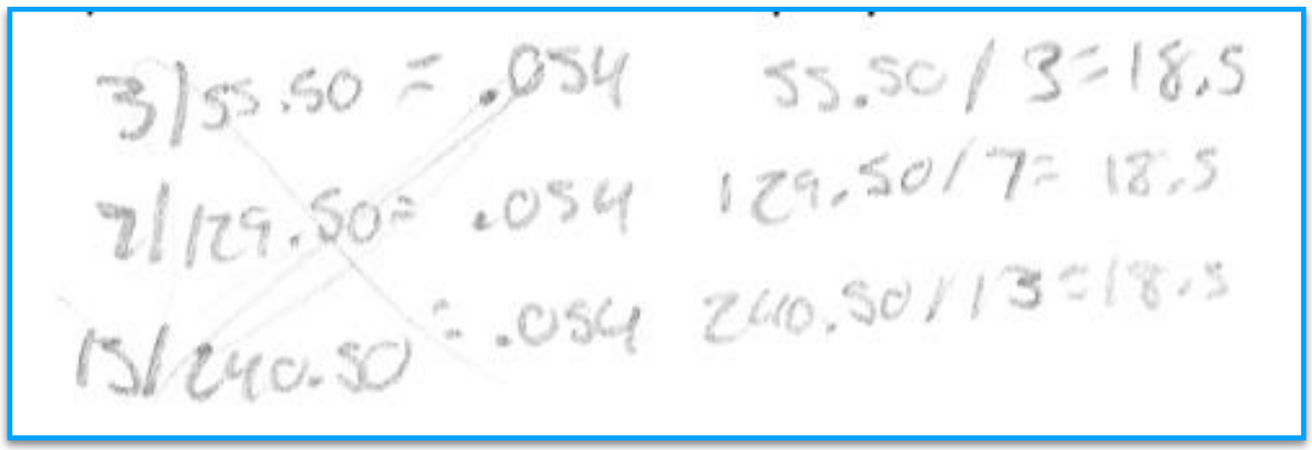
Changes in Ways of Reasoning about Linear Functions

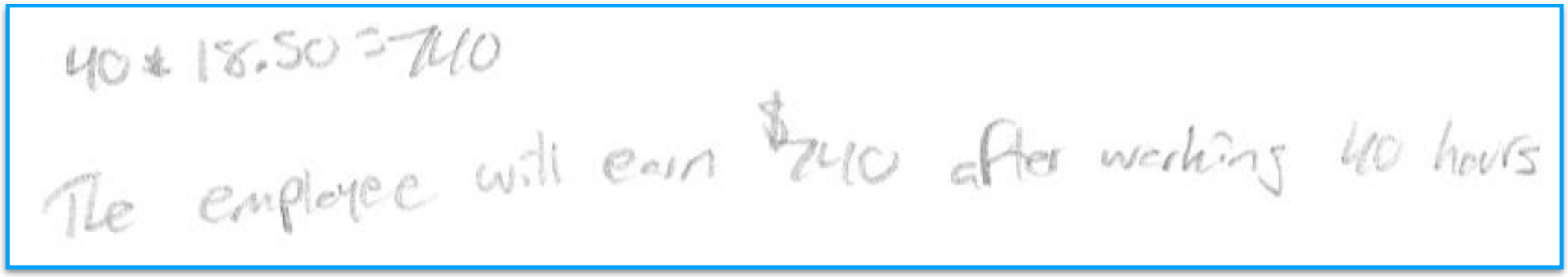
2. Correspondence View vs Covariational View of Functions

Alex

Before Quadratics

Hours Worked	Money Earned
3	$55.50
7	$129.50
13	$240.50





Results

Changes in Ways of Reasoning about Linear Functions

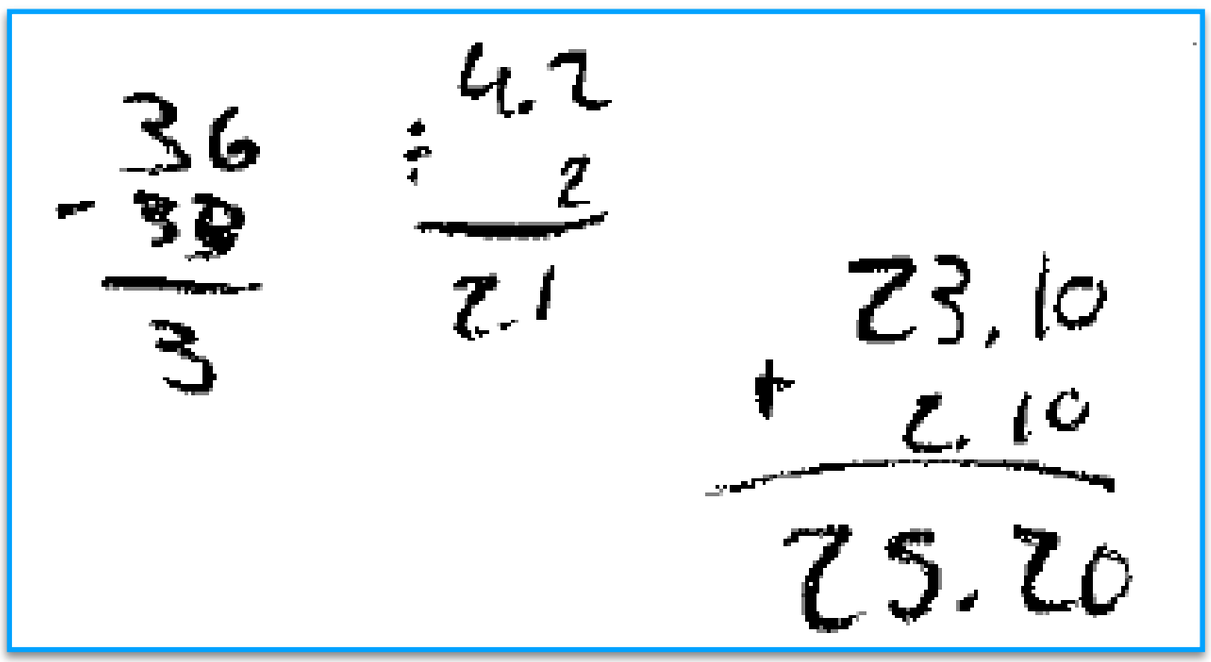
2. Correspondence View vs <u>Covariational</u> View of Functions

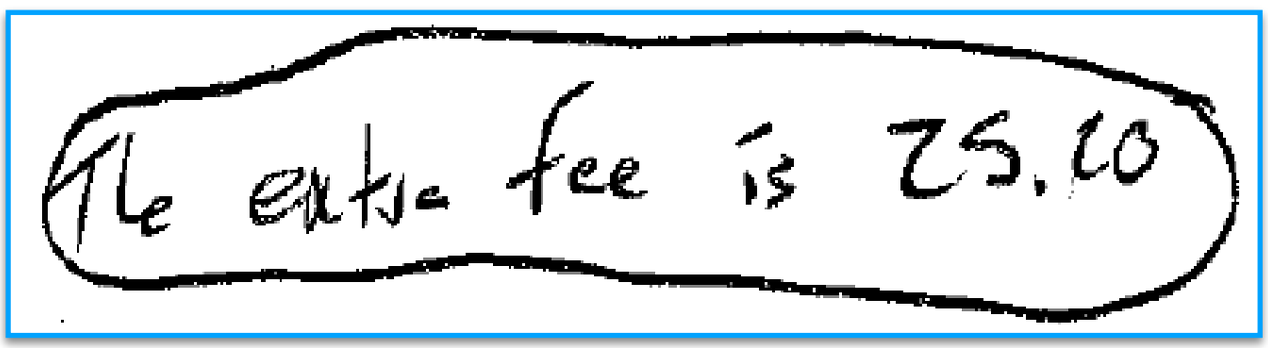
Alex

After Quadratics

Additional MB of Data Used	Extra Fee Charged
15	$10.50
27	$18.90
33	$23.10
36	

12 < 15 > 8.4
6 < 27 > 4.2
3 < 33 > 2.1





Summary

Answering the Research Question

- Quadratic functions learning activities can unintentionally influence students' ways of reason about linear functions.
- Looking at students reasoning about changes in quantities and the covariational vs correspondence view of functions seems promising.
- Changes in reasoning may be unintentionally productive. Changes in reasoning may also occur that are not more or less productive.

Implications for Practice

- Teachers could provide students opportunities after quadratics lessons to reason in linear contexts with changes in quantities.
- Teachers could emphasize the correspondence view during quadratics lessons so that they don't lose sight of it.

Extra Slides

Participants	High School A	Teacher 1	9th Grade Classroom 1: N_1=9
		Teacher 2*	10th Grade Classroom 2: N_2=27
	High School B	Teacher 3	9th Grade Classroom 3: N_3=18
		Teacher 4	10th Grade Classroom 4: N_4=24

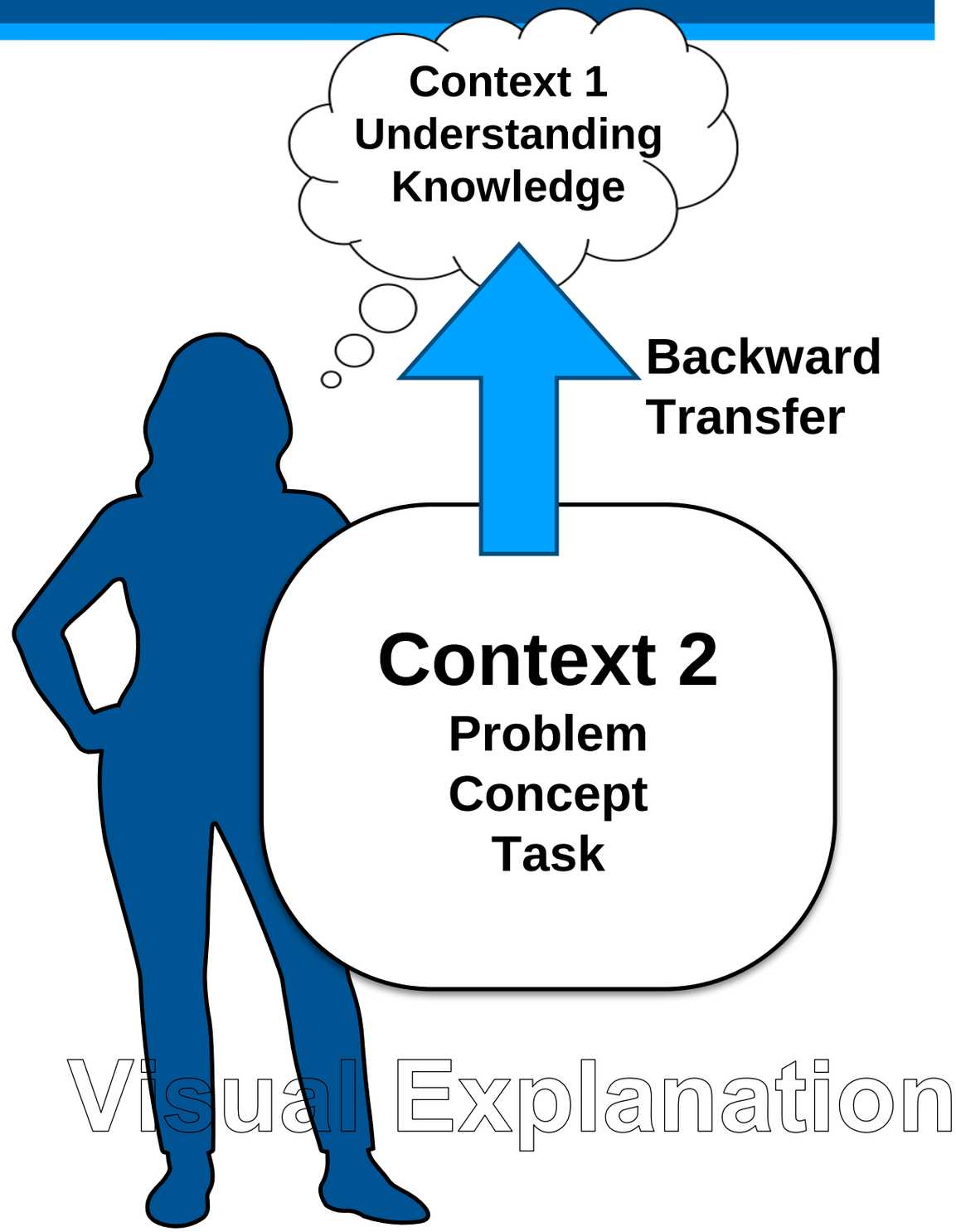
N_T=81

Extra Slides

Definition

Backward transfer is “the influence that constructing and subsequently generalizing new knowledge has on one’s ways of reasoning about related mathematical concepts that one has encountered previously” (Hohensee, 2014)

Visual Explanation



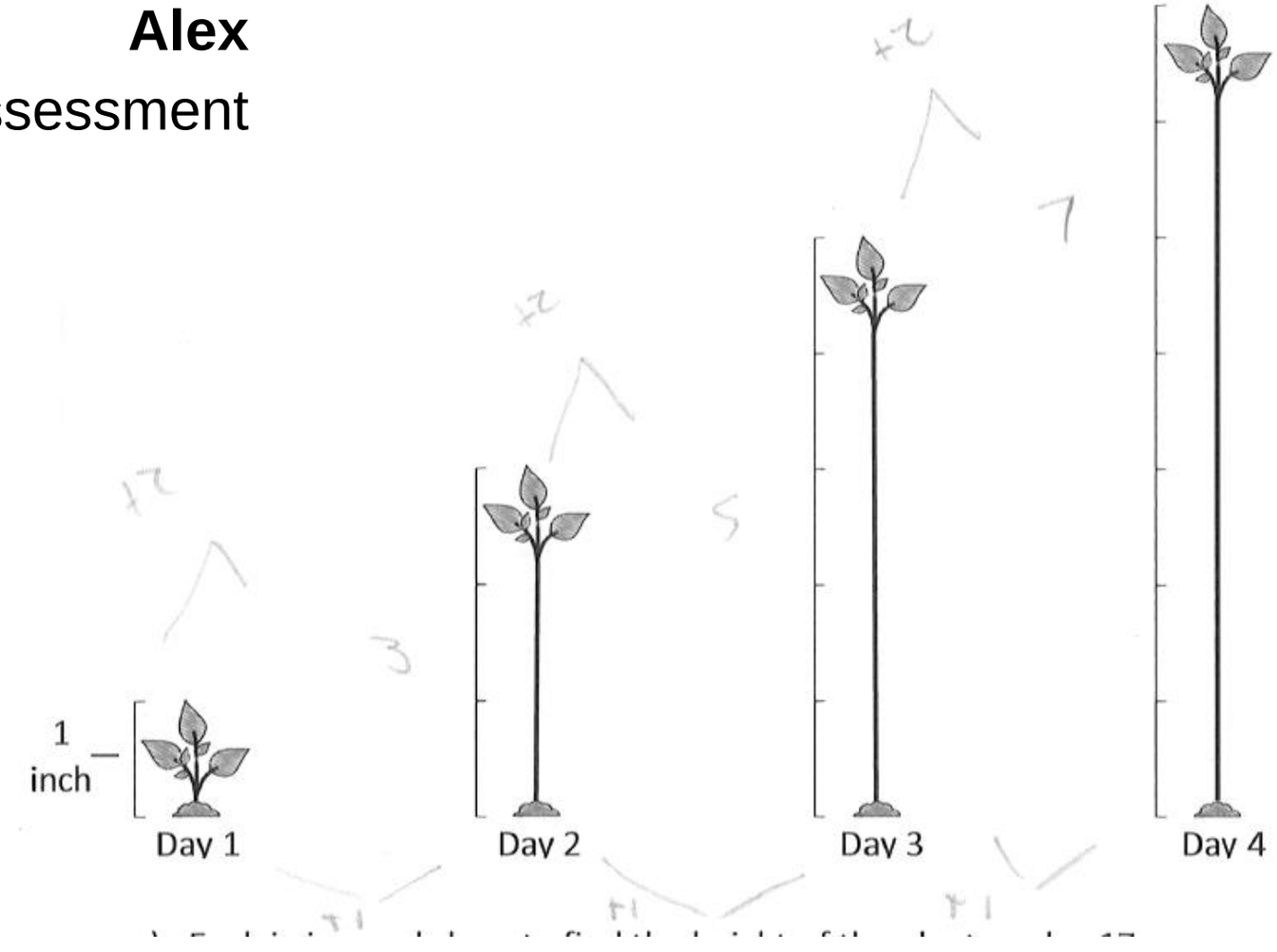
Extra Slides

Changes in Ways of Reasoning about Linear Functions

3. Additive vs Multiplicative Reasoning

Alex

Pre-Assessment



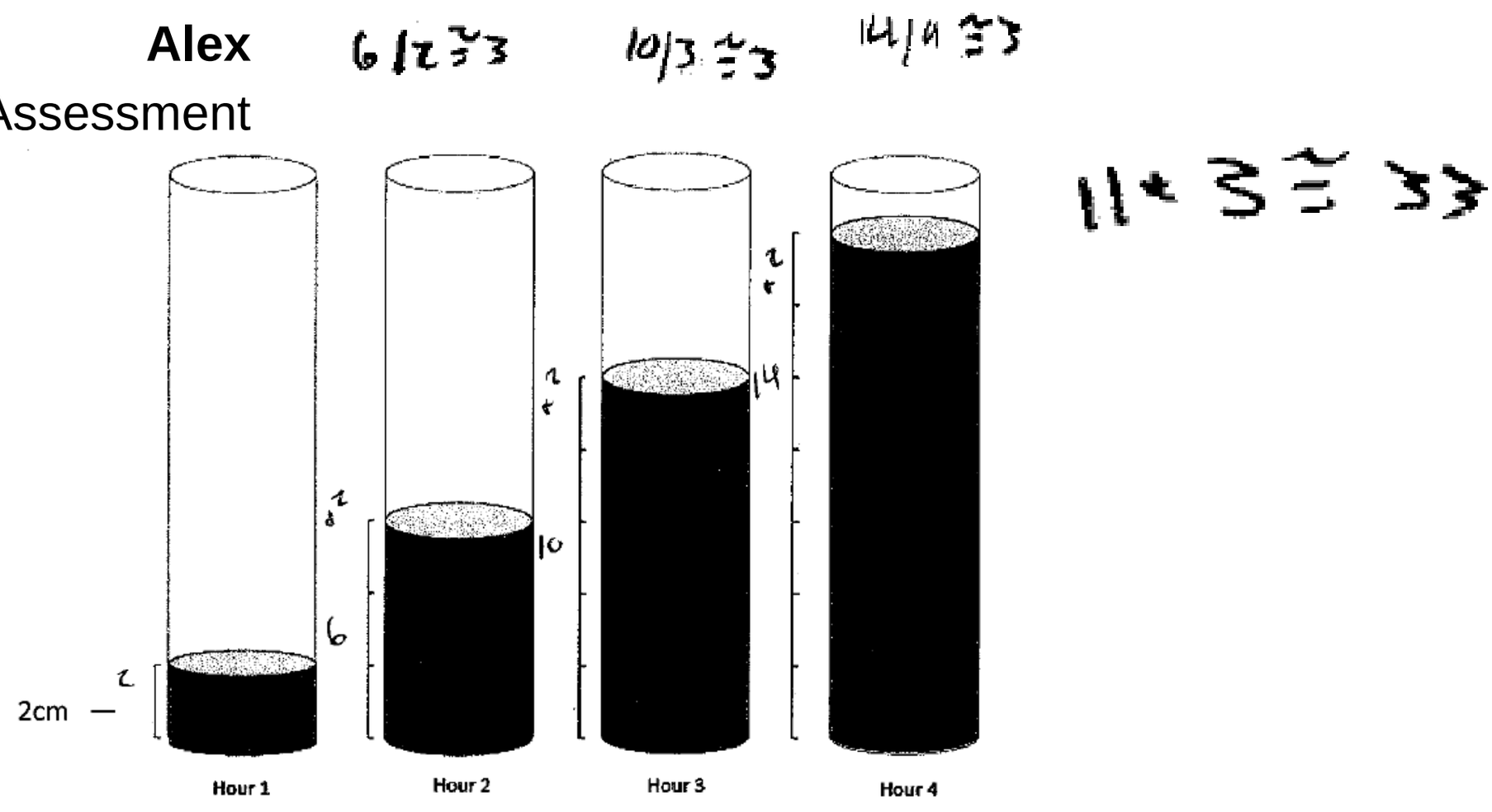
Extra Slides

Changes in Ways of Reasoning about Linear Functions

3. Additive vs Multiplicative Reasoning

Alex

Post-Assessment



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