Extension PD #2

Diagnostic Assessment Data: Error Analysis

Agenda

Readiness Individual Algebra Teaching of Supporting

Classroom Application

Tracking Progress

Common Error Types

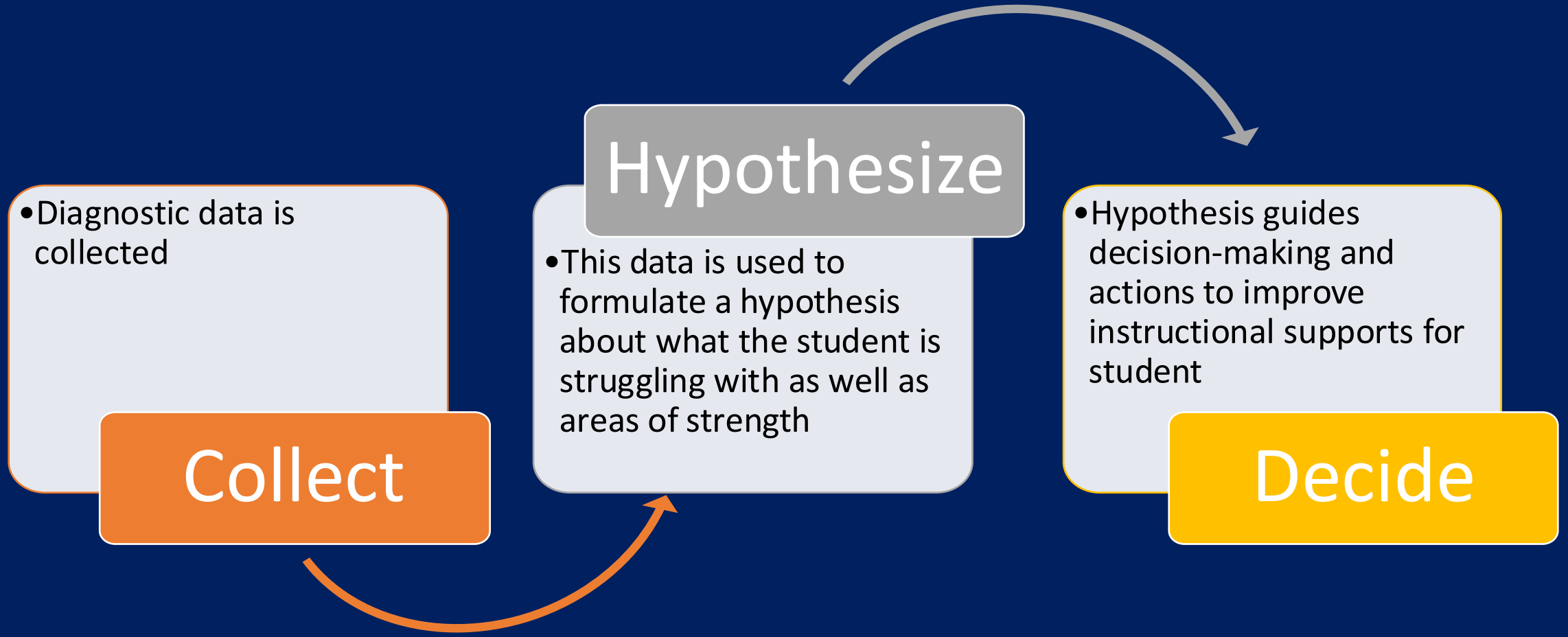
Overview of Error Analysis

Understanding Diagnostic Assessment Data

Agenda

Understanding Diagnostic Assessment Data

Understanding Diagnostic Data



Overview of Error Analysis

Error Analysis: An Overview

What is error analysis?

- **Diagnostic error analysis** is a *process of reviewing a student's work and looking for steps a student can perform correctly and patterns of errors*.
  - Involves the analysis of student errors on a worksheet, test, or other measure of student mathematics knowledge and understanding

Error Analysis: An Overview

- When errors are consistently made, it can indicate misunderstanding of mathematics concept or operation.
  - By analyzing these errors, we can obtain information about types of errors
  - Three main types of errors include:
    - Factual errors
    - Conceptual errors
    - Procedural errors

Steps to Conduct Error Analysis

Step 1- Collect data

- Ask the student to complete at least 3 to 5 problems of the same type (e.g., multi-digit multiplication).

Step 2 - Identify error patterns

- Review the student's solutions, looking for consistent error patterns (e.g., errors involving regrouping).

Step 3- Determine reasons for errors

- Find out why the student is making these errors

Step 4- Use the data to address error patterns

- Decide what type of instructional strategy will best address a student's skill deficits or misunderstandings.

(Brown et al., 2016)

Scoring

Typically, addition, subtraction, and multiplication problems should be scored from RIGHT to LEFT. By scoring from right to left, the teacher will be sure to note incorrect digits in the place value columns

Division problems should be scored LEFT to RIGHT

If the student is not using a traditional algorithm to arrive at a solution, but instead using a partial algorithm (e.g., partial sums, partial products) then addition, subtraction, multiplication, and division problems should be scored from LEFT to RIGHT

Common Error Types

Common Error Types

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Factual Errors

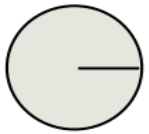
Procedural Errors

Conceptual Errors

Common Error Types

Factual errors occur when students lack knowledge of factual information, such as:

- vocabulary
- digit identification
- place value

Factual Error	Examples
Has not mastered basic number facts: The student does not know basic mathematics facts and makes errors when adding, subtracting, multiplying, or dividing single-digit numbers.	$3 + 2 = 7$ $7 - 4 = 2$ $2 \times 3 = 7$ $8 \div 4 = 3$
Misidentifies signs	$2 \times 3 = 5$ (The student identifies the multiplication sign as an addition sign.) $8 \div 4 = 4$ (The student identifies the division sign as a minus sign.)
Misidentifies digits	The student identifies a 5 as a 2.
Makes counting errors	1, 2, 3, 4, 5, 7, 8, 9 (The student skips 6.)
Does not know mathematical terms (vocabulary)	The student does not understand the meaning of terms such as *numerator, denominator, greatest common factor, least common multiple,* or *circumference*.
Does not know mathematical formulas	The student does not know the formula for calculating the area of a circle. 

Source: Brown et al. (2016)

Common Error Types

Procedural errors occur when students misunderstand what steps or procedures are required to solve a problem

Procedural Error	Examples	
Regrouping Errors		
Forgetting to regroup: The student forgets to regroup (carry) when adding, multiplying, or subtracting.	77 + 54 121	The student added 7 + 4 correctly but didn't regroup one group of 10 to the tens column.
	123 − 76 53	The student does not regroup one group of 10 from the tens column, but instead subtracted the number that is less (3) from the greater number (6) in the ones column.
	56 × 2 102	After multiplying 2 × 6, the student fails to regroup one group of 10 from the tens column.
Regrouping across a zero: When a problem contains one or more 0's in the minuend (top number), the student is unsure of what to do.	304 − 21 323	The student subtracted the 0 from the 2 instead of regrouping.
Performing incorrect operation: Although able to correctly identify the signs (e.g., addition, minus), students often subtract when they are suppose to add, or vice versa. However, students might also perform other incorrect operations, such as multiplying instead of adding.	234 − 45 279	The student added instead of subtracting.
	3 + 2 6	The student multiplied instead of adding.

Source: Brown et al. (2016)

Common Error Types

Procedural errors occur when students misunderstand what steps or procedures are required to solve a problem

Fraction Errors		
Failure to find common denominator when adding and subtracting fractions	$\frac{3}{4} + \frac{1}{3} = \frac{4}{7}$	The student added the numerators and then the denominators without finding the common denominator.
Failure to invert and then multiply when dividing fractions	$\frac{1}{2} \div 2 = \frac{1}{2} \times \frac{2}{1} = \frac{2}{2} = 1$	The student did not invert the 2 to ½ before multiplying to get the correct answer of ¼ .
Failure to change the denominator in multiplying fractions	$\frac{2}{8} \times \frac{5}{8} = \frac{10}{8}$	The student did not multiply the denominators to get the correct answer.
Incorrectly converting a mixed number to an improper fraction	$1\frac{1}{2} = \frac{4}{2}$	To find the numerator, the student added 2 + 1 + 1 to get 4, instead of following the correct procedure (2 × 1 + 1 = 3).

Source: Brown et al. (2016)

Common Error Types

Procedural errors occur when students misunderstand what steps or procedures are required to solve a problem

Procedural Error cont	**Examples** cont	
Decimal Errors		
Not aligning decimal points when adding or subtracting: The student aligns the numbers without regard to where the decimal is located.	120.4 + 63.21 75.25	The student did not align the decimal points to show digits in like places. In this case, .4 and .2 are in the tenths place and should be aligned.
Not placing decimal in appropriate place when multiplying or dividing: The student does not count and add the number of decimal places in each factor to determine the number of decimal places in the product. *Note: This could also be a conceptual error related to place value.*	3.4 × .2 6.8	As with adding or subtracting, the student aligns the decimal point in the product with the decimal points in the factors. The student did not count and add the number of decimal places in each factor to determine the number of decimal places in the product

Source: Brown et al. (2016)

Common Error Types

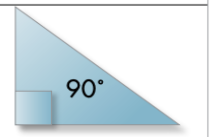
Conceptual errors occur when a student holds misconceptions or lacks understanding of the underlying principles and ideas related to a given mathematical problem

Conceptual Error	Examples	
Misunderstanding of place value: The student doesn't understand place value and records the answer so that the numbers are not in the appropriate place value position.	67 + 4 17	The student added all the numbers together (6 + 7 + 4 = 17), not understanding the values of the ones and tens columns.
	10 + 9 91	The student recorded the answer with the numbers reversed, disregarding the appropriate place value position of the numbers or digits.
	Write the following as a number: a) seventy-six b) nine hundred seventy-four c) six thousand, six hundred twenty-four Student answer: a) 76 b) 90074 c) 600060024	When expressing a number beyond two digits, the student does not have a conceptual understanding of the place value position.

Source: Brown et al. (2016)

Common Error Types

Conceptual errors occur when a student holds misconceptions or lacks understanding of the underlying principles and ideas related to a given mathematical problem

Conceptual Error cont.	**Examples** cont.	
Overgeneralization: Because of lack of conceptual understanding, the student incorrectly applies rules or knowledge to novel situations.	$\begin{array}{r} 321 \\ -\ 245 \\ \hline 124 \end{array}$	Regardless of whether the greater number is in the minuend (top number) or subtrahend (bottom number), the student always subtracts the number that is less from the greater number, as is done with single-digit subtraction.
	Put the following fractions in order from smallest to largest. $\frac{77}{486}$ $\frac{1}{351}$ $\frac{12}{200}$	The student puts fractions in the order $\frac{12}{200}$, $\frac{1}{351}$, $\frac{77}{486}$, because he doesn't understand the relation between the numerator and its denominator; that is, larger denominators mean smaller fractional parts.
Overspecialization: Because of lack of conceptual understanding, the student develops an overly narrow definition of a given concept or of when to apply a rule or algorithm.	Which of the triangles below are right triangles?	The student chooses *a* because she only associates a right triangle with those with the same orientation as *a*.
	a) 	
	b) 	
	c) both Student answer: a	

Source: Brown et al. (2016)

Let's Practice Together

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$$\frac{3}{7} + \frac{1}{7} = \frac{4}{\cancel{14}} \qquad \frac{7}{11} - \frac{4}{11} = \frac{3}{\cancel{0}}$$

$$\frac{4}{9} - \frac{2}{9} = \frac{2}{\cancel{0}} \qquad \frac{2}{4} + \frac{1}{4} = \frac{\cancel{1}}{\cancel{8}}$$

Your Turn!

Go to:

https://iris.peabody.vanderbilt.edu/module/dbi2/cresource/q2/p07/

or scan the QR code below.

- Scroll to the bottom until you see the Activity Link in a purple box
- Complete the activity and check your answers using the feedback link!

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Tracking Progress

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I’ve conducted error analysis….now what?

Monitor Student Progress

Score Report for Zachary

Skill	Number of Items Per Skill	Zachary's Score	Zachary's Skill Analysis
Long division	2	2	●
Convert to decimal	3	1	⊙
Convert to fraction	3	2	⊙
Multiplication with carrying	2	1	⊙
Addition of fractions	3	1	⊙
Subtraction of fractions	1	0	○
Multiplication of fractions	2	1	⊙
Division of fractions	3	1	⊙
Addition with decimals	1	1	●
Subtraction with decimals	3	1	⊙
Multiplication with decimals	1	1	●
Division with decimals	1	0	○

● = Mastered
⊙ = Partial Mastery
○ = Not Mastered

Error trackers can be a helpful tool for monitoring student skill progress when errors are identified!

What might be some other ways to track?

Wrap Up & Next Steps

Wrap Up & Next Steps

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Questions?

Thank you!

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