

Measuring Spreadsheet Skills Using Analytics within an Interactive Textbook

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November 2019



Thank you and...



Alex Edgcomb, Katherine Roach, Nneka Azuka, Megan Davidson

Disclaimer: I may financially benefit from sales of the interactive books discussed in this talk

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University of Toledo IRB protocol 201808

How we teach spreadsheets...



1. Demonstration

2. Recorded demonstration



3. No need – the students are digital natives

How we learn spreadsheets



By doing

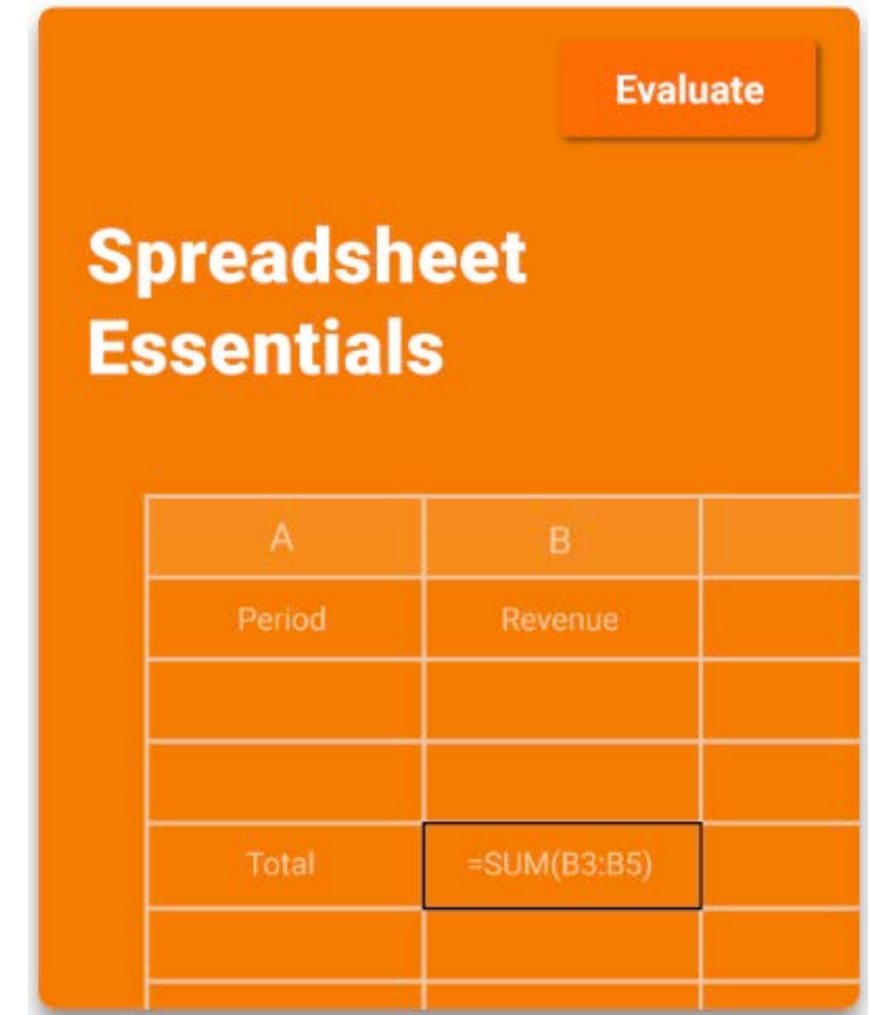
Why spreadsheets?



NOT Excel version X on platform Y

Spreadsheets are a commodity

Most features are independent of version or program



One big, happy family...



Started by Computer Science faculty in 2012

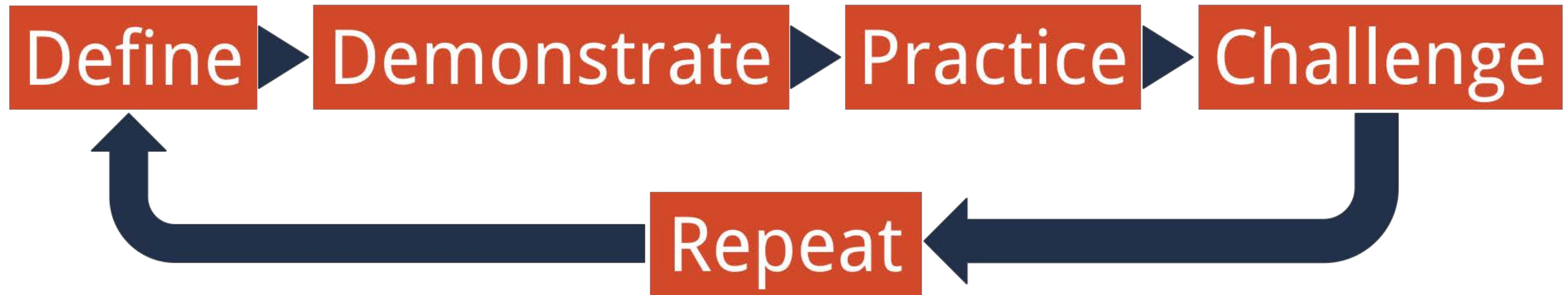
>35 fully interactive books

Over 450,000 students and 600 institutions



Purchased by John Wiley and Sons on July 1, 2019 for \$56M

Dividing content into interactive chunks



Definitions = Less text, more focus



Table 9.3.2: Example spreadsheet functions.

Function	Example
SUM (cell group) is a spreadsheet function that adds the numerical values of all selected cells.	=SUM(A1:A5) adds the numbers in cells A1 to A5.
MAX (cell group) is a spreadsheet function that returns the largest number from the selected cells.	=MAX(B1:D1) identifies the largest number of Cells B1, C1, or D1.
MIN (cell group) is a spreadsheet function that returns the smallest number from the selected cells.	=MIN(B3:B5) finds the smallest number of Cells B3 to B5.
COUNT (cell group) is a spreadsheet function that determines the number of cells containing a numerical value.	=COUNT(C5:E7) finds the number of cells containing a number within the range of cells from C5 to E7.
AVERAGE (cell group) is a spreadsheet function that calculates the mean of the selected cells.	=AVERAGE(A5:A11) averages the numerical values of cells A5 to A11.
PI () is a spreadsheet function that returns the mathematical constant and irrational number π .	=PI() returns 3.14159, which can be used to find the area of a circle.

Animations engage sight and touch



Start ☐ 2x speed

Formula bar

	A	B	C	D	E	F
1	component					
2	9	18				
3						
4						
5						

18 is displayed content for cell B2

=A2*2 is the stored content for cell B2

Formulas using \$ → 118% view rate (2018)

Flavors of learning questions



True
and
false

Matching

Multiple
choice

Short
answer

Learning by doing



A6, B5, C4, D3

B3:B7

E1, B4:F4, G6

C3:E3

A2:C5

	5 cells
	12 cells
	4 cells
	3 cells
	7 cells

Reset

Feedback?

CHALLENGE
ACTIVITY

9.2.1: Formulas, lists, and ranges.



Start



1



The two numbers are subtracted in cell A4 using the formula =A2-B2. Enter the number

Unique explanations with every response



Using the information in the spreadsheet below, answer the following questions.



	A	B	C	D	E
1		2			
2				4	
3					1
4	3				
5			5		

1) Cell A1 should have a numerical value of 2. Select a formula to calculate this numerical value.



- ☐ =A2
- ☐ =B2
- ☐ =B1

2) Cell E1 should have a numerical value of 6 after the formula =C5+_3 is completed. Identifying the missing part of the cell address as:



- ☐ C
- ☐ D
- ☐ E

Auto-graded, randomized practice



Calculate the logarithm of the number in column A to the base in column C. Enter the calculated number and formula using a spreadsheet function and cell addresses.

	A	B	C
1			
2			
3			
4	37		2
5			

Formula: Value:

Challenge activities create perpetual practice

Auto-graded, randomized practice



Calculate the logarithm of the number in column A to the base in column C. Enter the calculated number and formula using a spreadsheet function and cell addresses.

	A	B	C
1			
2			
3			
4			2
5	53		

Copy sheet

Formula:

=A1

Value:

7.16

=LOG(A1, C1)

$\log_{C1}(A1)$ or $C1^{??}=A1$

Challenge activities create perpetual practice

Interactive textbook data types



Reading
participation

Animation
views

Challenge
activity
success

Challenge
activity
attempts

Three categories and 290+ reading clicks



9) Spreadsheets

9.1 Spreadsheets

9.2 Formulas

9.3 Functions

9.4 Math functions

9.5 Logic/count functions

9.6 Sorting data

9.7 Charts

9.8 Trendlines

9.9 Solver + least squares

9.10 Error and statistics

9.11 Interpolation

9.12 Integration

9.13 Matrix functions

9.14 Systems of linear equations

9.15 Spreadsheets resources



Print chapter

1. General skills

2. Functions

3. Advanced skills

High reading rate quantified



Reading clicks >24,000 for 98 students (2018)

100% reading rate

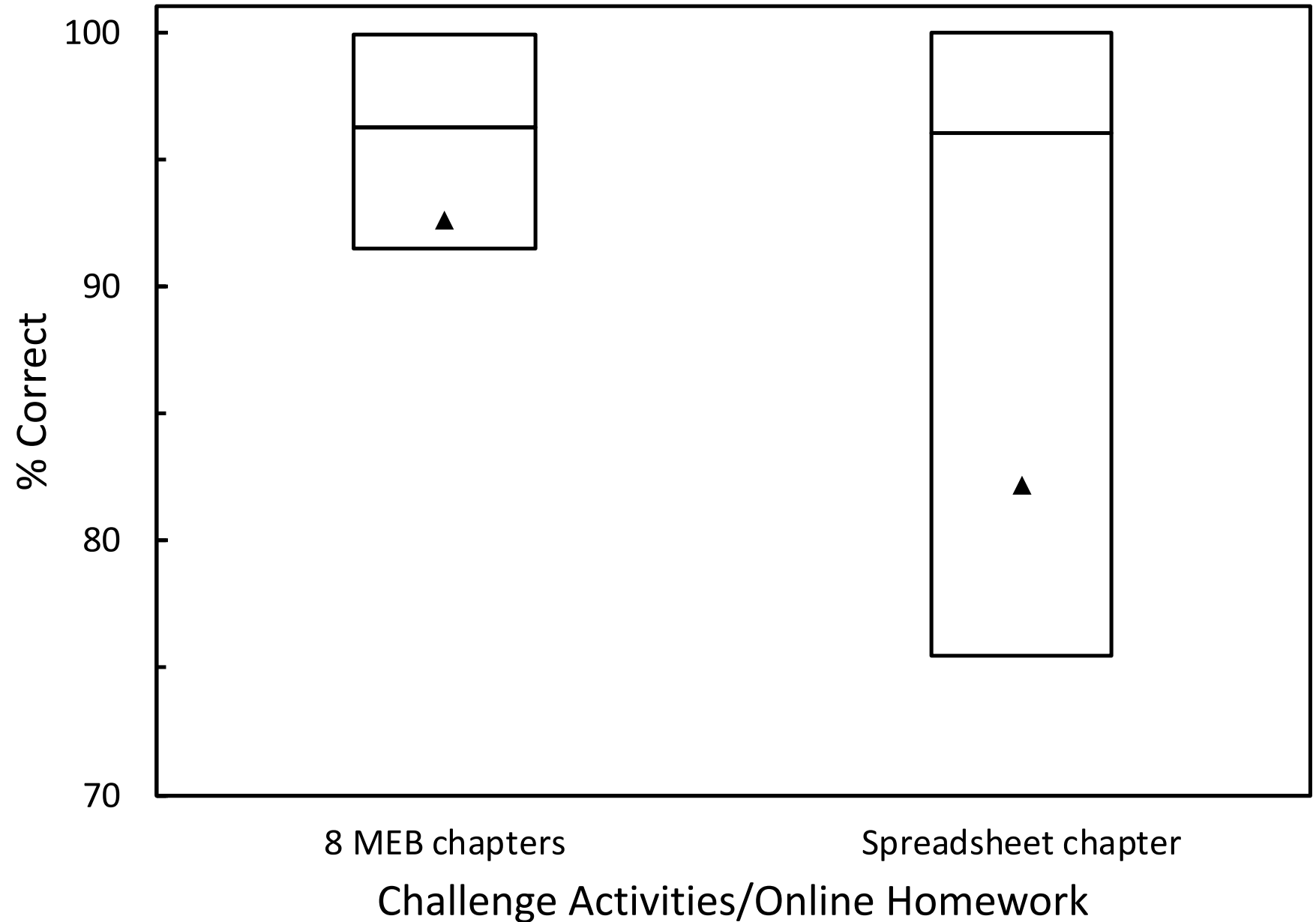
Both median and 1st quartile

Higher reading rate for spreadsheets
compared to previous results for MEB

100+ auto-graded, randomized problems



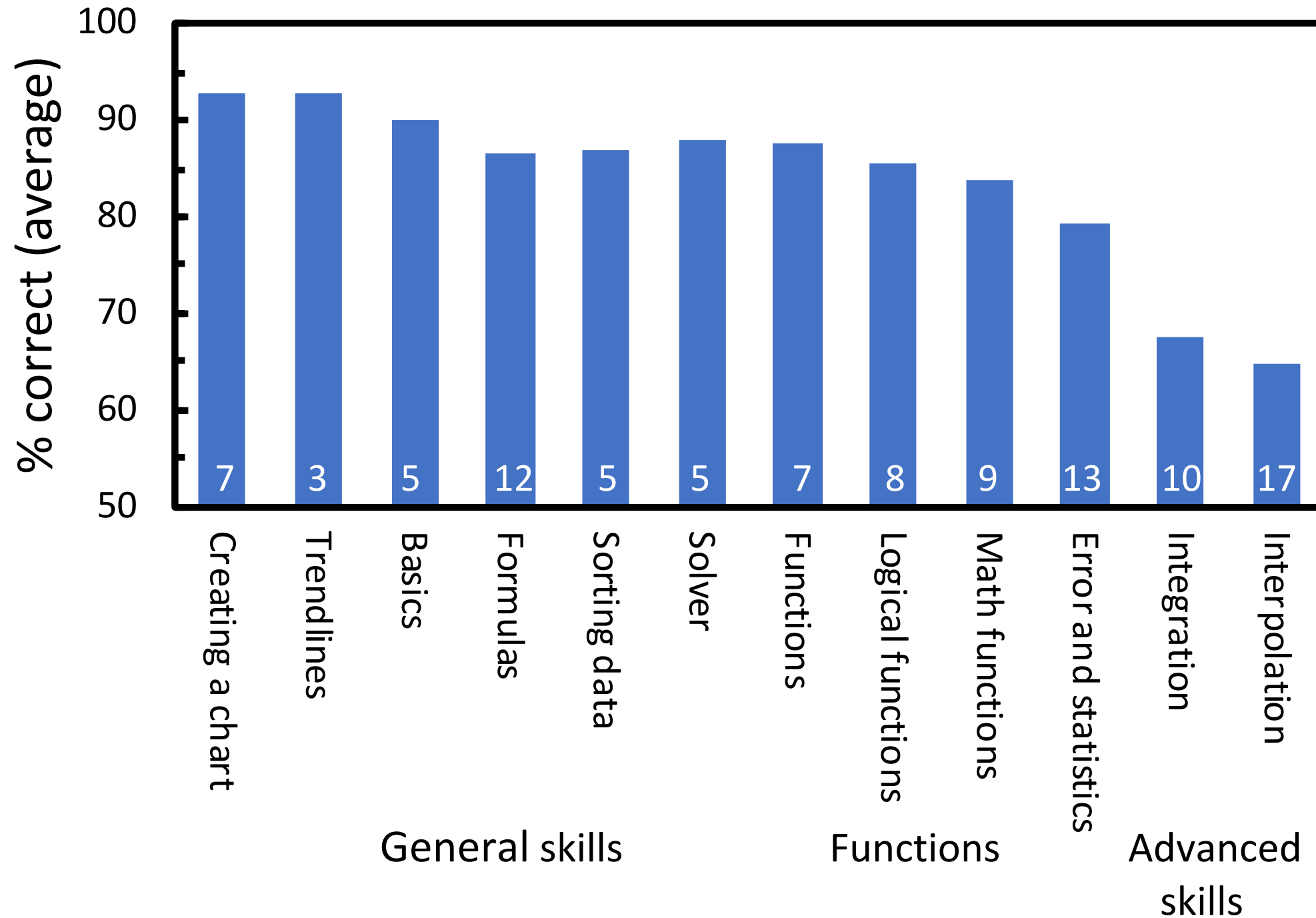
Broader
distribution of
2nd quartile for
spreadsheets
vs. MEB



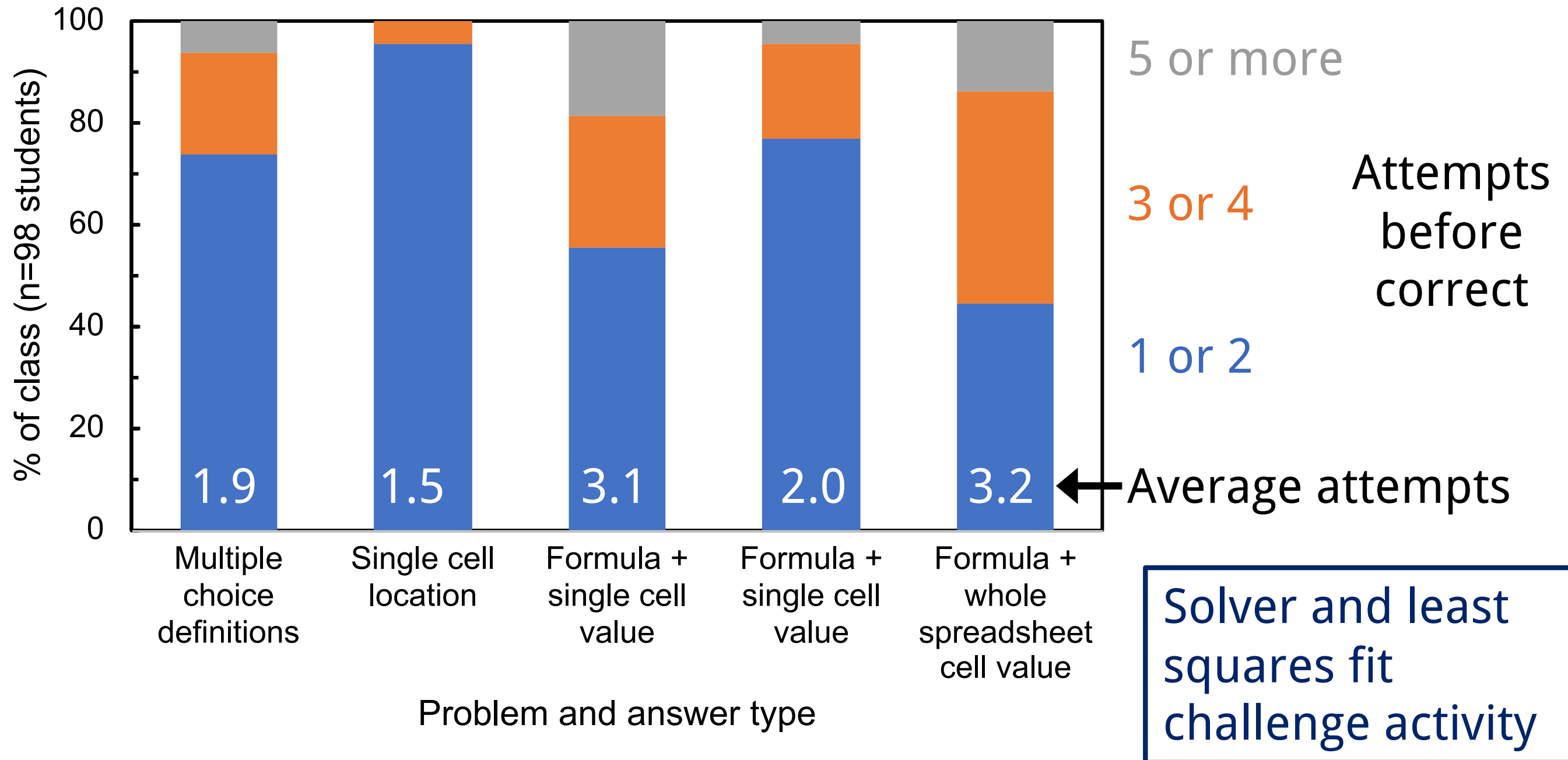
Problems = 199

101

Advanced topics more challenging



Attempts data identify “hard” problems



Spreadsheets + Interactivity = Success



100% 1st quartile reading rate

>95% median success on 100+ auto-graded problems

Over 490 attempts **after** correct

Text questions to

