GIS TECHNOLOGY + SOCIO-SCIENTIFIC ISSUES = TEACHER & STUDENT LEARNING

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WHO'S WHO & WHY ARE WE HERE?

INTRODUCTIONS
AGENDA

MOTIVATION (GAP)
OVERVIEW
FRAMEWORK
CONTEXT
FINDINGS
CONCLUSIONS & IMPLICATIONS

MBOROWCZAK
SCIEDBURROWS
ACTIVE ENGAGEMENT REQUIRES RELEVANT & AUTHENTIC PROBLEMS
52. **SHOPPING** At The Family Farm, you can pick your own fruits and vegetables.

   a. The cost of a bag of potatoes is $1.50 less than \(\frac{1}{2}\) of the price of apples. Write and solve an equation to find the cost of potatoes. \(p = \frac{1}{2}a - 1.50; \$2.00\)

   b. The price of each zucchini is 3 times the price of winter squash minus $7. Write and solve an equation to find the cost of zucchini. \(z = 3w - 7; \$1.97\)

   c. Write an equation to represent the cost of a pumpkin using the cost of the blueberries. **Sample answer:** \(p = 2b - 0.98\).
STEM TO SOLVE A BOUNDED PROBLEM
GUIDED BUT MANY APPROACHES

INTEGRATE STEM*
OVERVIEW

- Multi-day Integrated STEM Lesson within High School Geometry Course
  - GIS, Active Engagement, Hands On Activities (indoor/outdoor), Pre-Post Assessment
- Calculus methods used to reinforce geometry concepts
  - shhh - don’t tell the students they’re doing calculus :)

MBOROWCZAK SCIEDBURROWS
CONTEXT: PARTICIPANTS

- Urban “STEM” High School
  - Low SES, 90%+ on F/R Lunch
  - 2 Geometry Courses
    - 50+ 9th/10th grade students
    - New Teacher (<5 yr/exp)
- Urban Public University
  - NSF GK12 (Graduate Students in K12)
    - Fellow (Computer Science)
    - Coordinator (Education)
CONTEXT: 4 DAY LESSON

- Day 1: Catch & Scaffold + Pre-Assessment
  - French Fry Measurements; Dyad/Triad level-up
- Day 2: Planning Using Online GIS Tools
  - Real Community Problem (local pond access over time)
  - Bidding competition based on accurate measurements
- Day 3: Outdoor Measurement Activity
- Day 4: Presentations, Expert Q&A, and Post Assessment
SIMPLE GIS & MAPPING @ “ZERO COST”
ENHANCED/SUPPLEMENTED LESSON
AUTHENTIC INTRODUCTORY USE
ENABLED RAPID ITERATION

TECHNOLOGY
Almost every group used one approach.
RESULT OF PRE/POST ASSESSMENT QUESTIONS

- Q1: Formulas of Shapes
- Q2: Compute Area of Non-Polygon
- Q3: Irregular Shapes in Nature
- Q4: Increase accuracy of Measurement
- Q5: Numerical Methods

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<tr>
<th>Question</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
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<tbody>
<tr>
<td>Pre</td>
<td>44%</td>
<td>15%</td>
<td>33%</td>
<td>3%</td>
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<td>Post</td>
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<td>T-Test (p-value)</td>
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<td>p &lt; 0.00001</td>
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T-Test (p-value): p < 0.00001
PRE/POST ASSESSMENT SCORE BY QUESTION

Average Assessment Score

Q1

Q2

Q3

Q4

Q5

TOTAL

Pre  Post

RESULTS
RELATIONSHIP BETWEEN ASSESSMENTS

- plot.ly access @ bit.ly/site-gis
- Positive Correlation within any given assessment
- Activity to Post Assessment Slightly Positive
- Pre Assessment to Activity Uncorrelated
- Pre to Post: Slight Negative Correlation
THE LESSON MADE ME INTERESTED IN LEARNING MORE ABOUT ENGINEERING
“THE LESSON MADE ME FEEL MORE CONFIDENT ABOUT STUDYING MATH/SCIENCE”
4.2/5.0

LESSON RATING
4.3/5.0

Graduate Student Rating
CONCLUSIONS
AUTHENTIC LEARNING EXPERIENCES
ACHIEVED USING BEST-RESEARCH PRACTICES
ACADEMIC SUCCESS
PERCEPTIONS OF ABILITIES (SELF-EFFICACY)
THOUGHTS ON STEM AS A Viable CAREER PATH
TECHNOLOGY ENABLES ITERATION (ON-GOING)

STUDENTS EMBRACE AUTHENTIC ACTIVITIES
WHERE ALL DISCIPLINES ARE INTEGRATED
QUESTIONS?

THANK YOU