Removing Barriers to Success in Front-Door Math Courses

AMATYC – S026
Nov. 9, 2017
10:20-11:10
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Maryke Lee
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Why should I learn this stuff?

Maybe I don’t have what it takes?

Expectancy

Value

Why should I learn this stuff?
The Collaboration

• Initially sponsored by the Carnegie Foundation for the Advancement of Teaching (Stanford, CA) and UCLA
• Carnegie introduced Valencia College Math Faculty to University of Virginia researchers during the Summer of 2013
• Program designed to partner educators with researchers to solve real-world problems
• Partners
  – Valencia College East Campus Math Department
  – Motivate Lab at the University of Virginia
Timeline

• Initial pilot – Spring and Summer 2014
  • Used Developmental Courses - MAC0018, MAC0022, MAC0028
  • Switched to Front Door courses after FLSB 1720 - MAC1033C, MGF1106, STA1001C

• NSF Grant received Fall 2015
  • 3 years of data collection Spring 2016 – Fall 2018
  • 21 instructors participated Spring and Summer 2016
  • 30 instructors from 2 campuses participated 2016-17 academic year
  • 44 instructors and 2 campuses will be participating 2017-2018 academic year
  • 40 instructors will continue to complete fall 2018 data collection
# The Big Picture of the NSF funded Project

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<td>Spring</td>
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The image shows a timeline for the first three years of a project funded by the NSF. Each year is divided into three seasons: Spring, Summer, and Fall.
How many people are involved?

- **8,238 students**
  - SP16: n = 1038
  - SU16: n = 456
  - FA16: n = 2344
  - SP17: n = 1449
  - SU17: n = 603
  - FA17: n = 2348

- **59 Instructors**

- **349 CRNs**
  - MAT1033C: Intermediate Algebra
  - MGF1106: College Mathematics
  - STA1001: Introduction to Statistical Reasoning
Participation Rates Across Semesters

- Activity 1
- Activity 2
- Activity 3
- Activity 4
Data Sources

- **Students**
  - Student Activities 1-4
  - Focus Groups

- **Instructors**
  - Instructor Activity 1 & 2
  - Syllabi
  - Gradebook
  - Focus Groups

- **Administrative**
  - Roster/Course List
  - Grades & Demographics

- **Other**
  - Randomization
  - RateMyProfessor Ratings
  - Qualitative Coding

**Master Dataset**
Project Research Design

• 2 Types of Interventions that Target Motivation
  – **Expectancy**: Growth Mindset
  – **Value**: Utility Value

• **Control** Conditions
  – Reflective writing
  – Course reflections
Why should I learn this stuff? Maybe I don’t have what it takes?

Expectancy Growth Mindset

Value Utility Value

Why should I learn this stuff?
Growth vs. Fixed Mindset

- Students feel they can be **successful** in the learning context if they try

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Dweck (2006)
# Growth vs. Fixed Mindset

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<td>No point in trying if one is not a “natural”</td>
<td>Obstacles can be overcome through effort, help from others, and use of improved strategies</td>
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- **Note:** It’s **NOT** just about “trying harder”

Dweck (2006)
You Can Grow Your Brain

New Research Shows the Brain Can Be Developed Like a Muscle

By: Lisa S. Blackwell and David S. Yeager

Many people think of the brain as a mystery. We don’t often think about what intelligence is or how it works. And when you do think about what intelligence is, you might think that a person is born either smart, average, or dumb—either a “math person” or not—and stays that way for life.

But new research shows that the brain is more like a muscle—it changes and gets stronger when you use it. Scientists have been able to show just how the brain grows and gets stronger when you learn.

Everyone knows that when you lift weights, your muscles get bigger and you get stronger. A person who can’t lift 20 pounds when they start exercising can get strong enough to lift 100 pounds after working out for a long time. That’s because muscles become larger and stronger with exercise. And when you stop exercising, the muscles shrink and you get weaker. That’s why people say “Use it or lose it!”

But most people don’t know that when they practice and learn new things, parts of their brain change and get larger, a lot like the muscles do. This is true even for adults. So it’s not true that some people are stuck being “not smart” or “not math people.” You can improve your abilities a lot, as long as you practice and use good strategies.

Inside the outside layer of the brain—called the cortex—are billions of tiny nerve cells, called neurons. The nerve cells have branches connecting them to other cells in a complicated network. Communication between these brain cells is what allows us to think and solve problems.

The Growth Mindset Intervention

Intervention Activities:
- Reading
- Open-ended reflections
- Write a persuasive essay for another student
Utility Value

- The learning context has value to students

Utility Value:
This is useful and relevant for my:
- Daily life
- Future education
- Career
- Interests and hobbies

Personal:
This will help me get the job I want in the future.

Identity:
This is who I am. It’s important to me to be good at this.

Prosocial:
This allows me to do something that makes a difference in the world.

Interest:
This is fun! I just like doing this.
The Utility Value Intervention

1. Select a topic that is currently being covered in class.
2. Write a one-paragraph essay that applies the topic to your life or to the life or someone you know (control: just summarize).
3. Repeat 1-5x over course of semester.

Graphing is important part of life…. For an example, my grandmother and aunt work at a retirement home and they need to decide dosages per day, meals, and etc. Graphing out all the data they have will [help them] come out with a resolution.
“I currently work at our family owned jewelry store and ordering new merchandise or buying pieces off of counter customers is always something I need to calculate. We need to calculate how much we need to up-sell in order to make profit off of it, or what the lowest cost we can sell it for is.”

“Math is used in our daily lives indirectly. We could never have progress or advances if it weren't for math.”

“Math is useful in my daily life.”
Growth Mindset Intervention Results

(N = 449)

Percent Responses

- Malleability
- Competence
- Failure
- Effort
- Hope
- Challenge
- Practice
- Strategy Use
- Help-Seeking

Low Growth Only Growth+Strategy
Wormington, Hulleman, Kosovich, Lee, & Phelps (in prep.)
Utility Value Intervention Results
(N = 180)

Men
- Control: 59%
- Utility Value: 72%

Women
- Control: 68%
- Utility Value: 64%

Kosovich, Hulleman, Lee, & Phelps (under review)
Take a moment to think about how math is useful in your daily life. Think about the kind of math skills you use on a regular basis and how it helps you do daily tasks and activities. Please take a few moments to think about this and write your thoughts so that they can be shared with others.

In the space below, write a brief paragraph (3-4 sentences) that answers the question: How is math useful in your daily life. Try to pick a specific topic you learned about recently in your math class (e.g., solving equations, graphing, factoring, fractions) and explain how it helped you do something in particular. (Don’t worry about spelling or grammar. Just focus on getting your ideas across.)
Utility Value Coding:
What do responses look like?

“Math is used in buying groceries, paying bills”
Math is useful in general things that most people do

“I always need it to add or subtract something and sometimes I even have to use algebra in order to find something that is an ‘unknown variable’.” Specific math but not specific application
Utility Value Coding: What do responses look like?

“I do use math in my everyday life. I use math in my recording studio, when lining up vocals, math is a big part of producing a beat.” Non-specific math but specific application

“One day I found myself using the formula to find the perimeter of a picture frame that I needed to hang it on my wall.” Specific math and application
Future Plans

• Collect Data Through Fall 2018
• Explore student’s longitudinal outcomes
  • Starting with Fall 2014 pilot students
  • Track students to other Florida institutions
• Take deep dive into all data that has been collected
  • Institutional data on students and faculty
  • Classroom grades and teacher gradebooks
  • Qualitative students essays from intervention prompts
  • Focus group responses from students and faculty
  • Control groups surveys regarding the instructional climate
• Develop Faculty Training for Utility Value and Growth Mindset Interventions
# Future Plans: Student Focus Groups

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<th>Increase</th>
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|            | helpful professor, already know/understand the materials, study strategies/practice, motivation to do well/continue education, out-performing peers | external influence, class structure, internal doubt/lack of motivation (anxiety), don't understand material, failing/sensing failure | • **Increase**: “Teacher finds a way to teach the class to where all students can adjust/adapt”  
• **Decrease**: “failing tests after I study so hard” |

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|       | moving forward from this class, paid for the class, relevant to self (degree or everyday life), fear of failure | no relevance, teacher instruction was inadequate, internal stressors | • **Increase**: “If it has a real world use, I’ll want to learn more about it and pay more attention”  
• **Decrease**: “Not needed for my degree plan; not learning anything useful” |
This research was supported by the National Science Foundation, through grants DRL 1252463 and 1228661 and by the U.S. Department of Education, through grant #R305B090002. The opinions expressed are those of the authors and do not represent views of the funding agencies.
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