

Minds over Matter: Growth Mindset in the Postsecondary Classroom

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The Minds

University of Nebraska at Kearney

Kaye Sorensen

Senior Lecturer of
Mathematics & Statistics



Interests:

Bridge Program
Entry level courses
Underprepared students

Keri Pearson

Assistant Director of
the Learning Commons



Interests:

Tutoring strategies
Math support services

Amy Nebesniak

Associate Professor of
Mathematics Education



Interests:

Underprepared students
Training future teachers

The Underlying Problem

The majority of UNK are successful in math, but we want to find ways to encourage even greater success.



Problem:

Low math self-efficacy and student perseverance in entry-level math courses.

Symptoms:

- Negative attitudes towards math
- Apathy
- High DFW rates in GS math courses
- Delayed graduation

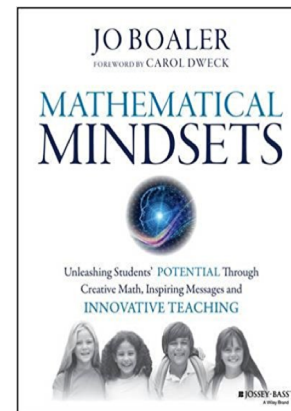
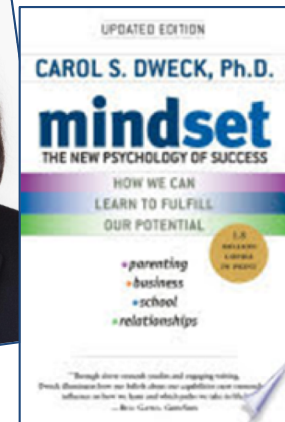
Many “Solutions” Ran Us into Brick Walls

No control outside
classroom and
service borders

No institutional
money to
implement ideas

Department not
focused on entry
level math courses

We didn't know which way to turn, until...



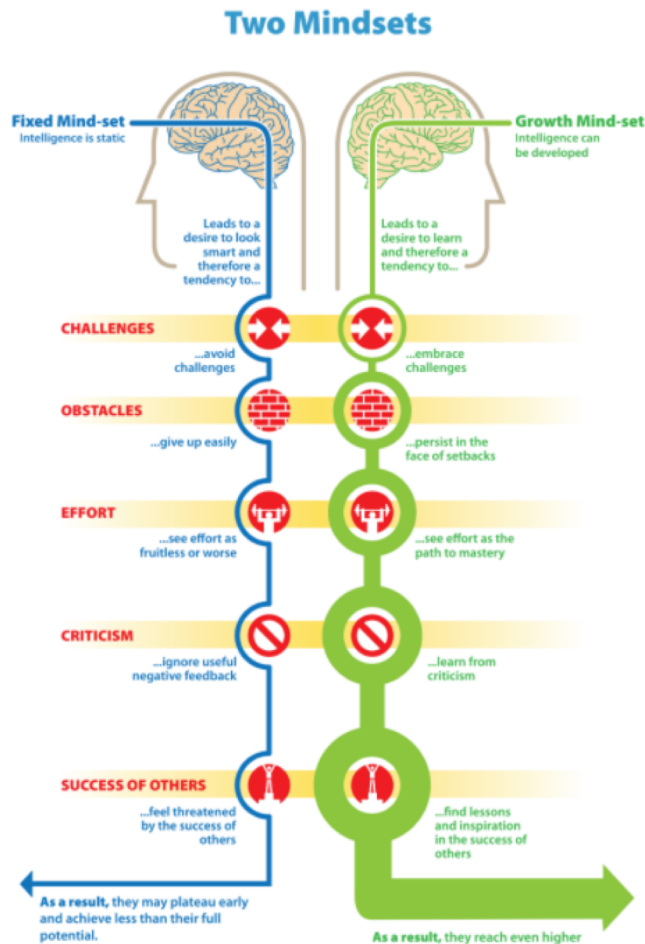
Mindsets Overview

“My research has shown that the view you adopt for yourself profoundly affects the way you lead your life.”



--Dr. Carol Dweck, Stanford University (2006)

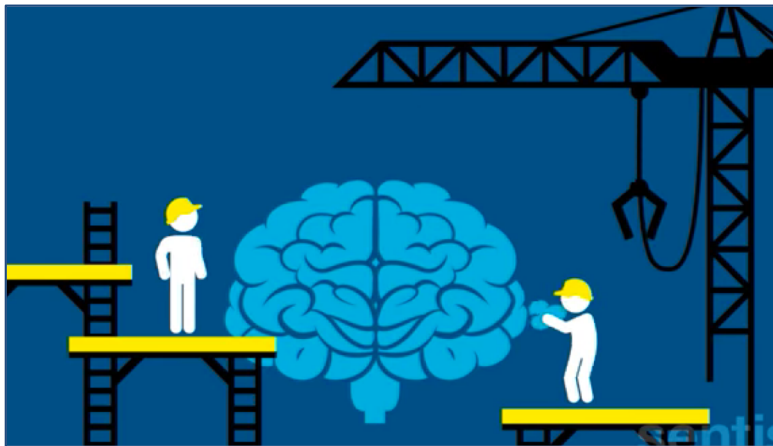
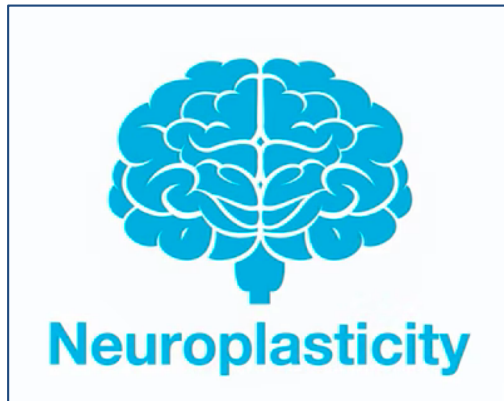
Mindsets Overview



According to researcher Carol Dweck and others, growth mindsets and fixed mindsets frame the running account taking place in people's heads.

They guide the whole interpretation process.

Mindsets Overview



Growth Mindset Goes to College

We sought ways around, rather than through,

No control outside
the brick walls.

No institutional

classroom and

money to

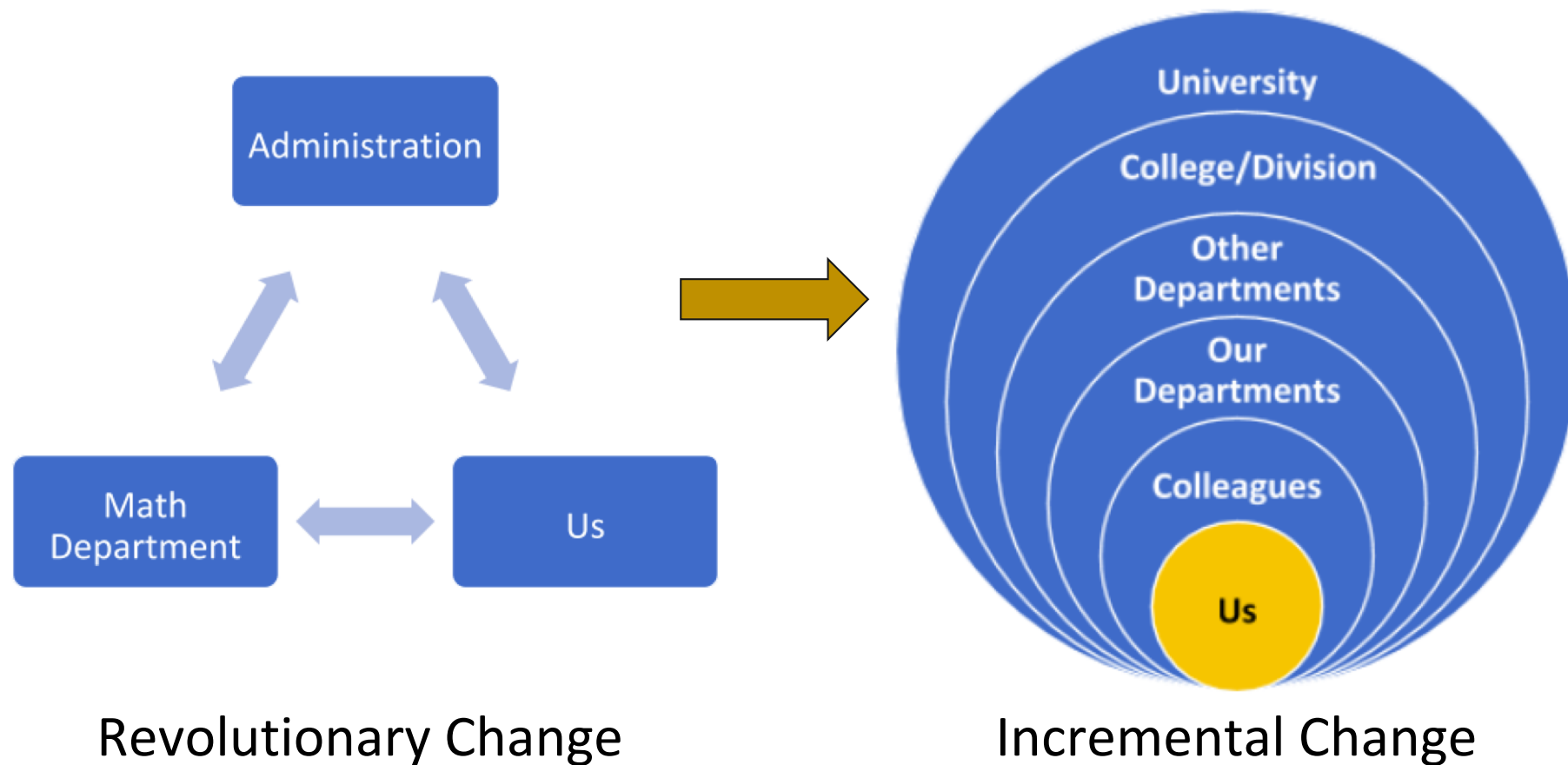
1. Pacing efforts to engage real culture change by
service borders collaborating across organizational “silos” implement ideas

2. Researching what other colleges have done with mindsets

3. Selecting interventions that can be universally
implemented Department not
focused on entry
level math courses

Culture Change

Our approach to culture change evolved



Differences in Higher Education

Unique circumstances in postsecondary education require we seek ways to build a growth mindset culture that may be different from K-12 schools.

High School

Class time

Every day,
4-5 hours per week per class



Class time use

Thorough reviews/repetition in class

Emotional state

Changing emotions about academics



College

Every other day,
2½ hours per week per class



Limited repetition and test prep

Emotions “hard wired” to subjects

Growth Mindset Research

The bulk of higher education intervention research does not mention growth mindset.

Instead, research focuses on changing student behaviors rather than mindsets.

COMMON INTERVENTIONS:

- **STEM initiatives recruiting majors**
- **Summer bridge programs**
- **Study skills classes**
- **Academic support services**
- **Blended skills/content curriculum**

Mindset Interventions



Social Psychological
Interventions

youcubed  Building a Mathematical Mindset Community 	
Teachers and students believe <i>everyone</i> can learn maths at HIGH LEVELS. - Students are not tracked or grouped by achievement - All students are offered high level work "I know you can do this" "I believe in you" - Praise effort and ideas, not the person - Students vocalize self-belief and confidence	Communication and connections are valued. - Students work in groups sharing ideas and visuals. - Students relate ideas to previous lessons or topics - Students connect their ideas to their peers' ideas, visuals, and representations. - Teachers create opportunities for students to see connections. - Students relate ideas to events in their lives and the world.
The maths is VISUAL. - Teachers ask students to draw their ideas - Tasks are posed with a visual component - Students draw for each other when they explain - Students gesture to illustrate their thinking	The maths is OPEN. - Students are invited to see maths differently - Students are encouraged to use and share different ideas, methods, and perspectives - Creativity is valued and modeled. - Students' work looks different from each other - Students use ownership words - "my method", "my idea"
The environment is filled with WONDER and CURIOSITY. - Students extend their work and investigate - Teacher invites curiosity when posing tasks - Students see maths as an unexplored puzzle - Students freely ask and pose questions - Students seek important information "I've never thought of it like that before."	The classroom is a risk-taking, MISTAKE VALUING environment - Students share ideas even when they are wrong - Peers seek to understand rather than correct - Students feel comfortable when they are stuck or wrong - Teachers and students work together when stuck - Tasks are low floor/high ceiling - Students disagree with each other and the teacher

Developed by Jo Boaler/Youcubed.org and Tulare County Office of Education

Content-specific
Interventions

Mindset Interventions



Social-Psychological

Suggestions for Implementation

The Intervention should be:

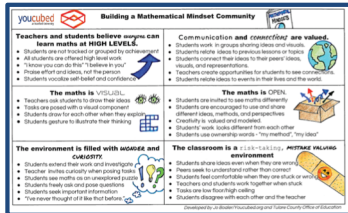
1. psychologically contextual
2. subtle (sneaky)
3. recursive
4. timed at “key educational junctions”

Key Implementation Strategies

- ❖ Teach about brain plasticity
- ❖ Explain the power of mistakes
- ❖ Believe in and encourage ALL students
- ❖ Value struggle and failure
- ❖ Praise effort, not “intelligence”

To make a difference, you must intervene in the right way.

Mindset Interventions



Math Content Interventions

Suggestions for Implementation

The 5 C's of Mathematics

1. Curiosity
2. Connections
3. Challenge
4. Creativity
5. Collaboration

Key Implementation Strategies

- ❖ Open-ended problems
- ❖ Find the mistake problems
- ❖ Non-examples
- ❖ Math talk (discourse)
- ❖ Value depth over speed
- ❖ Visual mathematics
- ❖ Mathematical modeling
- ❖ Emphasize reasoning and sense-making

Teach math as an open, creative, inter-connecting subject.

Our Mindset Interventions

Social Psychological Interventions



1. Neuroplasticity
2. Productive Struggle

Content-specific Interventions

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3. Using Mistakes
4. Math Talk

Intervention 1: Neuroplasticity

1. What is something in the video that caught your attention?
1. How does brain plasticity apply to your learning in this class?
1. **Math Ed:** How does brain plasticity apply to your future students' learning?
3. **College Algebra:** How does brain plasticity apply to working with your class study partner?



Social-Psychological Intervention

Intervention 2: Productive Struggle

1. What is something in the video that caught your attention; surprised you; gave validation?
1. How does *learning from mistakes* apply to your learning and growing in this class?
1. **Math Ed:** How can you apply this to your future teaching career?



Social-Psychological Intervention

Intervention 3: Using Mistakes

College Algebra:

The student
mistakenly writes
this *function's*
domain set here.
What could be
done to improve
this response and
why?

c) of ordered pairs: $\{(5,0), (4,0), (-4,0)\}$

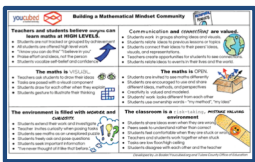
[1] function? yes

[2] D: $\{-4 \leq x \leq 5\}$

R: $\{0\}$

Math Education:

Maurice rewrites
 $6(3 \cdot 7)$ as $(6 \cdot 3) \times (6 \cdot 7)$
and says he is using
the distributive
property. What is his
misconception? How
would you help him
understand his
mistake?



Content-Specific Intervention

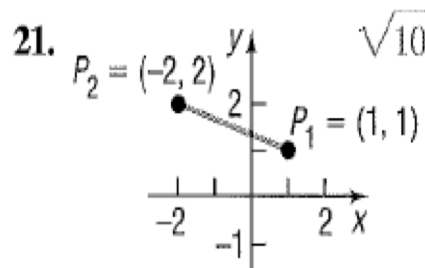
Intervention 4: Math Talk

College Algebra:

Discuss two approaches to finding this distance.

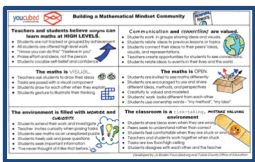
- (1) using your graph
- (2) using your algebra

How could we use some math language to describe each approach?



Math Education:

- *Think-Pair-Share
- *Simon Says
- *Partner Coach
- *Quiz-Quiz-Trade



Content-Specific Intervention

Assessment 1: SMQ-II Survey

Glynn, S. M., Brickman, P., Armstrong, N., & Taasobshirazi, G. (2011)

Never (0), Rarely (1), Sometimes (2), Often (3), Always (4)

Examples:

1. I enjoy learning *math*.
2. I am sure I can understand *math*.
3. I put enough effort into learning *math*.
4. Getting a good *math* grade is important to me.
5. Understanding *math* will benefit me in my career.

5 Components:

- Intrinsic motivation
- Self-efficacy
- Self-determination
- Grade motivation
- Career motivation

The SMQ-II assesses components of students' motivation to learn science/math in college and high school courses.

Assessment 1: SMQ-II Survey

Glynn, S. M., Brickman, P., Armstrong, N., & Taasobshirazi, G. (2011)

College Algebra Findings

Category	Female Change in Percent Growth Mindset	Male Change in Percent Growth Mindset	TOTAL Change in Percent Growth Mindset
Intrinsic Motivation	1.81%	-7.14%	2.42%
Self-Efficacy	8.25%	-12.38%	-1.21%
Self-Determination	-3.57%	15.90%	4.85%
Grade Motivation	-6.73%	-6.96%	-7.27%
Career Motivation	11.52%	2.66%	6.06%

n = 33; 18 females, 15 males

Assessment 1: SMQ-II Survey

Glynn, S. M., Brickman, P., Armstrong, N., & Taasobshirazi, G. (2011)

Math Education Findings

Category	Percent Growth Mindset Pre-Survey	Percent Growth Mindset Pre-Survey	Change in Percent Growth Mindset
Intrinsic Motivation	39.49%	74.87%	35.38%
Self-Efficacy	61.54%	80.51%	18.97%
Self-Determination	70.26%	83.59%	13.33%
Grade Motivation	85.64%	93.33%	7.69%
Career Motivation	80.51%	92.82%	12.31%

n = 39; 36 females, 3 males

Intervention 1: Neuroplasticity

NEW TUTORS

1. Why do you like the subjects you tutor?
2. When we say someone is “good” at something, what does that mean?
3. When we say someone isn’t good at something, what does that imply?

LEVEL II TUTORS

1. How does neuroplasticity relate to asking **probing questions**?
2. How does brain plasticity impact **studying**?



Social-Psychological Intervention

Intervention 2: Productive Struggle

NEW TUTORS

1. What **praise** do you GET from teachers?
2. What praise do you GIVE to students?
3. How can praise build a growth mindset?

LEVEL II TUTORS

1. How can you help a student see they are struggling with a **study behavior**?
2. When can learning be **messy**? When can it be organized?



Social-Psychological Intervention

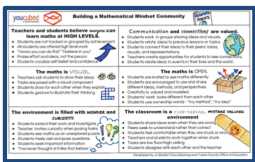
Intervention 3: Using Mistakes

ALL TUTORS

1. To summarize the end of a session, ask the student to **find a mistake** in the problem.
 - a. Tutors quickly identified that just finding the mistake was **not enough**

LEVEL II TUTORS

1. When you look at these **notes**, what mistakes do you see?



Content-Specific Intervention

Assessment 2: Tutor Observations

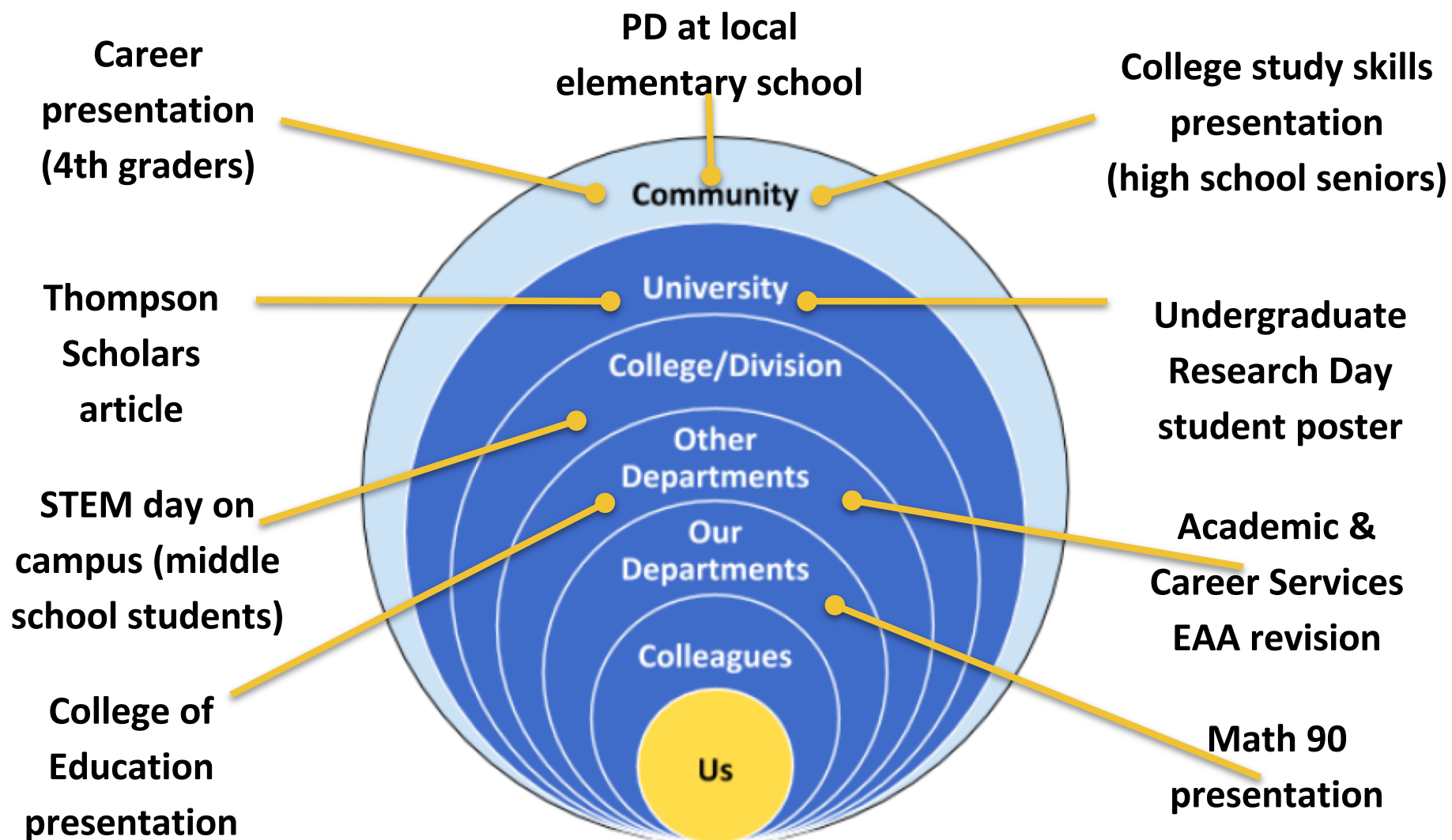
Observation Guidelines

- ☐ Praise effort, not outcome (social/psy)
- ☐ Ask student to find, correct, and describe at least one mistake (content)
- ☐ Use open tasks to help a student think through problems and ideas (content--not yet part of training)

Assessment #2: Tutor Observations

- **Engaging effort instead of outcomes**
 - adjust what is said to reflect peer relationships
 - “I appreciate you worked on this first.”
 - “Looking back, you’ve done a lot more work on your own this time.”
- **Finding a mistake**
 - Have “ready” problems to make it efficient
 - Use an activity in study groups
 - Connect with the 3-step tutoring process (TryCycle)

Incremental Impact



Thank you for our time together.

Kaye Sorensen

sorensenkm@unk.edu



Keri Pearson

pearsonka@unk.edu



Amy Nebesniak

nebesniaka2@unk.edu



For more about mindsets, mathematical mindsets, and change in higher education:

Abiola, O. & Dhindsa, H. (2011). Improving classroom practices using our knowledge of how the brain works. *International Journal of Environmental and Science Education*, (7) 71-81.

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Dweck, C. S. (2006). *Mindset*. New York, NY: Random House.

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Sousa, D. & Tomlinson C. (2011). *Differentiation and The Brain*. Bloomington, IN: Solution Tree.

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