Wise Instructional Choices:
Your Roadmap for New Faculty Workshop and Future Teaching

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AAPT Physics and Astronomy New Faculty Workshop
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pod NETWORK

Get on I-395 N from George Washington Memorial Pkwy

3 min (2.1 mi)

1. Head southeast

33 ft

2. Turn right toward S Smith Blvd

276 ft

3. Continue onto S Smith Blvd

194 ft

4. Slight right onto the GW Pkwy N ramp to I-395/Washington

486 ft

5. Merge onto George Washington Memorial Pkwy

1.7 mi

6. Use the right lane to merge onto I-395 N via the ramp to Washington

16 min (11.8 mi)

7. Merge onto I-395 N

0.4 mi

8. Keep right to stay on I-395 N

1.1 mi

9. Keep left at the fork to continue on I-695

1.9 mi

10. Use the right 2 lanes to take exit 2B for State Hwy 295 N toward US-50 S

0.5 mi

11. Merge onto State Hwy 295
Entering Maryland

4.2 mi

12. Use the left 2 lanes to continue on MD-201 and follow signs for Baltimore-Washington Parkway N/Interstate 95/Baltimore

0.2 mi

13. Keep left to continue on Baltimore-Washington Pkwy

3.2 mi

14. Take the MD-410 exit toward Hyattsville/New Carrollton

10 min (3.2 mi)

15. Use the left 2 lanes to turn left onto MD-410 W/Riverdale Rd
Continue to follow MD-410 W

0.8 mi

16. Slight right toward Kenilworth Ave

157 ft

17. Turn right onto Kenilworth Ave

0.5 mi

18. Turn left onto River Rd

0.3 mi

19. At the traffic circle, take the 1st exit and stay on River Rd

0.8 mi

20. Make a U-turn

0.5 mi

21. Turn right toward Physics Ellipse Dr

226 ft

22. Turn right onto Physics Ellipse Dr

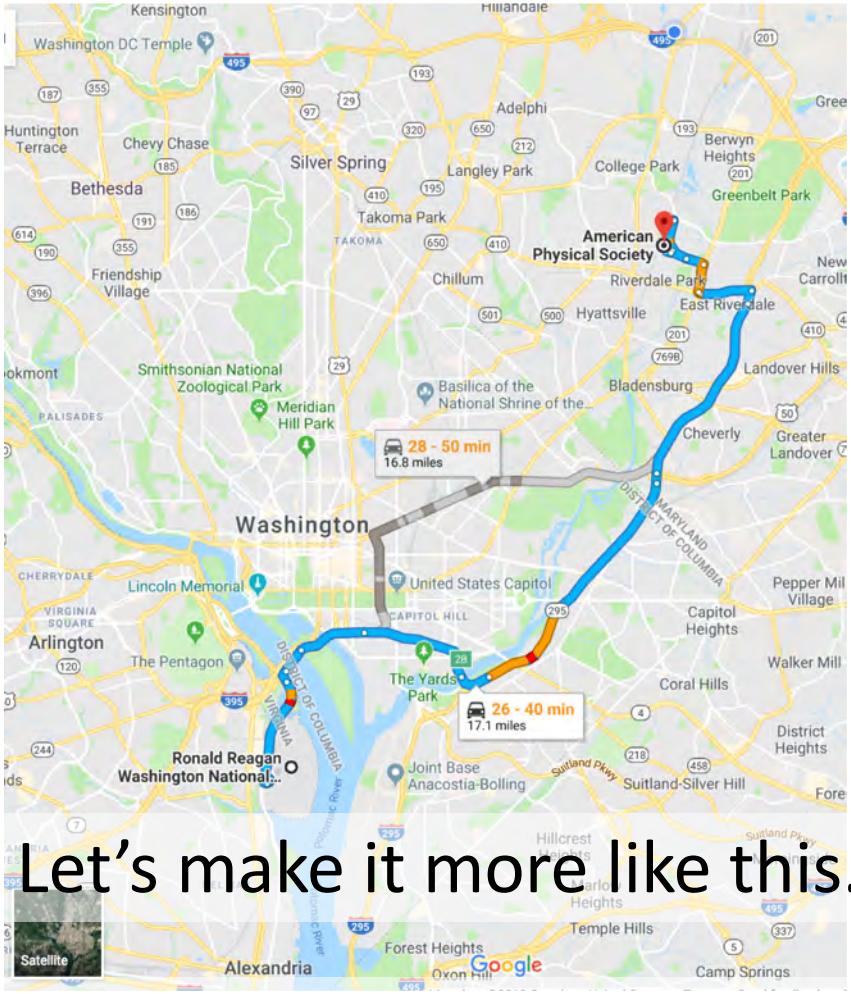
0.3 mi

23. Turn left
Destination will be on the right

56 ft

NFW can seem like this.

Learning physics and astronomy can seem like this.



Let’s make it more like this.

Let’s make it more like this.

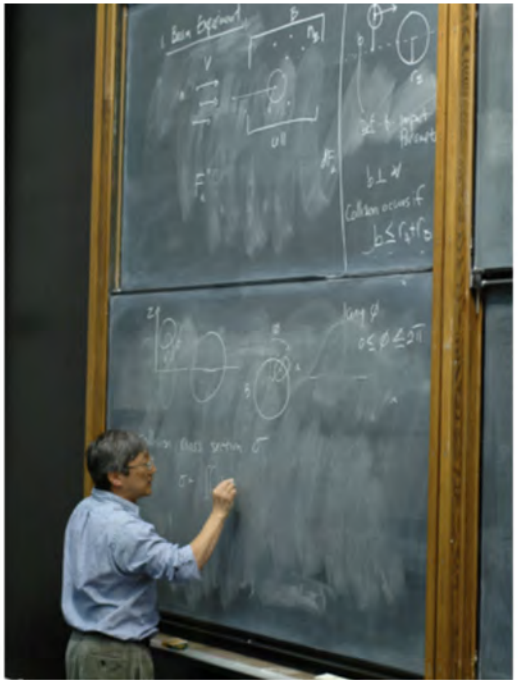
- **Articulate priorities for student learning**
- **Identify what makes teaching methods work**
- **Recognize how your context matters**

+ Anticipate stages in building teaching expertise

Plan:

1. **Priorities for Student Learning**
2. Wise instructional choices
3. Context matters

University science teaching is changing



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University science teaching is changing

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RBISs

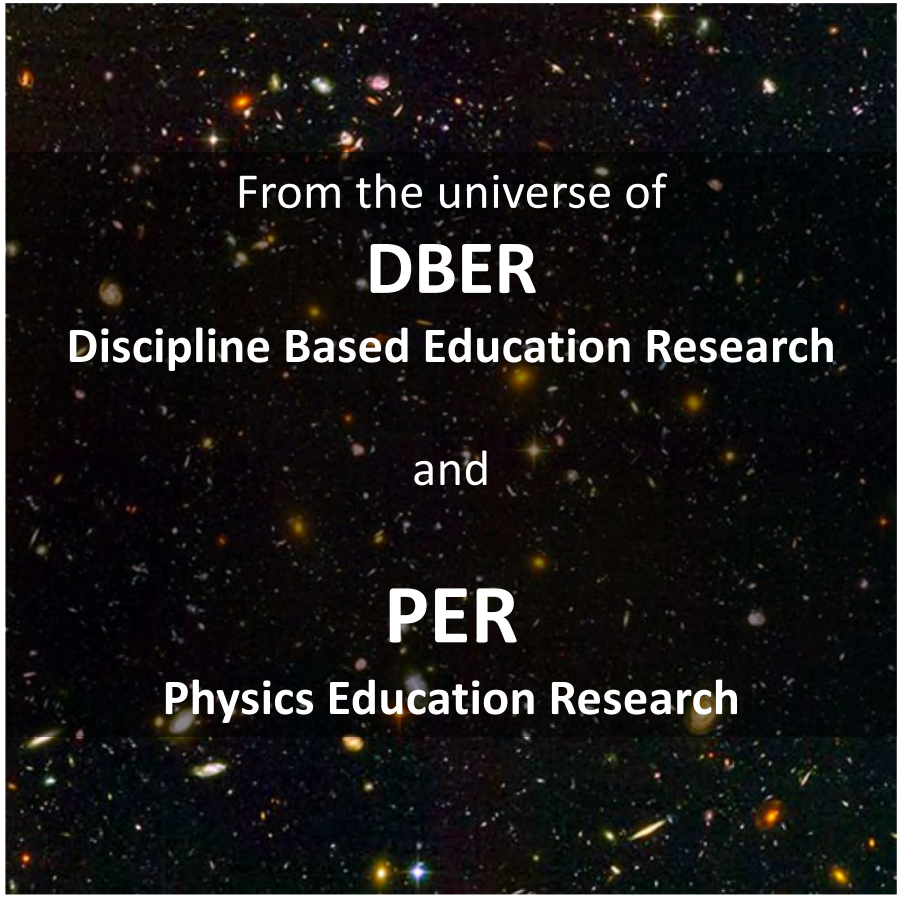
Research
Based
Instructional
Strategies

Close relatives:

EBIPs
Evidence
Based
Instructional
Practices

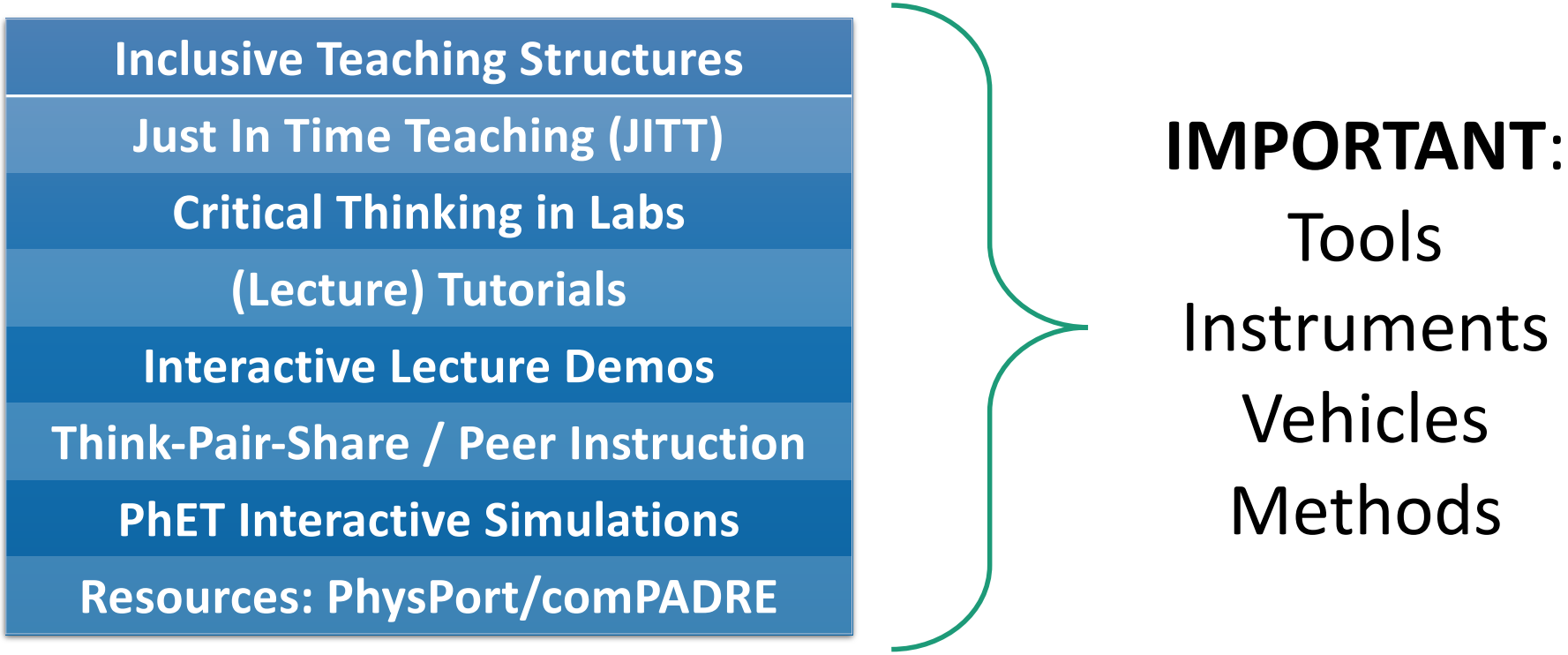
RBISs

Research Based Instructional Strategies



NASA/ESA/S. Beckwith(STScI) and The HUDF Team

RBISs you'll explore in New Faculty Workshop

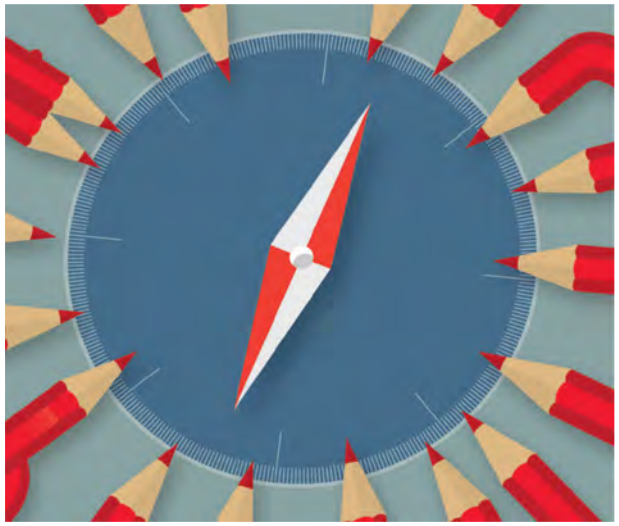


“Why use this?”

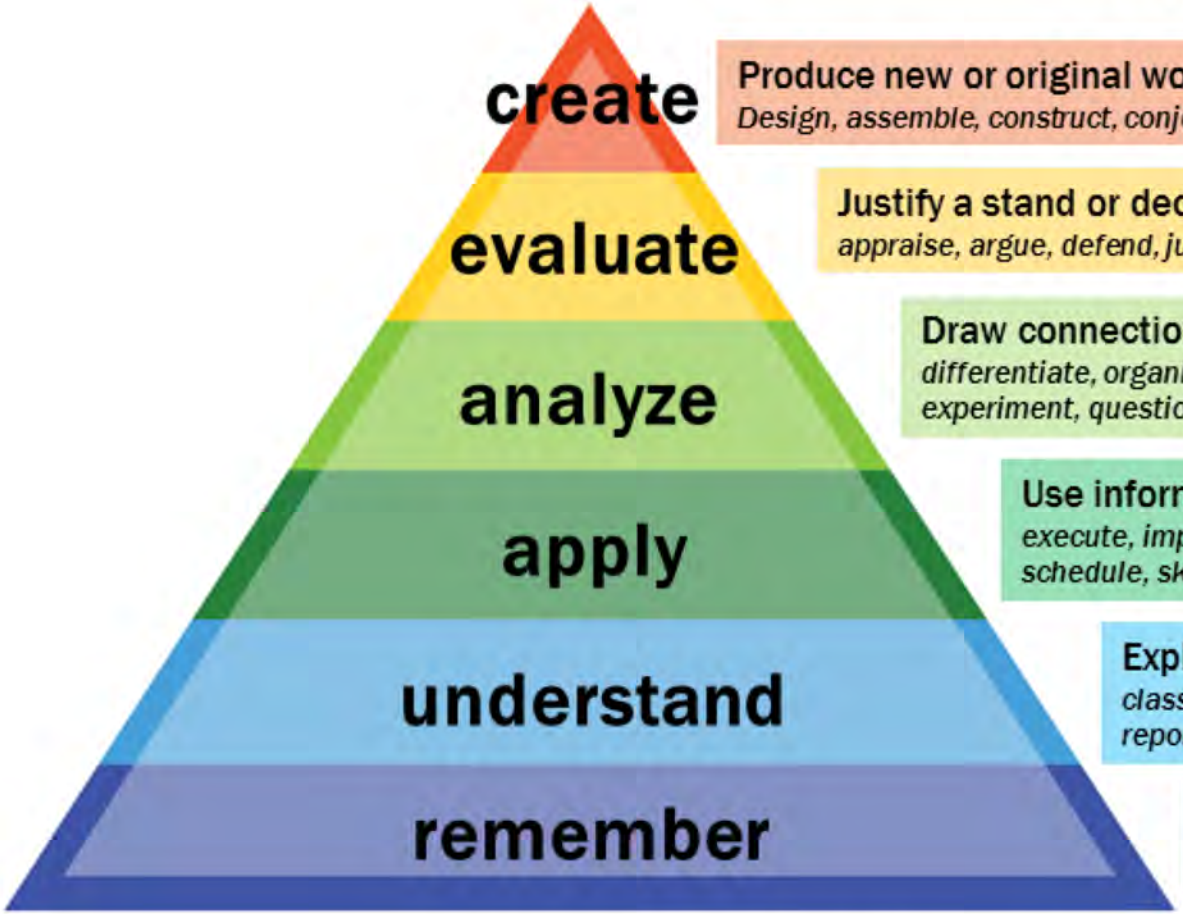
- Inclusive Teaching Structures
- Just In Time Teaching (JITT)
- Critical Thinking in Labs
- (Lecture) Tutorials
- Interactive Lecture Demos
- Think-Pair-Share / Peer Instruction
- PhET Interactive Simulations
- Resources: PhysPort/comPADRE

Orient your compass –

Intentions for students



Bloom's Taxonomy



Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate

Justify a stand or decision
appraise, argue, defend, judge, select, support, value, critique, weigh

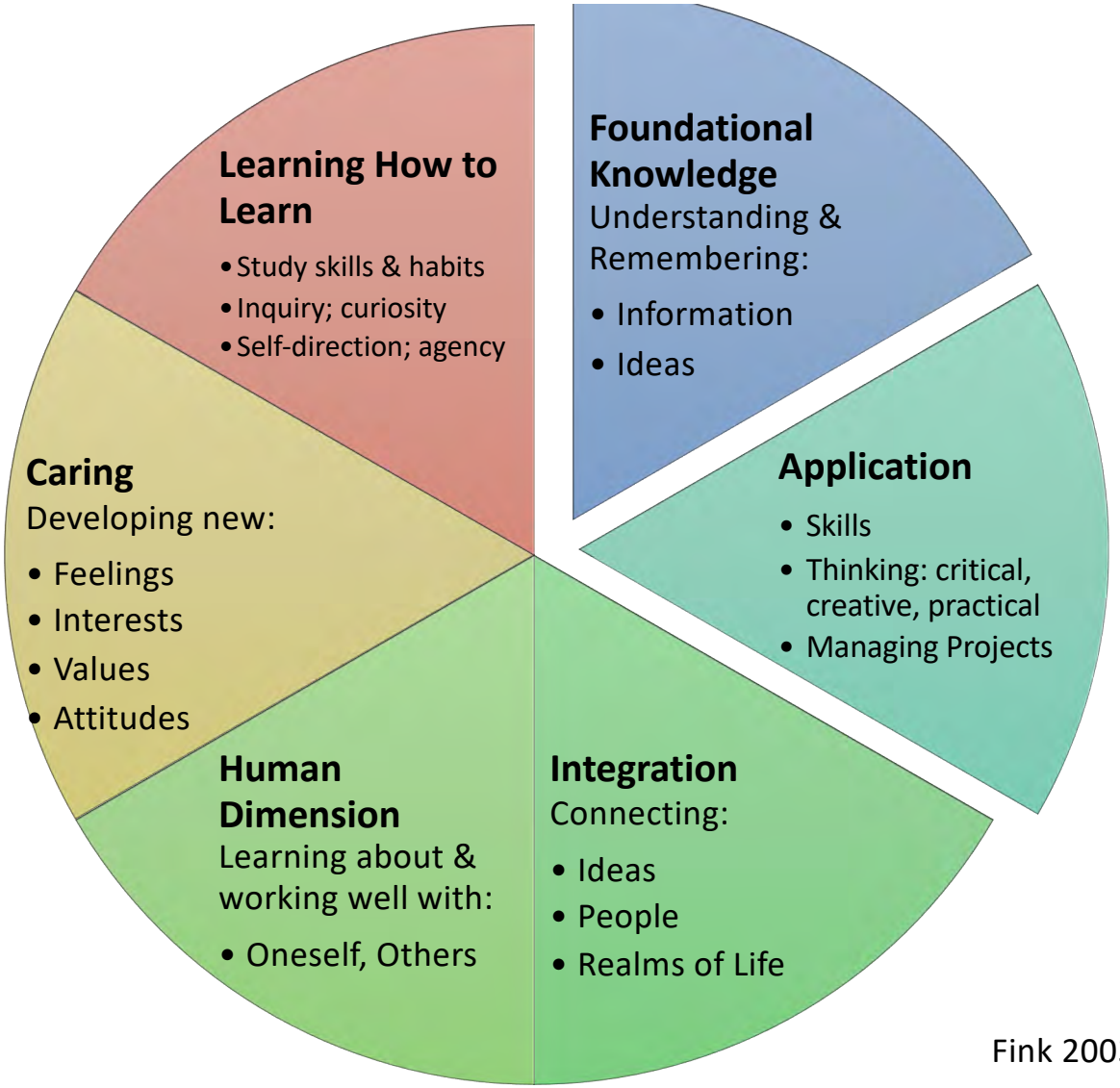
Draw connections among ideas
differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test

Use information in new situations
execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch

Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate

Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state

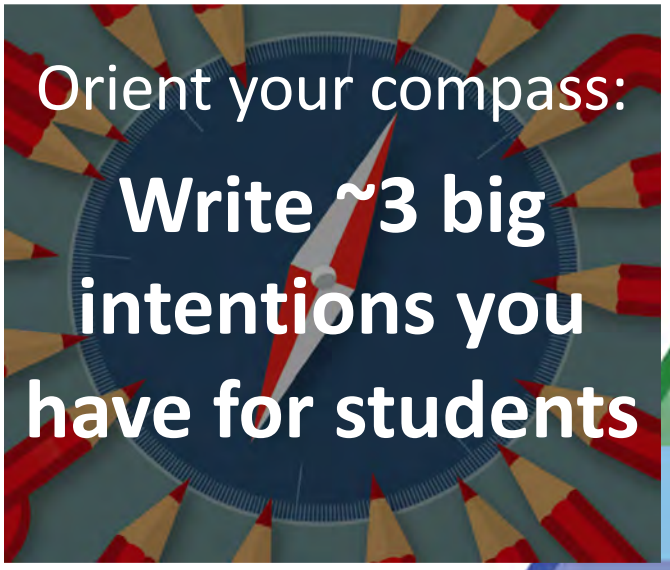
Multiple kinds of learning…

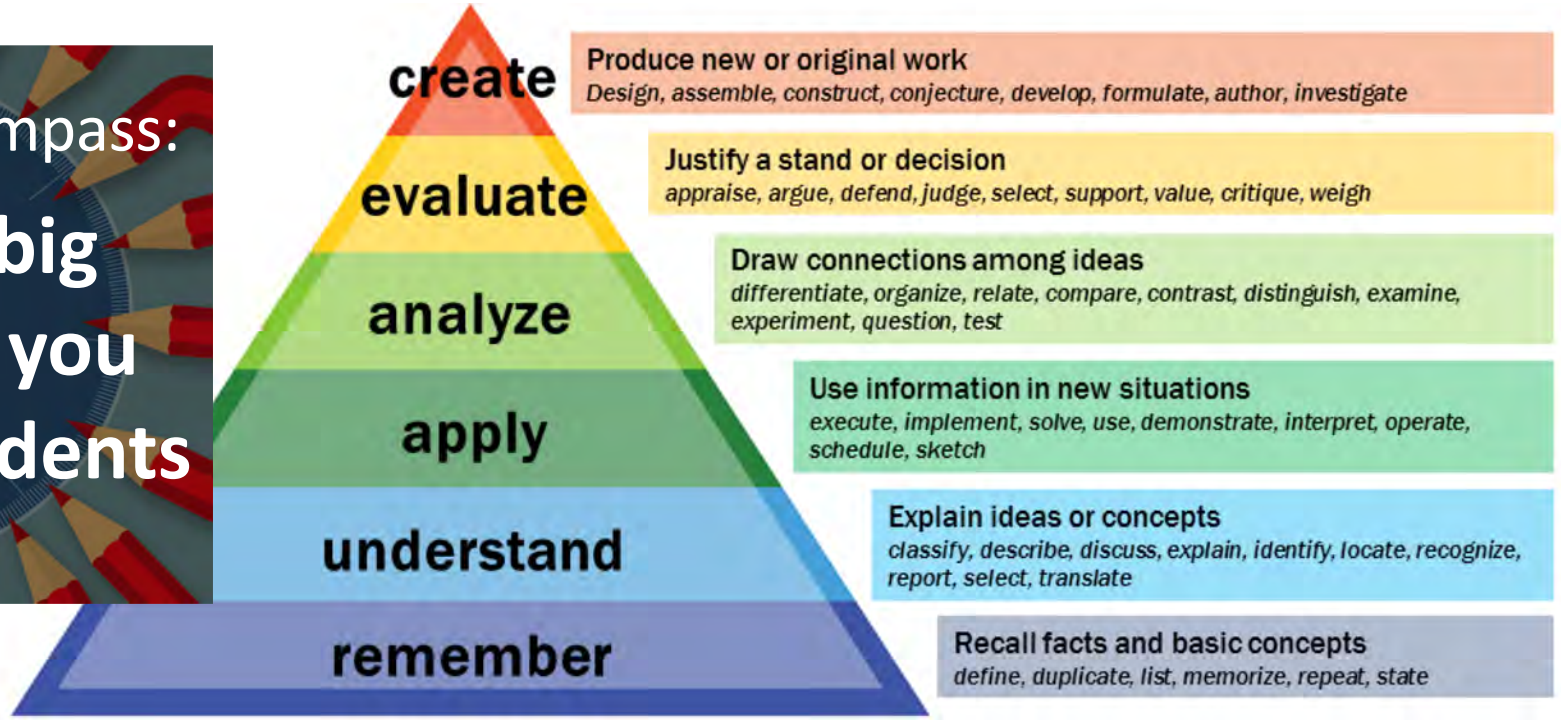


Fink 2003

Caltech Physics + Chemistry + Math (Core) Faculty: Big intentions for students

• see the world differently	*integration*
• motivate further inquiry	*caring*
• tackle real-world issues	*application*
• recognize and solve different kinds of problems	*learning to learn*
• collaborate effectively	*human dimension*
• appreciate the relevance of foundational science	*caring + knowledge*





Integration – Connecting Ideas, People, Realms of Life
Human Dimension - Learning about & working well with oneself and others
Caring – Developing new: Feelings, interests, values, attitudes
Learning How to Learn – Study skills & habits; Inquiry; curiosity; Self-direction; agency

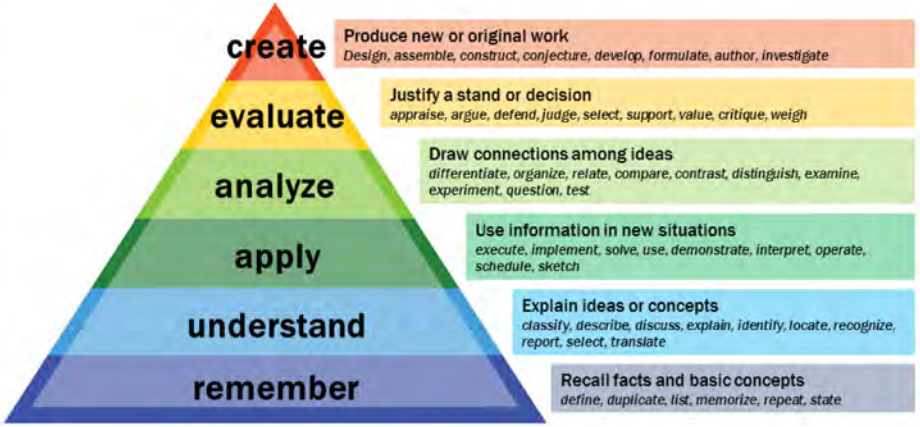
Why use this?

Hypothetical RBIS A

- Students work in pairs
- Short conceptual questions
- One cycle takes a few minutes

Hypothetical RBIS B

- Students work in teams of four
- Multi-part problems/cases
- One cycle takes 20-30 minutes



1. Priorities for Student Learning
2. **Wise instructional choices**
3. Context matters

Wise instructional choices:

- **Why use this?**
  What kinds of learning outcomes is it good for?
  What are its key affordances?
- **What aspects are essential?**

- **What are the potential pitfalls?**

Fidelity of adoption

Image: Jordanhill School D&T Dept, CC BY 2.0

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What's crucial?

What's adaptable?

Li et al. 2015

Minimum increment

What aspects are essential?

Hypothetical RBIS A

- Students work in pairs
- Short conceptual questions
- One cycle takes a few minutes

Hypothetical RBIS B

- Students work in teams of four
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- One cycle takes 20-30 minutes

Fidelity of adoption?
Minimum increment?

What are the potential pitfalls?

- Common “mistakes” (non-optimal implementations)
- Ways to avoid them

Potential pitfalls

FEEDBACK

“ [Student] comments on the use of [think-pair-share] are generally mixed, but encouraging.

One of the general takeaways, that you had already warned me about, is that such things can be useful, but one has to be very careful how one uses it.

I enjoyed the [method] and aim to use it more in the future, but it requires a lot of thought to make it productive. And even more to have the students recognize the value :-) ”

What are the potential pitfalls?

- Common “mistakes” (non-optimal implementations)?
- Ways to avoid them?

Ask:
- NFW Facilitators
- Each other

“Going deeper” and practice sessions

These may not always be in the published literature…

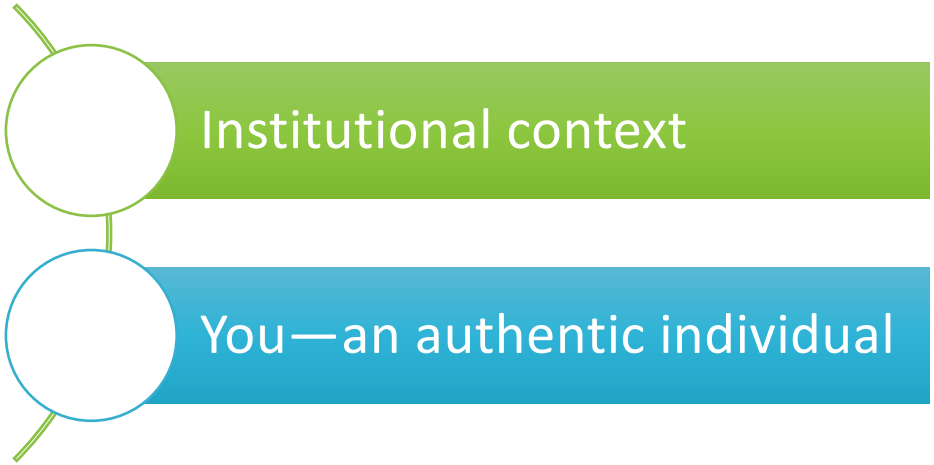
Handy reference…

Why use this RBIS? • For what kinds of learning goals and objectives is it well suited? • What are its key affordances?	
What are the essential aspects? • What do you need to do to maintain fidelity? • What's the minimum increment?	
What are the potential pitfalls? • Common "mistakes" (non-optimal implementations)? • Ways to avoid them?	

1. Priorities for Student Learning
2. Wise instructional choices
3. **Context matters**

What matters in adopting & sustaining RBISs?

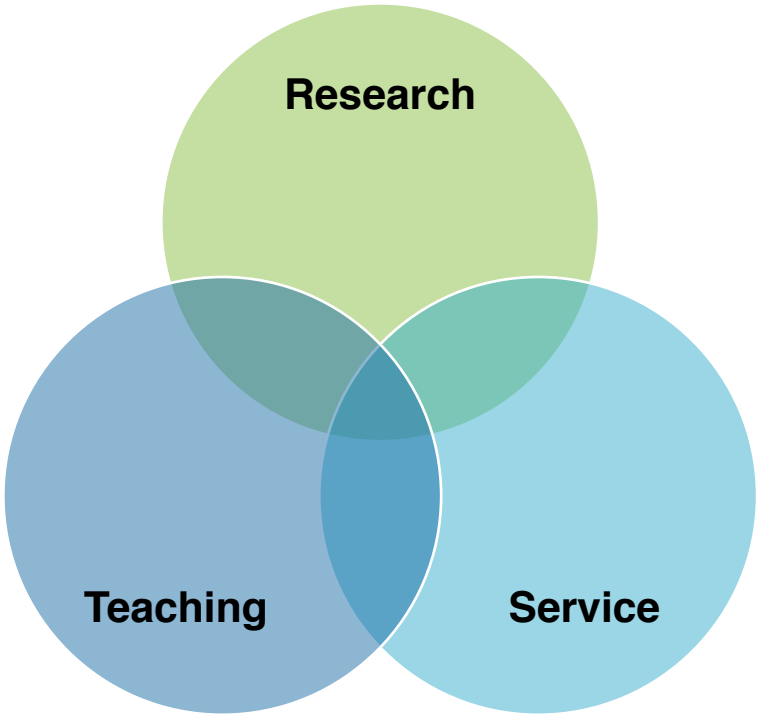
- **Training** ✓
- **Time**
- **Incentives**
- **Professional identity**



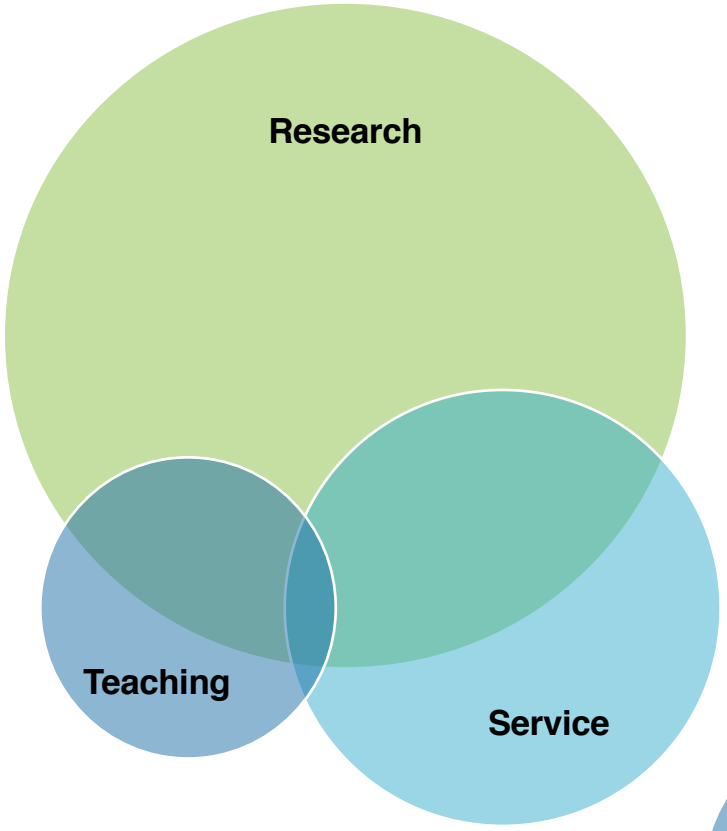
Brownwell & Tanner 2012

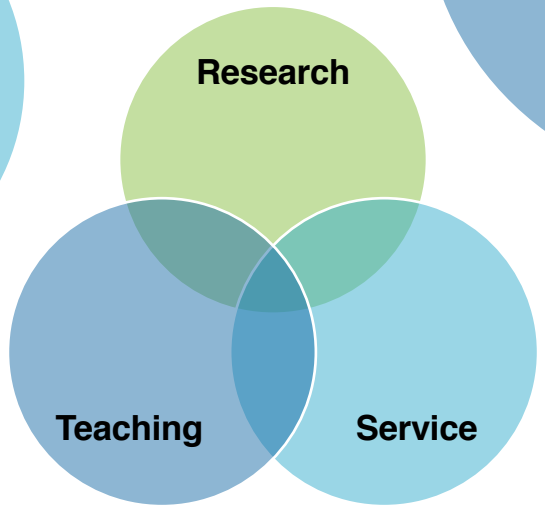
Institutional context

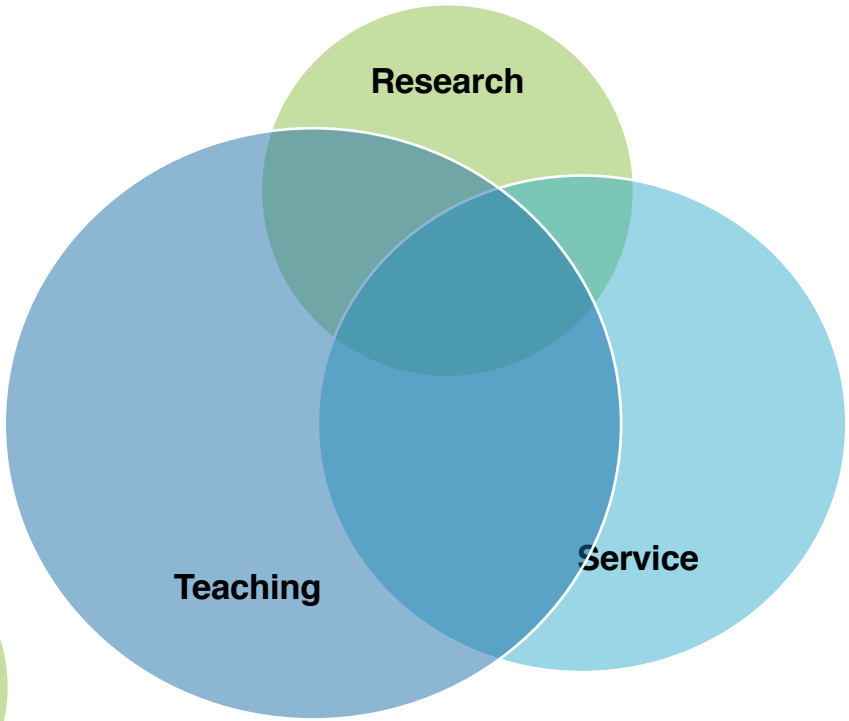
Time
Incentives
Identity



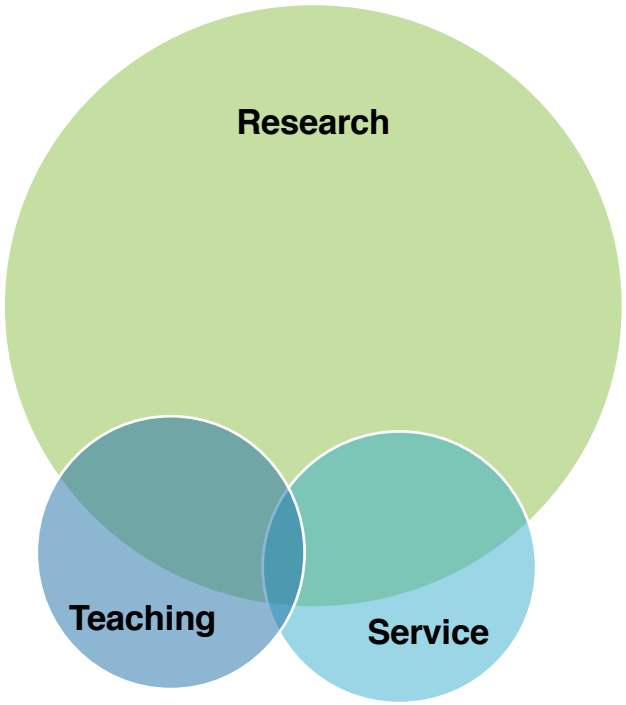
Context: Institutional Differences

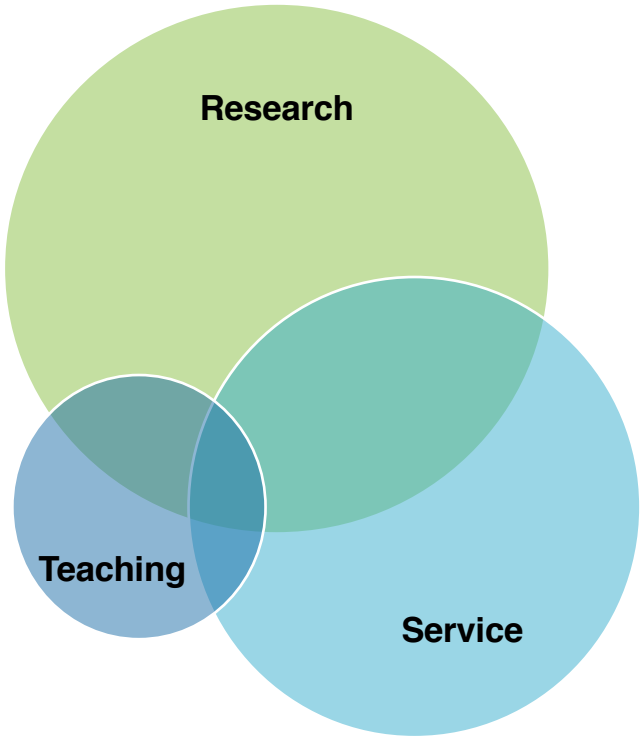


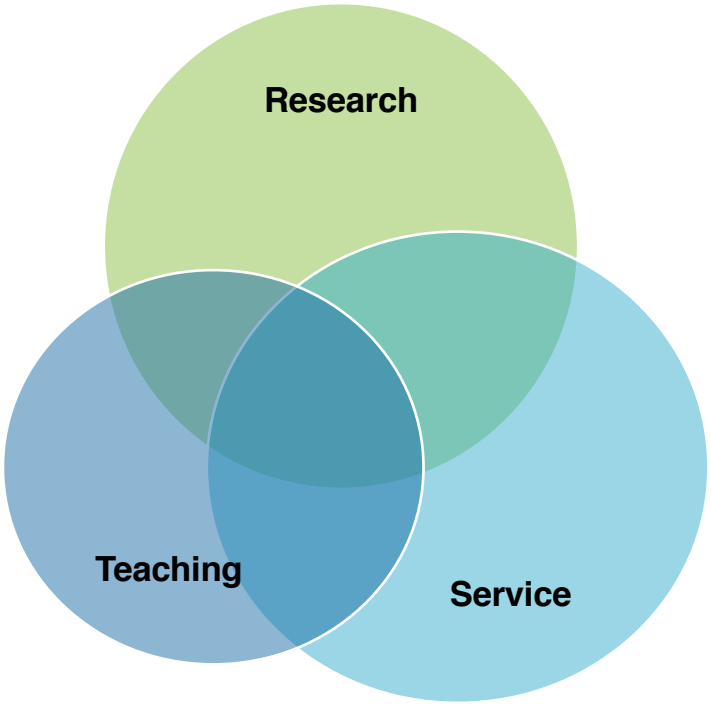




Context: Career Stage Differences

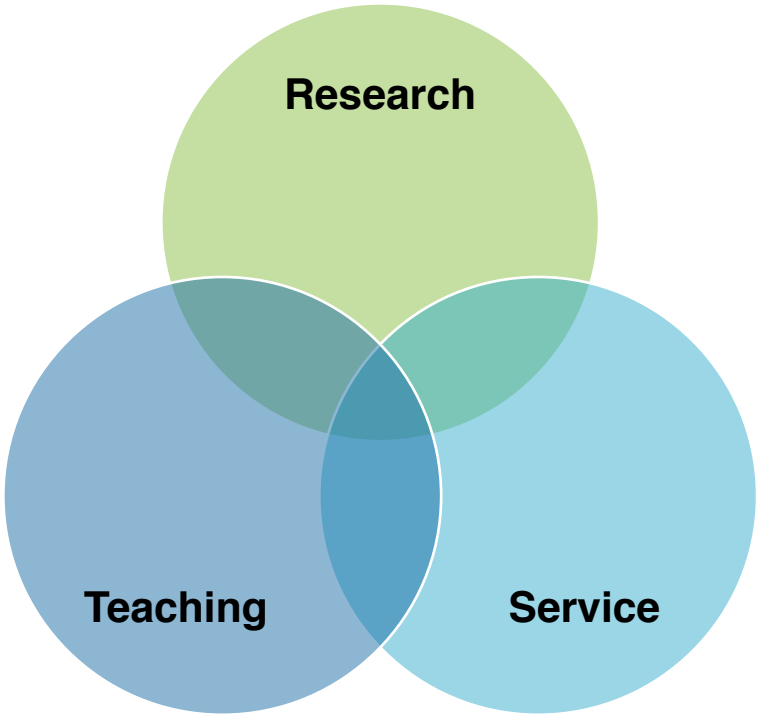




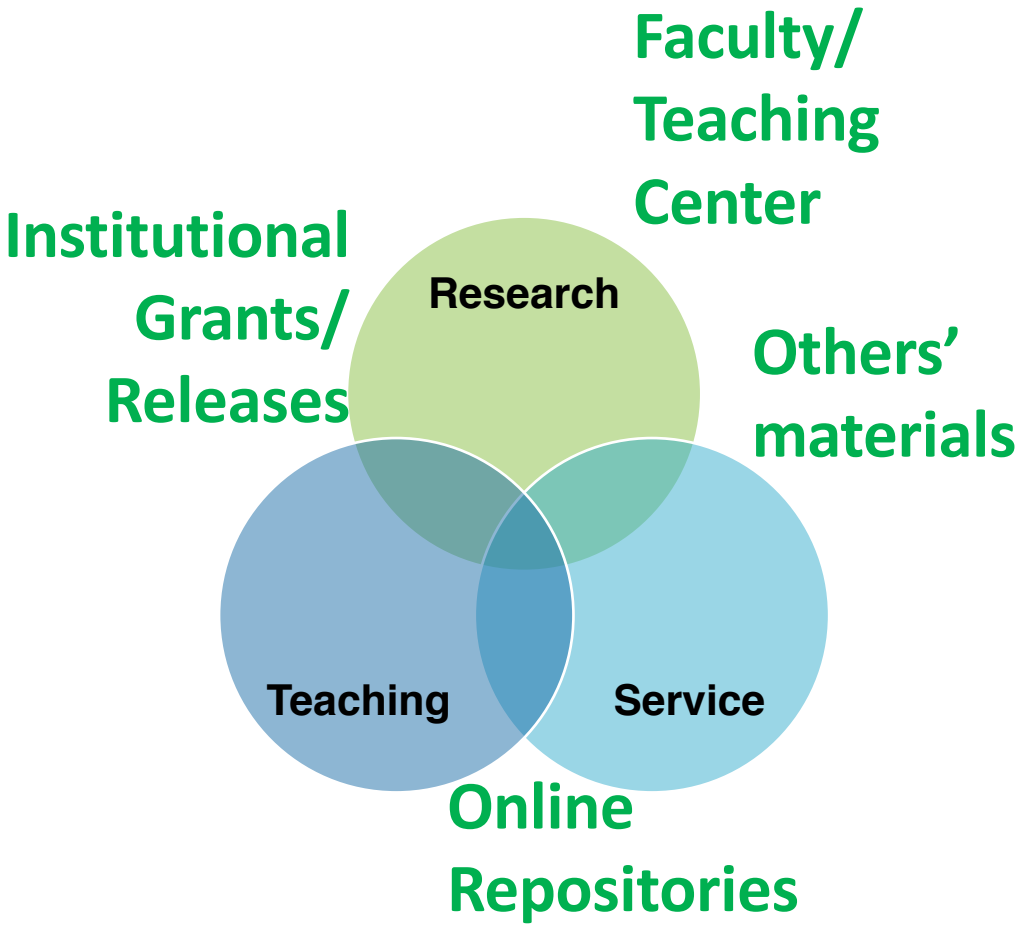


Evaluation Criteria (Promotion/Tenure)

Time
Incentives
Identity

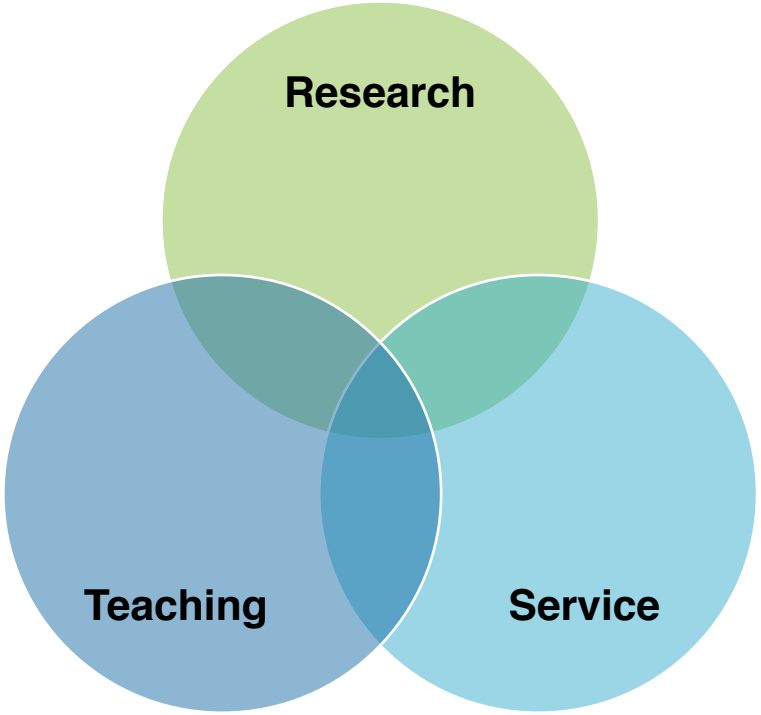


USING RESOURCES



Institutional context

Time
Incentives
Identity



~~Magic Wand~~

Productive Alignment

You—an authentic individual

Professional & Personal Identity Matters

- Who you are as a scientist, educator, mentor, colleague, person…
- Circumstances in which you best express your enthusiasm and passion…

Context and Identity

Hypothetical RBIS A

- Students work in pairs
- Short conceptual questions
- One cycle takes a few minutes

Hypothetical RBIS B

- Students work in teams of four
- Multi-part problems/cases
- One cycle takes 20-30 minutes

What if you:

- Teach in rooms with fixed, tiered seating?
- Find it challenging to interrupt/improvise?
- Have a full set of lecture materials from a colleague?
- Have a full set of problems/cases from a colleague?

Handy reference…

How does this RBIS align with your context? • Time, effort, support, resources…	
How does it align with your personality, values, and goals? • How does it seem like a fit? • What might be challenging? • Are the challenges worth it now?	

The following questions may be helpful when deciding which RBISs (Research Based Instructional Strategies) to implement

Why use this RBIS? • For what kinds of learning goals and objectives is it well suited? • What are its key affordances?	
What are the essential aspects? • What do you need to do to maintain fidelity? • What's the minimum increment?	
What are the potential pitfalls? • Common "mistakes" (non-optimal implementations)? • Ways to avoid them?	
How does this RBIS align with your context? • Time and Effort • Support and Resources • Expectations in Your Role	
How does it align with your teaching personality, values, and goals? • How does it seem like a good fit? • What might be challenging? • Are the challenges worth it now?	

Thriving in Academe

REFLECTIONS ON HELPING STUDENTS LEARN

Wise Instructional Choices in an Evidence-driven Era

Everywhere you turn, colleagues are talking about evidence-based teaching. But even when the evidence is convincing, it can be tough to choose a strategy and begin using it well. This navigational guide will help you get started.

BY CASSANDRA VOLPE HORII
California Institute of Technology

It's true—we have an unprecedented body of evidence about effective college-level teaching. A wide range of techniques, focusing on active learning, lure with catchy titles and clever acronyms: Think-Pair-Share, JITT (Just in Time Teaching), Peer Instruction, POGIL (Process-oriented Guided Inquiry Learning), and Flipped Classrooms, to name a few.

We all care about our students and want them to learn. Across disciplines, but especially in science, technology, engineering, and mathematics (STEM) fields, institutions are undertaking strategic initiatives, course redesigns, and curriculum transformation projects with evidence-based instructional strategies at their core.

Whether your motivation stems from curiosity, a desire to help students, participation in an institutional initiative, or some combination, navigating the available practices and strategies can be overwhelming. How do you choose? What lies between choosing and implementing? And, what can do you do if your chosen strategy doesn't seem to work?

Here's your chance to step back from the alphabet soup of methods and answer the underlying questions that will help you make wise instructional choices that take into account your teaching context, authenticity, and interests. The following pages will guide you through key steps toward navigating the terrain of evidence-based teaching.

6 NEA HIGHER EDUCATION ADVOCATE

Your Instructional GPS

You wouldn't set out on a road trip without taking your GPS-enabled device. In our classrooms, we also need navigational assistance. When it comes to evidence-based teaching, our internal compasses may not be as reliable as we think.

The sections that follow here will help you develop your instructional GPS. Rather than dictate methods to use (see Resources for suggested approaches), this sequence will help you evaluate teaching methods and decide what to use and how to use it.

Research about adoption of evidence-based teaching suggests most faculty are familiar with such techniques and may be convinced they're worth trying, but long-term implementation lags behind. To make these techniques something you can see yourself doing and that you are willing to stick with, it helps to prepare as follows.

Foundational questions

In your own discipline, you have go-to questions that you instinctively run through when faced with a new artifact, problem, text, or piece of evidence. You likely developed your processes through intensive study, exposure to many examples, and a great deal of practice. You can develop your reflexes for productive questioning of evidence-based teaching methods, too.

Meet Author

Cassandra Volpe Horii (cvh@caltech.edu) is the founding director of the Center for Teaching, Learning, and Outreach at the California Institute of Technology and the current president of the POD Network in Higher Education. With a background in physics and atmospheric science, she has focused on the research and practice of educational development—improving teaching and learning through faculty development, course and curriculum development, and organizational development—for over 15 years. Her research interests include preparing future faculty as mentors of undergraduate research, organizational structures in support of systemic educational change, and innovative instructional consultation methods. She is active in several national STEM education efforts and has taught courses in STEM pedagogy, sustainability, expository writing, and atmospheric chemistry.

TALES FROM REAL LIFE > GO FOR AUTHENTICITY

Over the past decades, I've seen our collective approach to university teaching transform from one based on private wisdom to one where teaching practices are routinely studied and discussed. I've also seen the volume of findings become almost paralyzing for some instructors. Others feel compelled to adopt certain practices, even with a strong underlying sense of antipathy. Ultimately, I've concluded that, while we need good evidence, we must realize that teaching is more than can be summarized in any chart. Evidence-based pedagogies are enacted via human instructors, in relationship with students—all with unique personalities, interests, passions, and aspirations. The teacher, as an authentic, individual human being, matters very much.

I now encourage instructors to pick methods that will enable their best expression of enthusiasm and authenticity with students. Methods vary in the amount of lecture, the types of interactions with students, the amount and kind of preparation, and the distribution of your time. Ideally, you should feel like yourself in the classroom. I believe that the more you choose evidence-based methods that feel meaningful and compatible, the more effective, enjoyable, and sustainable teaching will be.

NEA HIGHER EDUCATION ADVOCATE 7

cvh@caltech.edu

Wise instructional choices

Final thought:

NFW is an opportunity to take ONE NEXT STEP in your teaching development…

Some students → all students
20% active → (20+x)% active
Low structure → mod/high structure
Translucent → transparent

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