

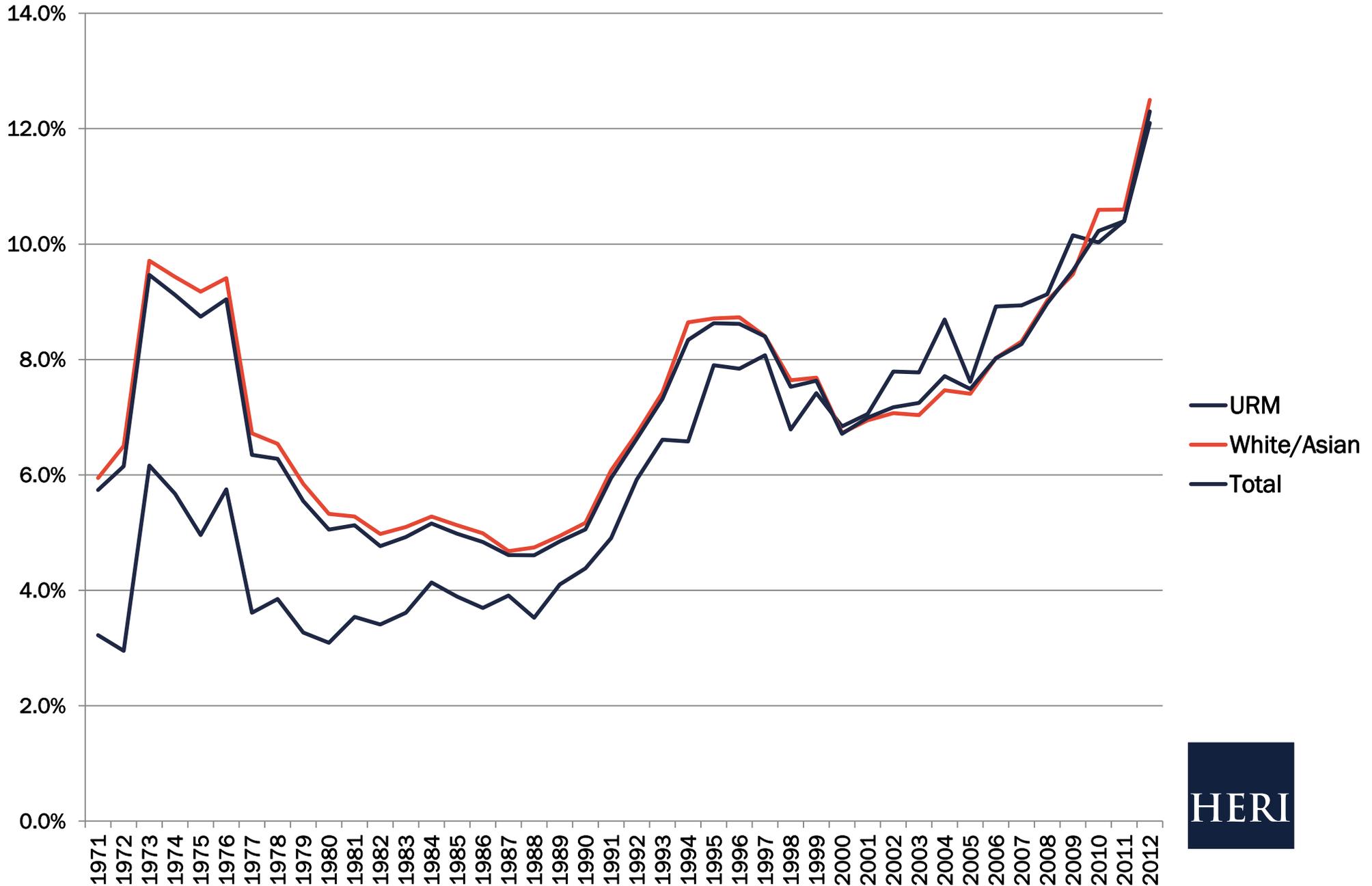
# **Institutional Transformation:** *Models and Strategies of Institutional Change in Practices for Undergraduate Teaching and Research*

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University of California, Los Angeles  
July 2017

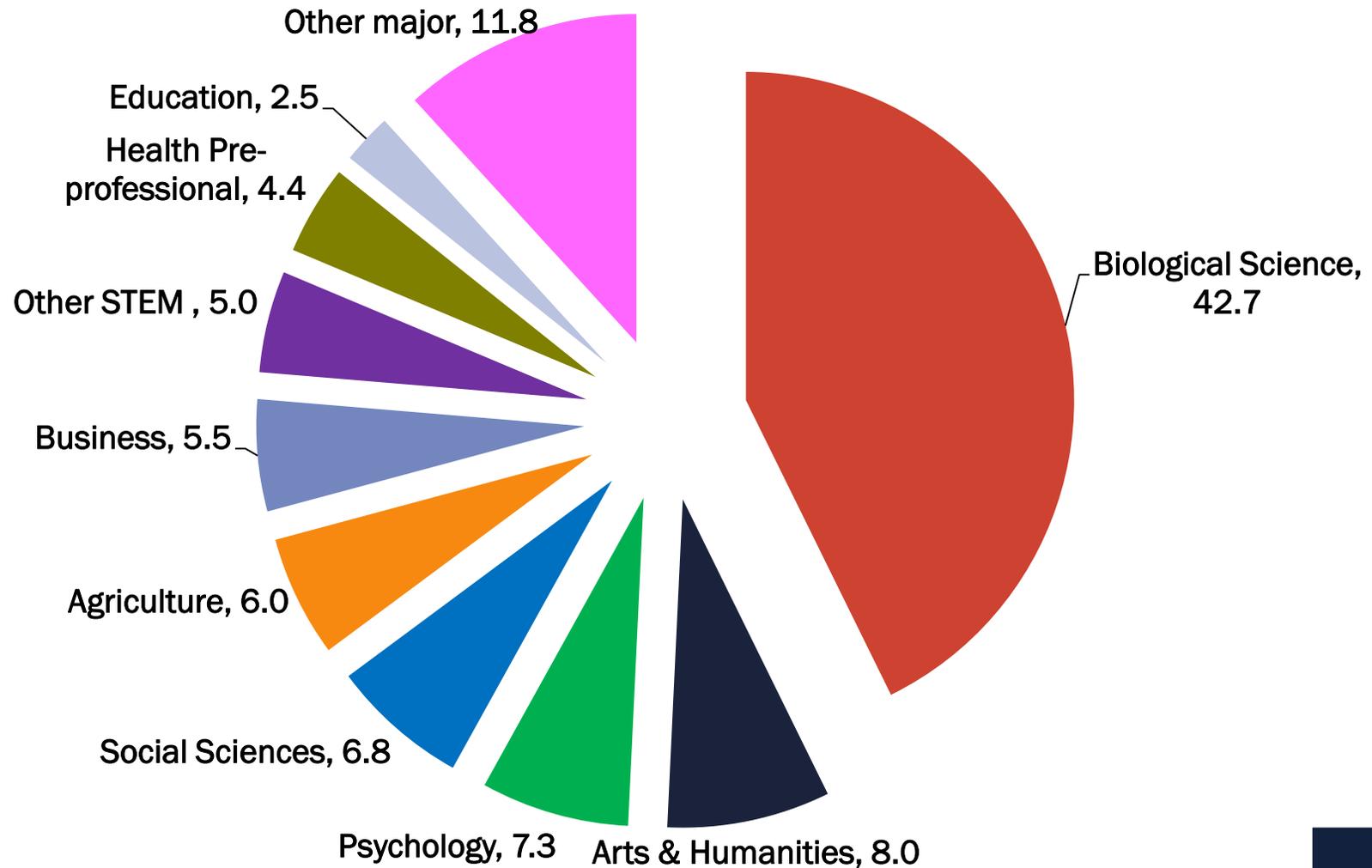


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# Trends in student interest in the Biological Sciences reported at the beginning of their freshman year



# Of students who aspired to major in the biological sciences in the beginning of their freshman year, what is their final major?



# Biomedical Science Completion versus Completion in Another Field of Study 6<sup>th</sup> year (30,614 biology aspirants, 296 colleges)

Prior Preparation	
Average high school GPA	+
Student-centered pedagogy factor	+
SAT composite score (100)	+
Years of HS study: Mathematics or Biological science	+
Entering Aspirations and Expectations	
Communicate regularly with professors	+
TFS Academic Self-Concept	+
Ph.D./Ed.D. degree aspiration	+
Medical degree aspiration	+
Grading on a curve	-

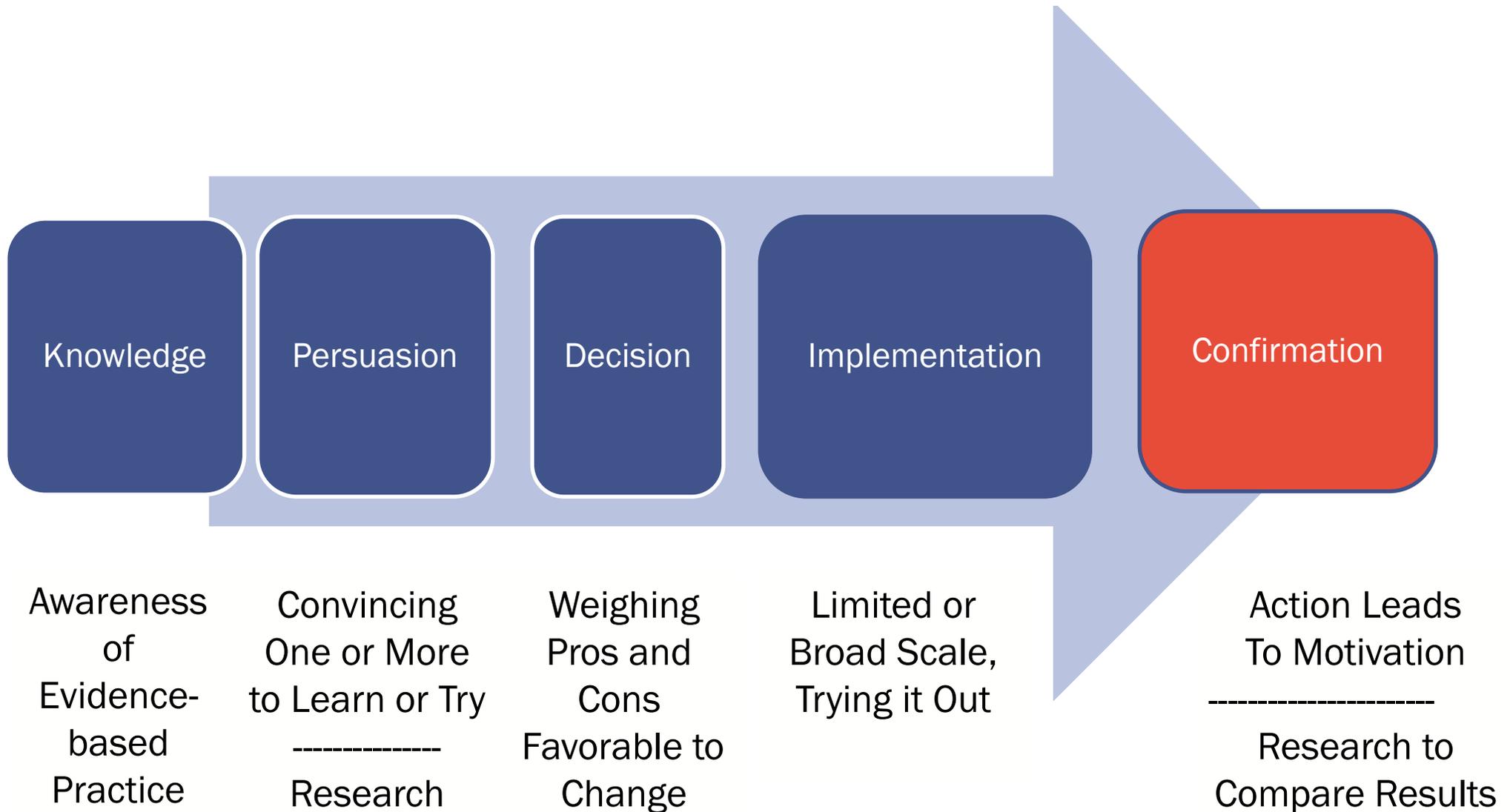
# Different Models of Institutional Change

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# Steps in the Adoption of Innovations

Rogers, *Diffusion of Innovations*, Free Press, 2003



Wieman “bring the teaching and research aspects of the culture much closer together “ to facilitate change in *Improving How Universities Teach Science* (2017)

<b>Aspect of System to be Changed</b>	<i>Individuals</i>	<p><b>I. Disseminating: CURRICULUM &amp; PEDAGOGY</b></p> <p>Change Process: Tell/Teach individuals about new teaching conceptions and/or practices and encourage their use.</p> <p>Examples: dissemination/training (SER, FDR), focused conceptual change (FDR)</p>	<p><b>II. Developing: REFLECTIVE TEACHERS</b></p> <p>Change Process: Encourage/Support individuals to develop new teaching conceptions and/or practices.</p> <p>Examples: reflective practice (FDR), curriculum development (SER), action research (FDR, SER)</p>
	<i>Environments and Structures</i>	<p><b>III. Enacting: POLICY</b></p> <p>Change Process: Prescribe new environmental features that Require/Encourage new teaching conceptions and/or practices.</p> <p>Examples: policy change (HER), strategic planning (HER)</p>	<p><b>IV. Developing: SHARED VISION</b></p> <p>Change Process: Empower/Support stakeholders to collectively develop new environmental features that encourage new teaching conceptions and/or practices.</p> <p>Examples: institutional transformation (HER), learning organizations (HER)</p>
		<i>Prescribed</i>	<i>Emergent</i>
<b>Intended Outcome</b>			

C. Henderson, A. Beach, & N. Finkelstein, 2011, Facilitating Change in Undergraduate STEM Instructional Practices: An Analytic Review of the Literature, *Journal of Research in Science Teaching*, 48, 8, 952-984

# How Talent is Cultivated

Some faculty actively thought about how their teaching practices contribute to the academic success of students

The first and most important lesson I've learned is to **appreciate the difficulty that some students have with the material and to make sure that they don't feel judged for the difficulty** that they're having, to express the idea that some of this material is challenging, it is different from anything that they've had before. Some of it is not intuitive, and that's okay. It's okay to struggle with it, and many people do. They won't be judged harshly for not getting it right away.  
— *Professor in Ecology and Evolutionary Biology, Introductory Classroom Data*

# Institutional Resources or Policies that Support Faculty in Cultivating Talent

Change efforts must be multi-level and multi-strategy

*One of the things that I pushed throughout [my career] was that we have to get this from many different levels. We have to train junior faculty. We have to try to implicate senior faculty. We have to train the next generation of post-docs and graduate students. We have to provide grant incentives. We have to provide awards. We have to provide negative reinforcement for the other ways [that reduce STEM success]. Just in every angle, I see different ways of either rewarding or discouraging the behaviors we either want or don't want respectively. – Biology Professor, Pioneer Data*

# Structure in Place: Still Requires Change Leadership

There was a lot of opposition from other units who thought that these active learning classrooms were a fad, a waste of time, and didn't believe the data that showed that it was very effective for student learning. That's how the building got to be [with key champions], and as with anything new, there were bumps in the road, and there was student resistance at the beginning....It's not what most universities were doing, and so that was a little, "What's going on here?" Frankly, some of the things we said to them didn't help. The first one or two semesters, basically, we told them it was an experiment, so they're guinea pigs. Well, that—that did not go over well, so we soon learned to say, "No, this isn't an experiment. We know this works well. We've seen the grades of students who came through this university before and after this, and there's a big difference. Students are grasping material better. We have many fewer DFW grades. C students tend to get bumped up into the lower B range, and, no, A students, you're not suffering."

Associate Dean, Public Research University- Exemplar Case Studies Data

# **Institutional Transformation: A New Framework Informed by Strategies Utilized at Highly Productive Institutions**



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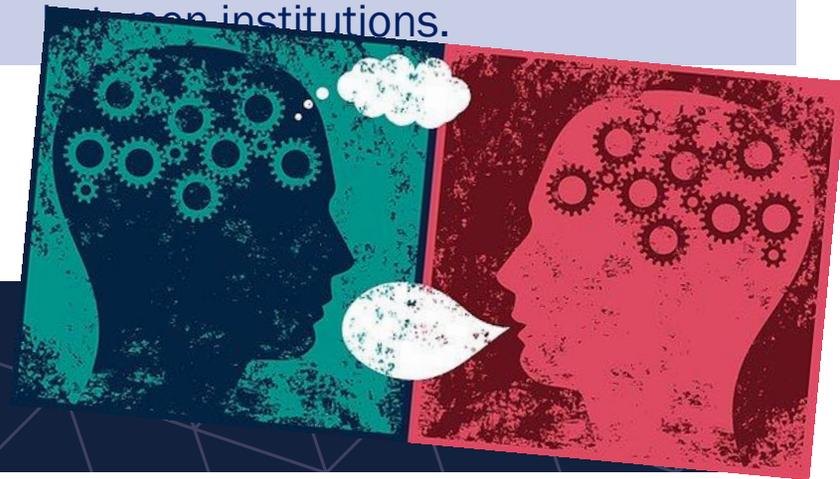
# Methods

## Sample

- Case studies from 11 diverse institutions
  - Institutions had 'exemplary success' in producing STEM degrees overall, or among a particular underrepresented racial group of interest
  - Efficiency scores generated by stochastic frontier analysis identified 'exemplar' campuses
  - Roughly 20-25 STEM faculty, program directors, and upper level administrators were interviewed at each institution
- We investigated evidence-based practices and the overall context for STEM education

## Coding and Analysis

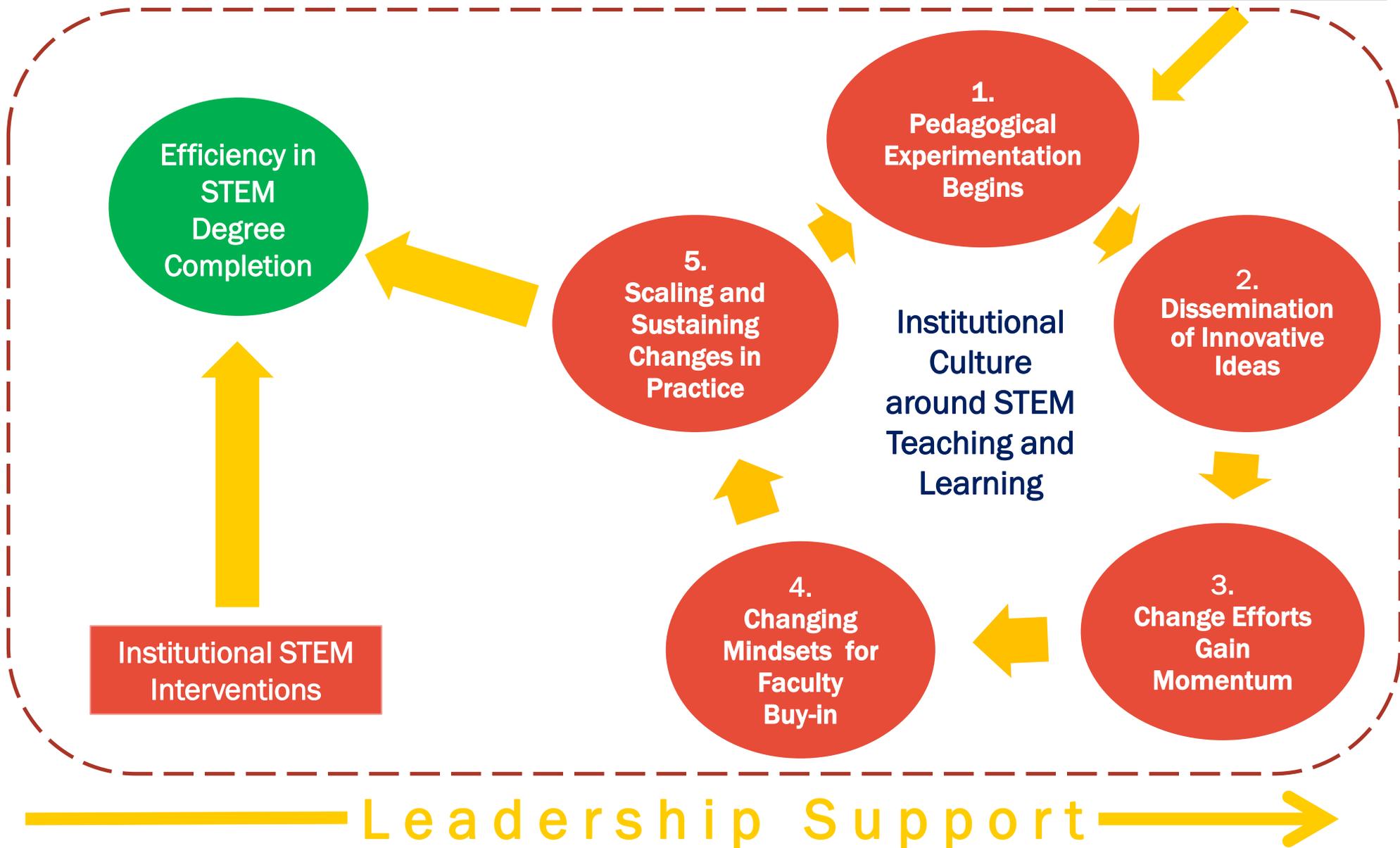
- Constant Comparative Approach used to code
  - Transcripts open coded for salient larger themes followed by axial coding to determine how themes were interconnected.
- Analysis involved visually displaying the data within each code in spreadsheets by institution.
  - Easily allows for comparisons between institutions.



# Organizational Perspective for Changing Norms in STEM Teaching and Learning

Attention to Diversity within Institutional Culture

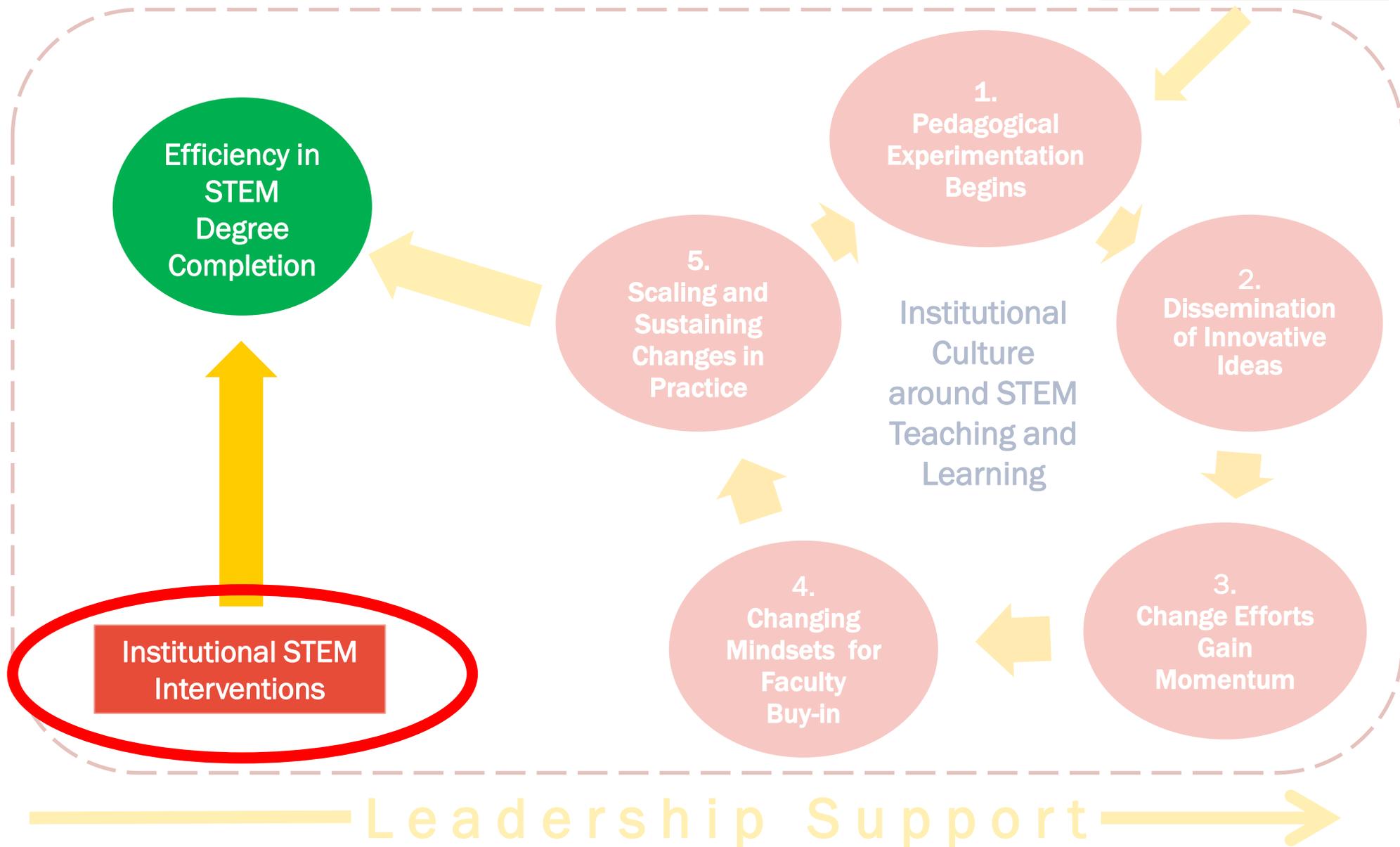
External Pressures



# Organizational Perspective for Changing Norms in STEM Teaching and Learning

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# Institutional STEM Interventions

- Institutional Partnerships with Surrounding Community
- Comprehensive Programs for Students Specifically in STEM
- Undergraduate Research Opportunities
- Academic Support and Advising
- Mentoring Programs

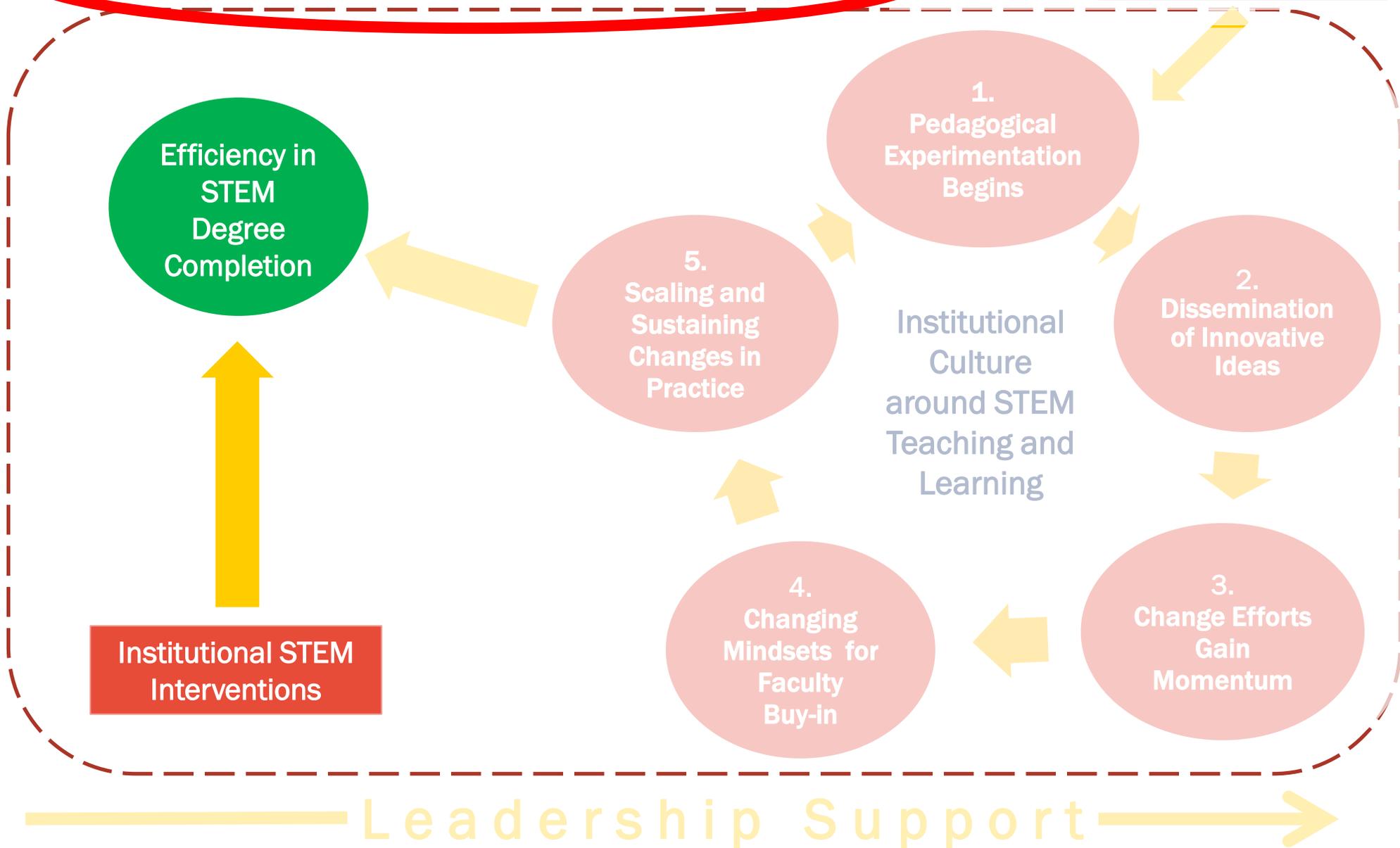
*“The Living Learning Communities, I think, are really a good model for again making sure students don’t fall through the cracks. They come in, and you have a faculty director who knows these 24 kids really well, and so when somebody’s struggling, you know it. It’s those high-touch things that we can do... We’ve had the Natural Science LLC for six years, I think. Those 24 students get lots of perks and benefits...I want all the students to be able to experience that, but when you **scale it up**, can you keep all the high-touch practices? ...We don’t know yet. We’re working on that experiment. [Professor] has money to be able to do that. That’s part of this big IUSE grant.”*

~ Associate Professor of Biology, Private  
HSI

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# Attention to Diversity within Institutional Culture

- Institutions embraced increasingly diverse student body
- Leadership vocal about the importance of diversity
  - Hiring of diverse faculty & faculty who value teaching/doing research with diverse students
- Collaborations with nearby Native American communities
- Institution recognizes that effectively teaching diverse students requires attention to additional challenges that URMs face
- Services may need to be tailored so that they can target diverse students

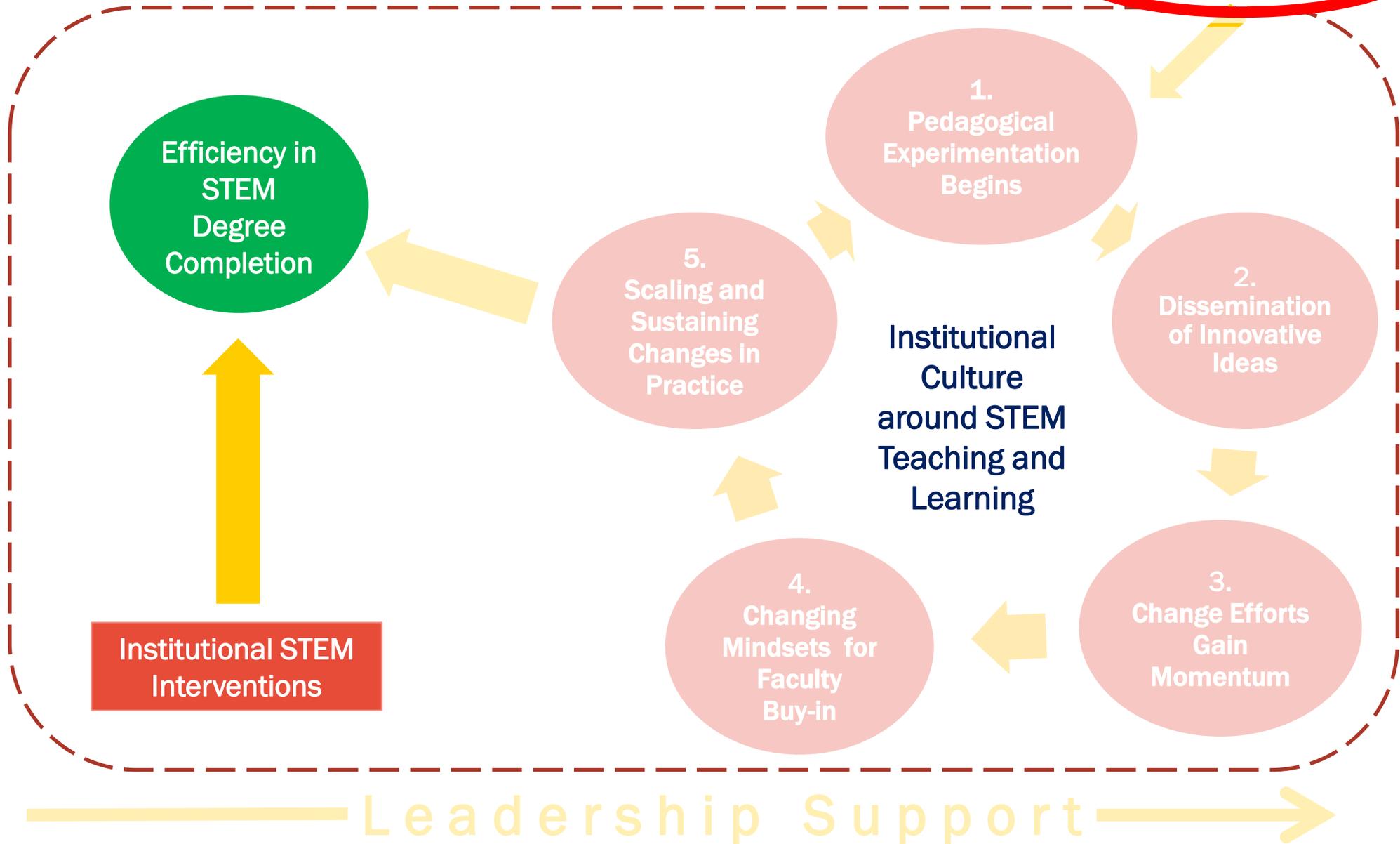
*When we hire faculty... we are looking for somebody who really loves being with students, who likes teaching students, who's not afraid to work with people from different diverse backgrounds.*

**~ Professor Emeritus in  
Biology, Master's  
Comprehensive HSI**

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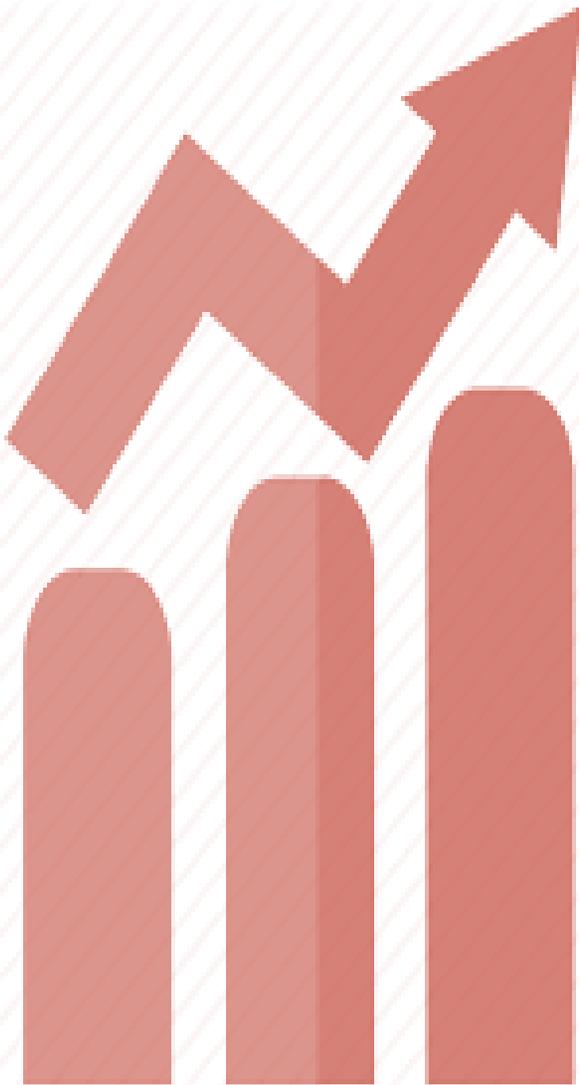


# External Pressures

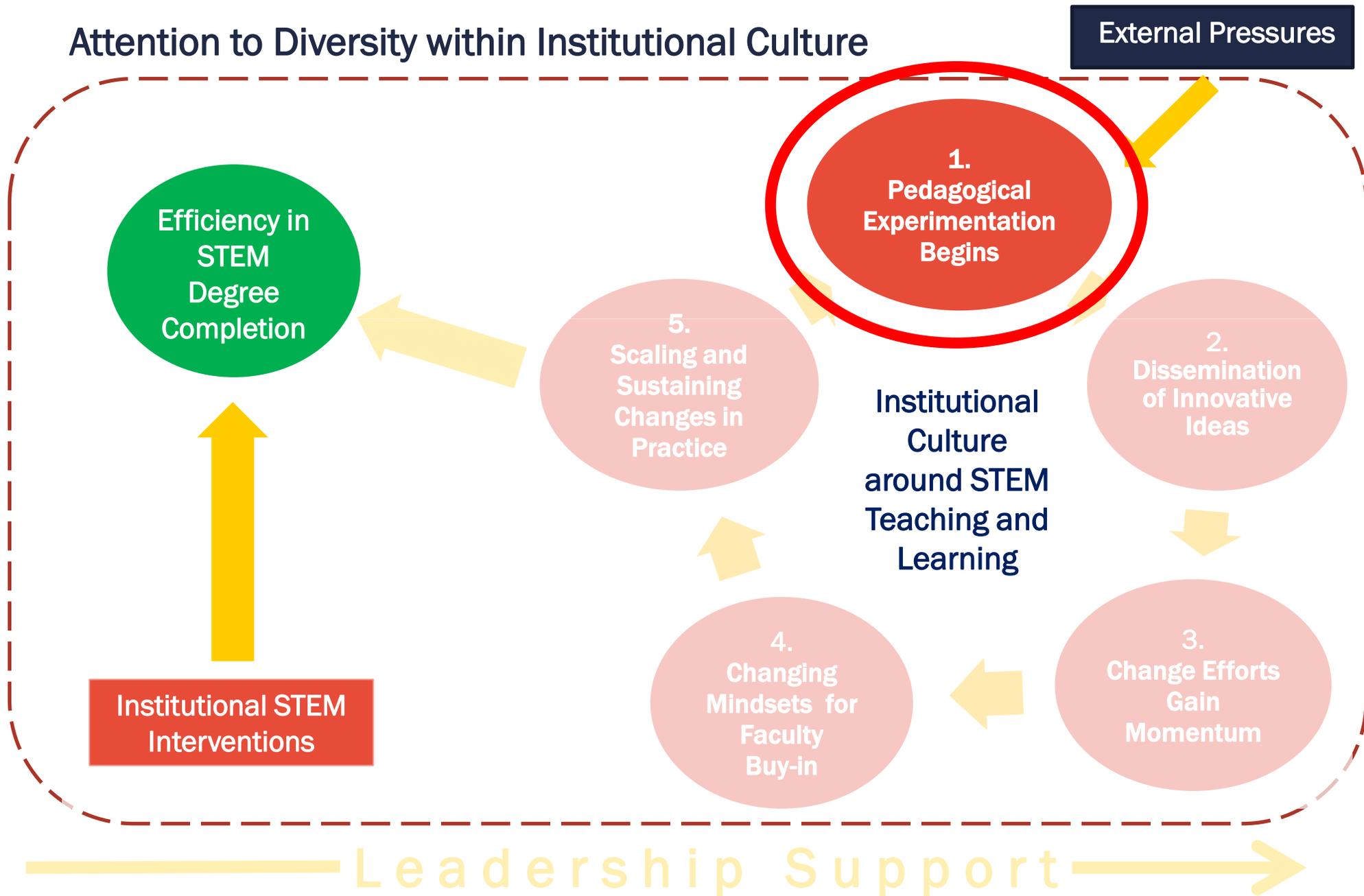
...the director for our program was here in January, and he said that **there is a good probability that this particular program will sunset.** And so, he said, "You know, if you write a renewal, think about language too. **How can you take the last round of funding, and try and scale these things at the institutional level?"**

So, to address that – I don't know how common these things are at other institutions, but **the recitation sections and supplemental instruction is something that started out as a boutique, and was scaled up. Institutional resources were brought to bear on that, and it does seem to help reduce the drop, withdrawal, and fail rates for all students in the earlier stages.**

~ Associate Professor in Biology, Public Research University



# Organizational Perspective for Changing Norms in STEM Teaching and Learning



# Starting Change: Pedagogical Experimentation Begins

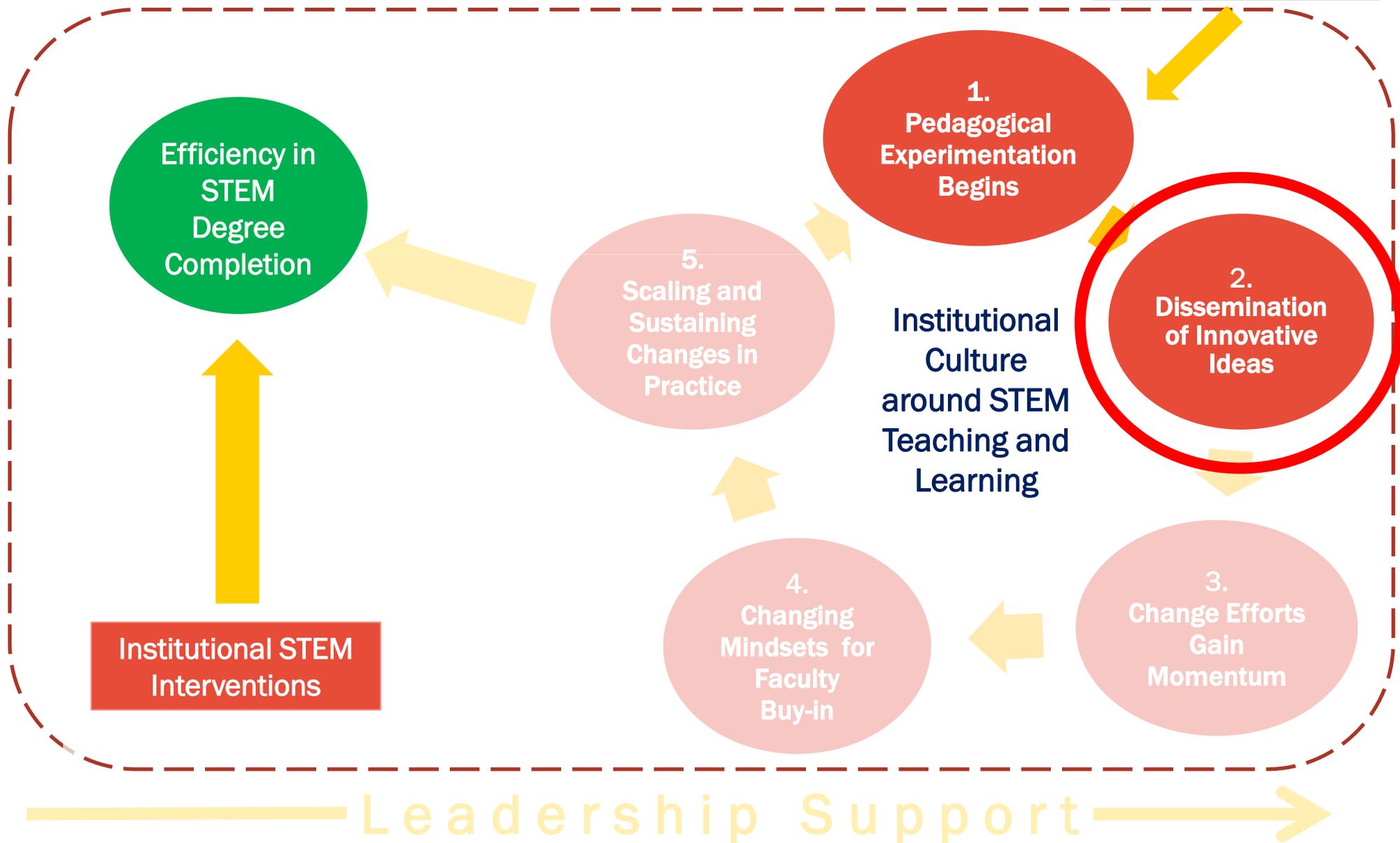
We have four classes in Biology ...So we talk about a total of about nine sections each semester, times 250 students. **The students basically are struggling with [aspects] in general. So what we did was establish a program that is based on professor nominations....I will email all the students you know from all the sections and invite them to participate as peer tutors, It's voluntary, you don't get paid.** ... And these were tutors that took the classes again with those same professors...So they not only know Physiology really well, the tutors, they also know my teaching styles, they all know the way I write exams and that's very helpful. From next semester we are going to change the format a little bit and now we're going to bring the tutors into the classroom and again they will sit there help during class activities and after that they will offer an hour and a half based on whatever time works for them as soon as we are able to meet with students one on one.

~Professor, Biology, Large Public R1 PWI

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*I had a statistician from the [Center for Teaching and Learning] working on it and it was clear that something good was going on. The Center wrote up a one page report and so I have to credit [an instructional consultant] in the Center, who...sent it up the chain of command. He sent it to the Provost right away. And they noticed, the chancellor, the Provost, the Deans they all noticed. And it got a lot of attention, but I kept feeling nervous like 'This isn't even published yet.'*

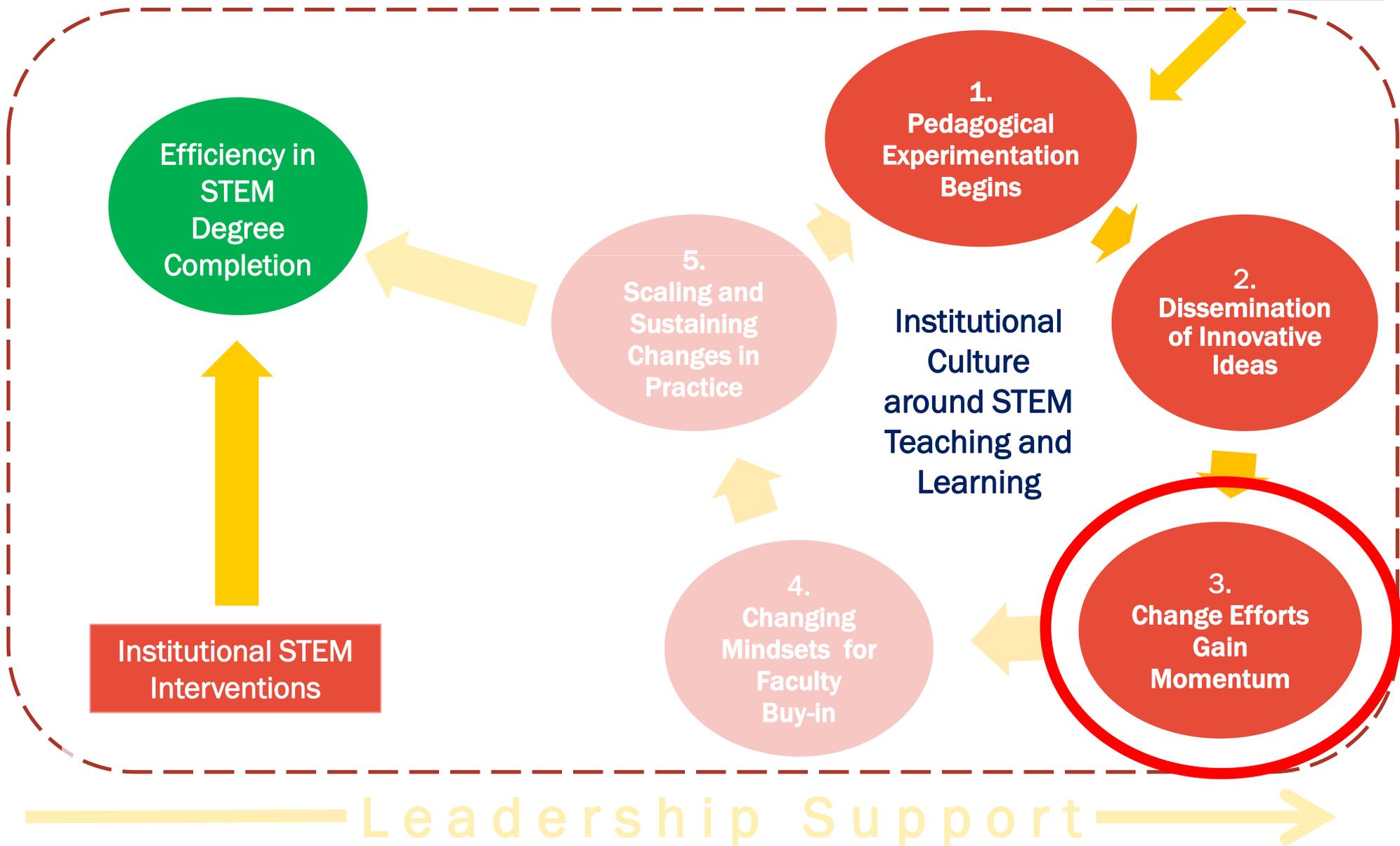
## Dissemination of Innovative Ideas

Director of Instructional Innovation  
for the College of Arts and Sciences,  
Large Selective Public University

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Change Efforts  
Gain  
Momentum

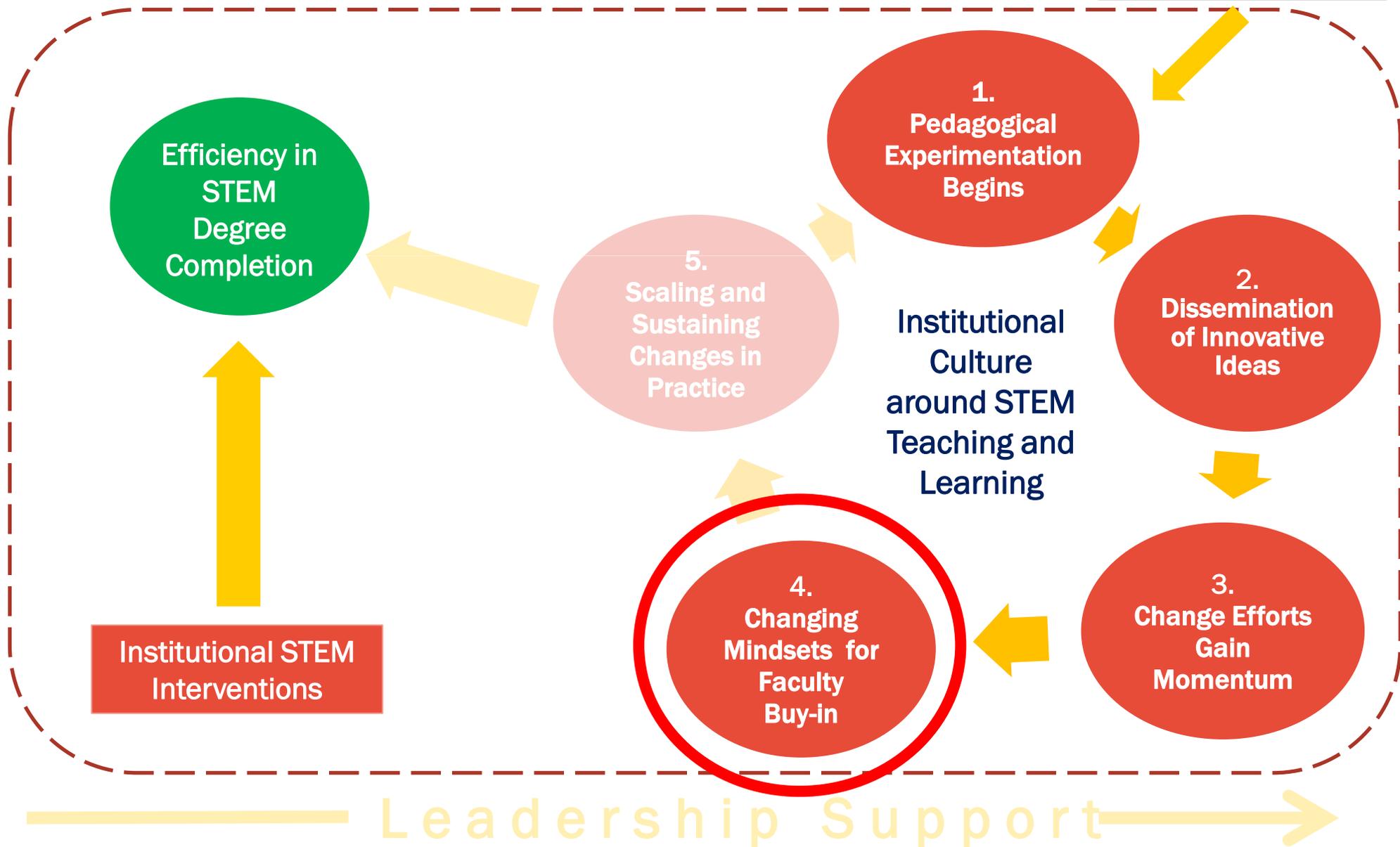
*“The data look really great, after comparing semesters...And we published a paper on that. We had halved the achievement gap for our black students, closed it entirely for first generation college students, which I didn’t even know there was a gap there.... So all of those things led the college to really take a look when they saw the numbers changing and said, “how do we replicate this in other classes?” So I co-chaired the large taskforce committee...And as some of those taskforce committee reports can go, we were like really worried it was just going to get buried somewhere. And so the dean really made some changes based on that and one of them was to create my [new administrative] position.”*

*~Teaching Associate Professor in Biology and Administrator, Large Public R1 PWI*

# Organizational Perspective for Changing Norms in STEM Teaching and Learning

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We had some initial discussions, and [faculty] weren't terribly receptive to the idea. It falls on the one person, the Director of Undergrad Studies for the Biochem, Biophysics, Molecular Biology Department, since both chemistry and physics impinge on this. **With backing of the rest of the Educational Policy Committee, we're asking him and maybe his department head or someone else from this department to initiate those discussions again to see if we can get a little more buy-in from them...**We don't wanna threaten them, but we do wanna make it clear that, if they aren't offering a course that suits our students, that there's something wrong there.

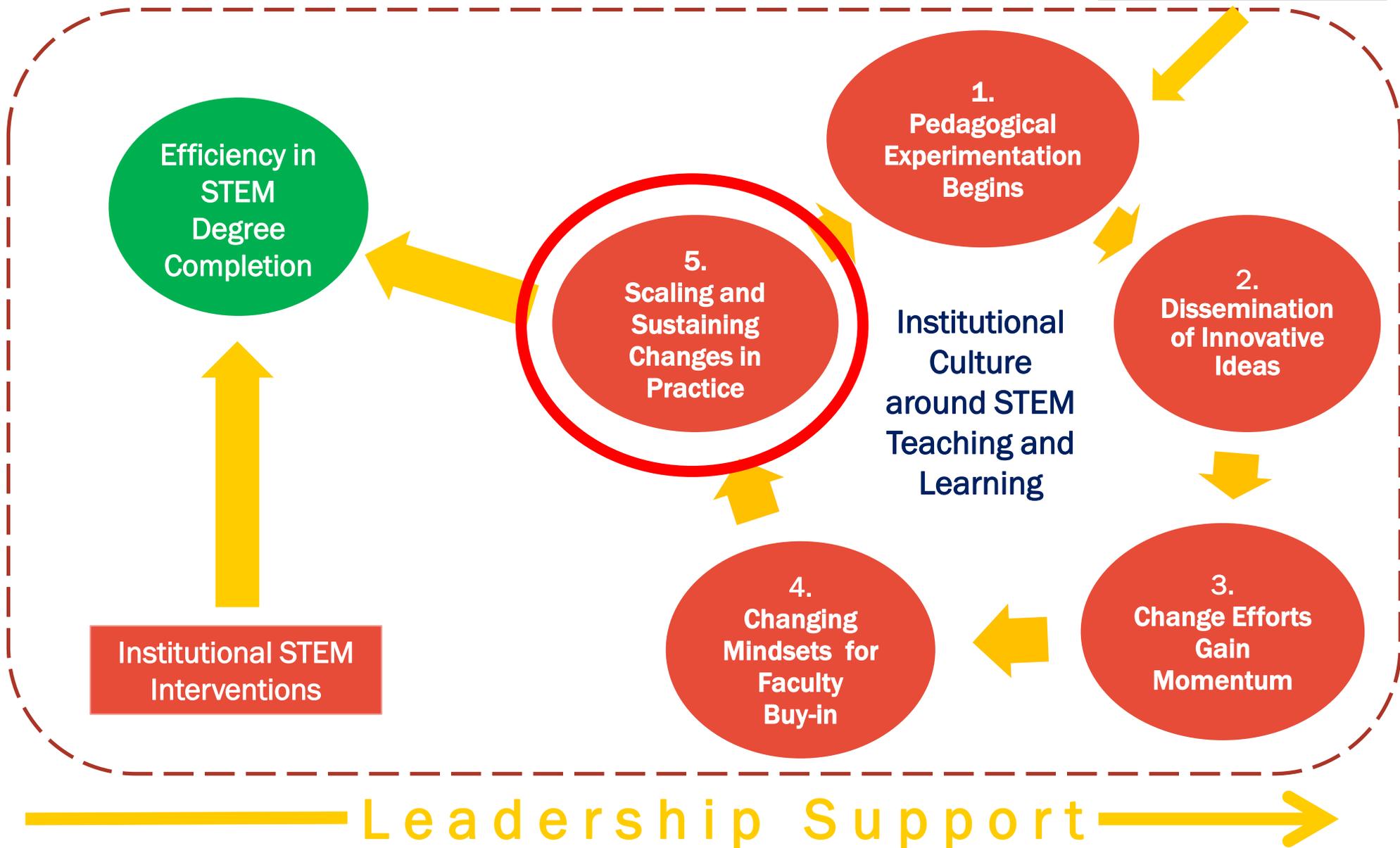
## Changing Mindsets for Faculty Buy-in

~ Professor in Biology and Director of Undergraduate Studies, Large Public R1 PWI

# Organizational Perspective for Changing Norms in STEM Teaching and Learning

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## Scaling and Sustaining Changes in Practice

We are in our third year now. We have an **apprentice mentor model** where we are intentionally looking at which classes we want to work on, and what **we settled on was all of our introductory chem, physics and biology courses**...what we do with the money we have been given, we incentivize a course release for the faculty member who says, “I want to learn how to do this but I don’t have time and I don’t know how.” **They get a mentor and they get a semester to not teach that course but to be part of someone else’s course and learn from that person. And then we can efficiently transfer some of the information, the same slides and technology can all be passed down.**

*~Teaching Associate Professor in Biology and Administrator, Large Public R1*

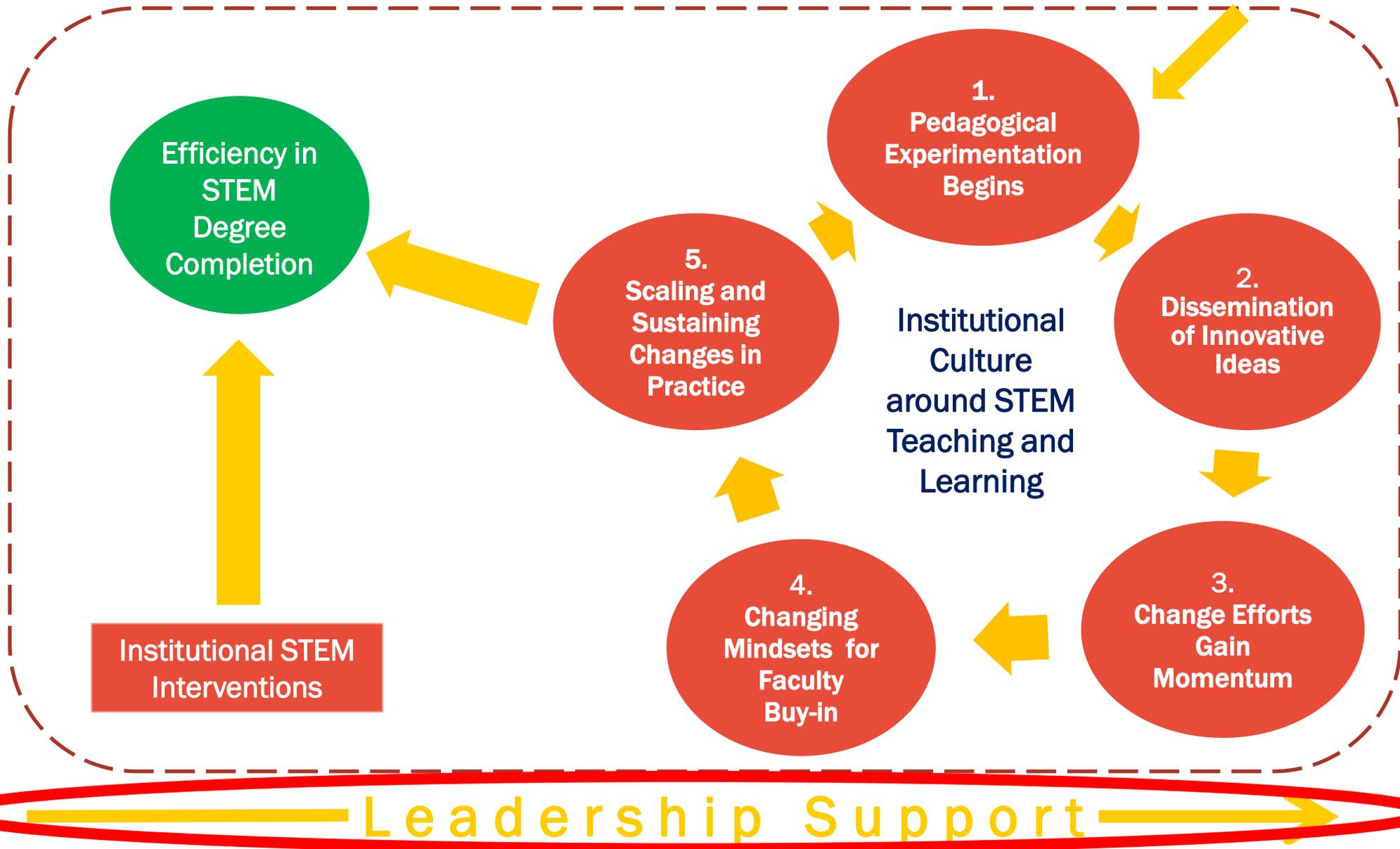
# Innovative Pedagogical Changes in the Classroom

- Some departments are making more strides than others in the use of innovative teaching techniques
- From lecture towards structured inquiry-based, active-learning classroom experiences
- In some cases the innovation in the classroom went beyond simply incorporating active learning technique and completely changing the classroom from a lecture format to a flipped or hybrid format – part online/part in classroom.
- There is a movement around accepting failure as a normal part of learning & having a growth mindset
- “High touch” culture for making contact with students falling behind in the classroom to convey concern for progress and to help students move forward

# Organizational Perspective for Changing Norms in STEM Teaching and Learning

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# Leadership Support

*You have to be in [the change process] for the long run. They take a while, but it isn't something that just happens with one person, but **it does require both commitment from the top down and excited ideas from the bottom up. The bottom up being faculty...** the people that are doing it... And at big public universities, people don't have a lot of extra time [to do new innovative things to change their teaching]... **So finding ways that you can do little things like extra support when they put a grant and you make those matching funds... That kind of recognition I think has a huge impact.** And then I think if you're going to get new faculty hires to actually care about it, allowing them to care about it and have that not be considered something that goes against them in tenure.*

~ Chancellor of University, Large Selective PWI

# Conclusion & Implications

- Substantial student interest in biological sciences
- Retention in a biology or biomedical career is a national priority
- What you do as individuals makes a difference (grassroots leadership)
- What you do *collectively* makes an even bigger difference

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