

*Spring 2025 IAMSE Webcast Audio Series*

***Reducing the Basic Sciences Curriculum:  
Ensuring Students are Adequately Prepared***

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# Disclosure

- No conflicts of interest

# Purpose

- Explore learning mechanisms and instructional approaches that will help you mitigate concerns about preparedness when ‘reducing basic science’
- Cross-cutting themes that can be applied even though schools differ in how the basic sciences are reduced/redistributed and differ in how preparation is conceived

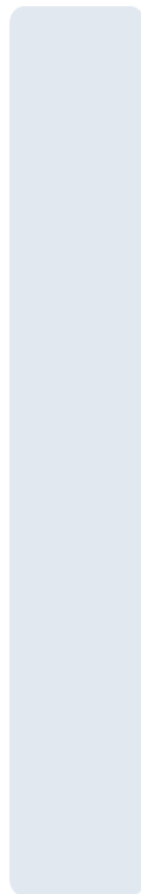
# Some Keys to Student Preparation in a Reduced Basic Science Curriculum

- Activating and building upon prior knowledge<sup>1</sup>
- Exposing student thinking and knowledge gaps<sup>2,3</sup>
- Stimulating effective learning strategy use<sup>4</sup>
- Organizing effective and timely instructional discourse in which teachers and learners meet<sup>5,6</sup>
- Driving learning forward through desirable difficulties and productive failure<sup>7,8,9</sup>
- Wraparound academic support<sup>10</sup>

Is your institution currently reducing or has it recently reduced the basic sciences in your curriculum?

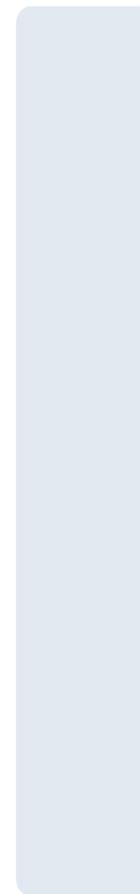


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Yes

0%



No

# What do we mean by 'reduced basic science'

- Early start to clerkships
- Reduce depth
- Integration
- Offloading
- Elimination
- Redistribution



Small is Beautiful

# Tensions and Contradictions: Less is More?

- Early start to clerkships
- Reduce depth
- Integration
- Offloading
- Elimination<sup>11</sup>
- Redistribution
- Increase opportunities to learn by doing
- Focus on “most important”
- No content without context<sup>12</sup>
- Reduce the “bloated” curriculum; can’t teach everything; promote critical thinking
- Learn at the right time

# Tensions and Contradictions: More is More?

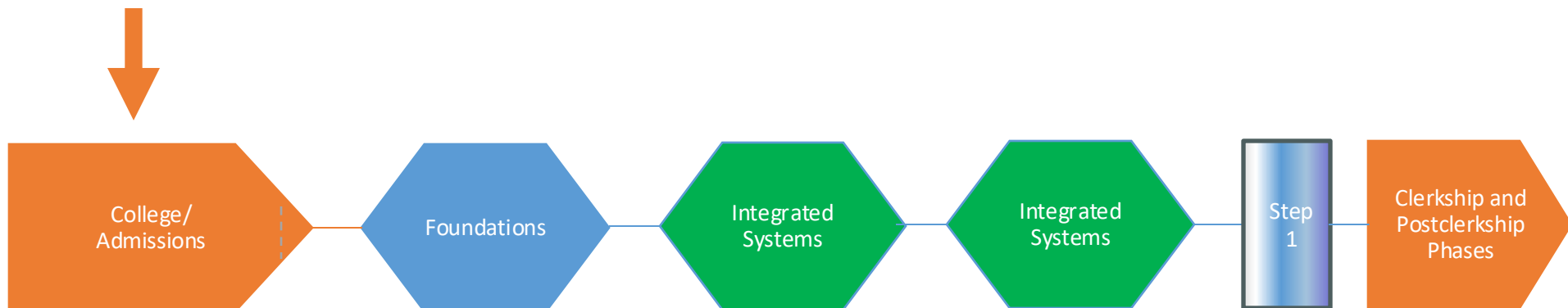
- Reduce all you want but Step 1 has not changed
- Disciplinary knowledge grows by leaps and bounds
- Multiple encounters with information better than fewer
- Prior knowledge matters; the rich get richer

# What do we mean by ‘adequate preparation’

- Prepared to pass tests?
- Sufficient background knowledge to succeed in our particular preclerkship and clerkship contexts?
- Ready to apply knowledge in clinical contexts?<sup>3</sup>
- Preparation for future learning?<sup>13,14</sup>

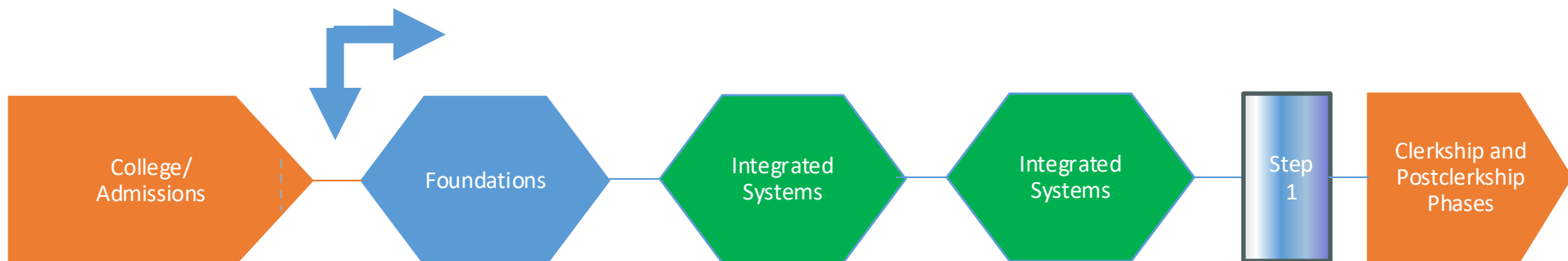
# Preparedness At Different Junctures

- One approach would be to bring students into medical school 'already prepared'
  - Change pre-med curriculum requirements further<sup>11</sup>
  - Change admissions approach to select students who can thrive in a shortened preclerkship phase
  - Concerns about how this would limit applicant pool



# Ensuring Preparedness

- Provide resources during pre-matriculation and first course to help at the course level
  - early testing
  - self-instruction
  - support



## Does your institution offer pre-matriculation materials for incoming students?

👍 0

Yes, pre-matriculation materials are required for all students

0%

Yes, pre-matriculation materials are required for select students

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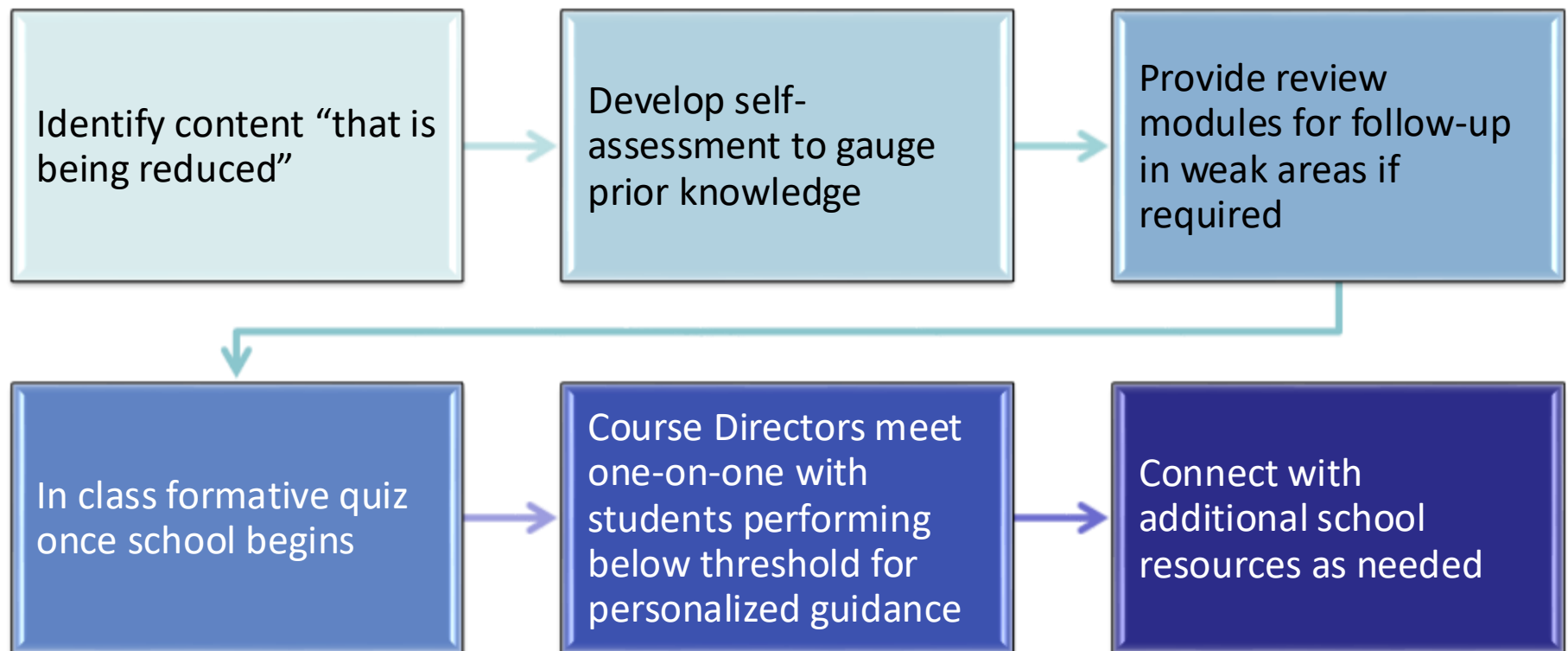
Yes, pre-matriculation materials are provided but are optional

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No pre-matriculation work is not offered

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## Our approach



## Rationale for using pre-matriculation modules and formative pre-tests

### 1. Activating Prior Knowledge & Identify Gaps

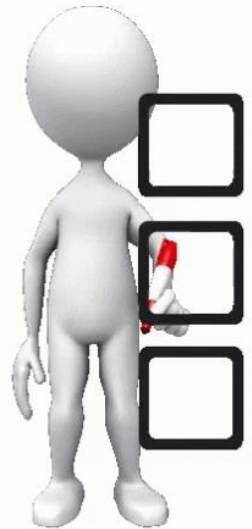
- Reinforce foundational concepts and identify knowledge gaps for targeted review
- Highlight how basic science principles apply in clinical practice

### 2. Connecting Students with School Resources

- Identify students who may benefit from early support
- Guide students to institutional resources

### 3. Enhancing Metacognition & Self-Directed Learning

- Help students assess their own strengths and weaknesses
- Build confidence and reduce anxiety through low-stakes test practice



# What we did

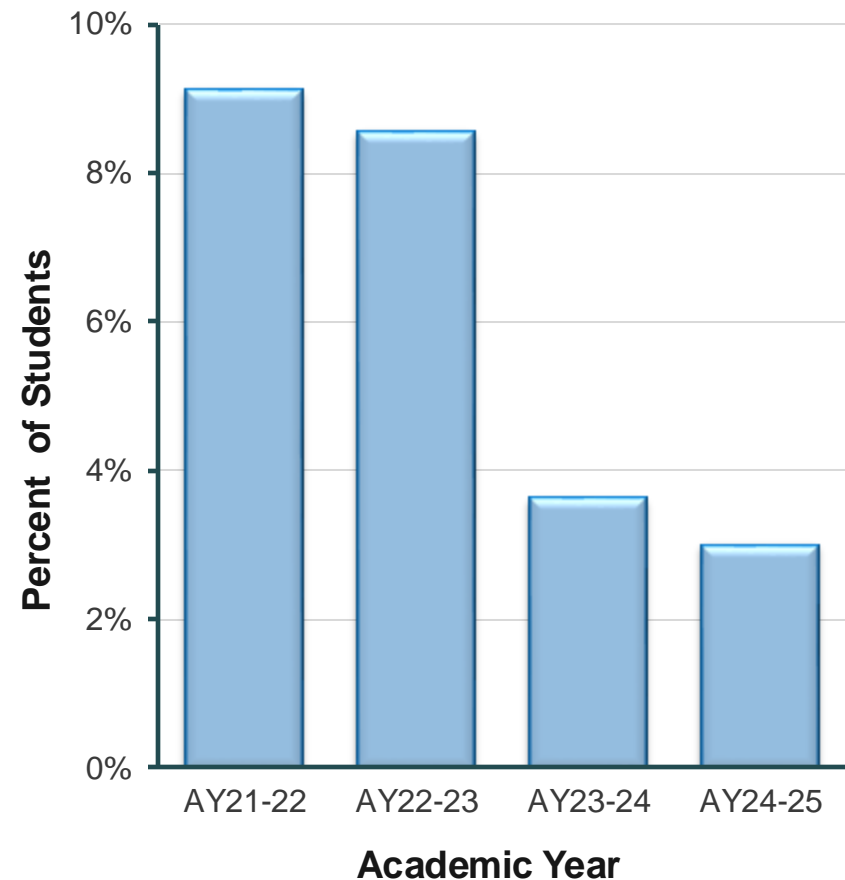
1. Remove specific basic biochemistry topics from preclerkship curriculum that is assessed on the MCAT
  - Amino Acids & Proteins
  - pH in Biochemistry: Principles and Applications
  - Enzyme Structure & Function
  - Enzyme Kinetics
2. Provide pre-matriculation module comprised of self-assessment quiz & review materials
  - Score  $\geq 80\%$   $\rightarrow$  No further action required
  - Score  $< 80\%$   $\rightarrow$  Review materials & retake quiz
3. Students informed that there will be a formative in-class quiz on the same topics
4. In-class Formative Assessment: Short 45-minute quiz at the start of preclerkship curriculum
5. Students scoring below threshold met with course directors for individualized support and introduced to available institutional resources:
  - Learning Specialists with expertise in test-taking strategies and effective study habits
  - Support through the Student Affairs Office
  - Access to group and one-on-one tutoring program
  - Office hours with course directors for additional faculty support

# What we found

Following introduction of modules:

- Percent of students not meeting threshold for first Course Exam reduced from an average of 8.8% to 3.3%

**Trends in Student Performance:**  
Percent of students scoring below passing threshold



## **Things we were wary about:**

1. Encroachment on students' summer
2. Possible stigma associated earlier identification
3. Dangers of early screening

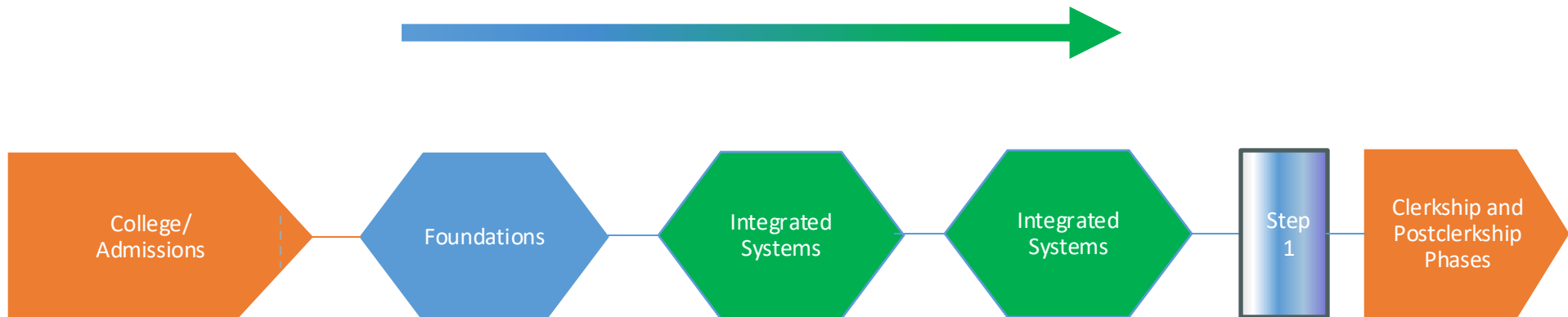
## Why we think it worked for us

### Proactive approach

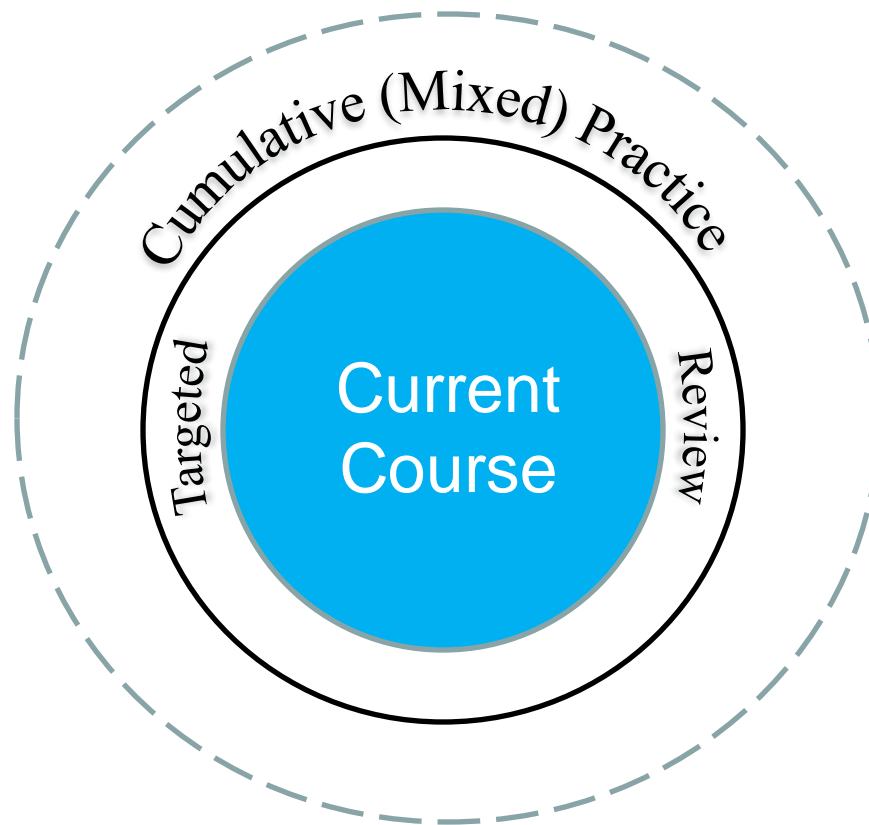
- Created a supportive and reflective learning environment
- Facilitated earlier adjustment to study strategies
- Encouraged timely use of available resources

# Ensuring Preparedness

- Across Courses

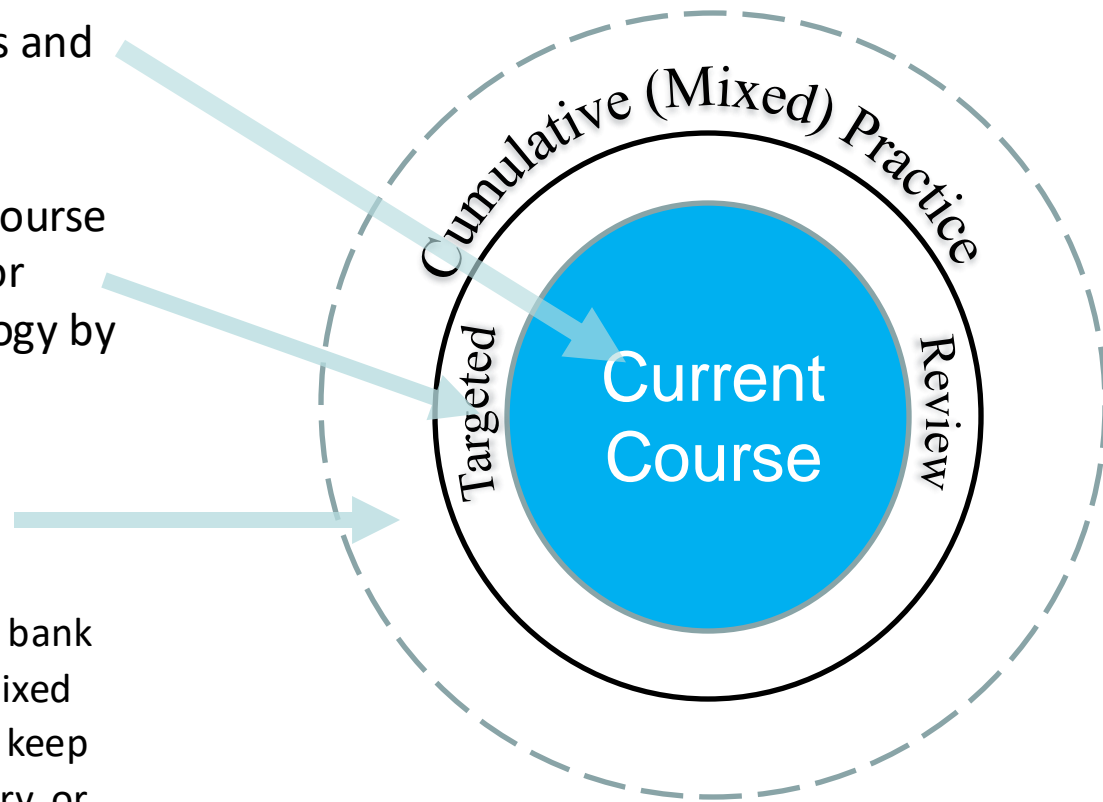


# Spheres of Student Activity



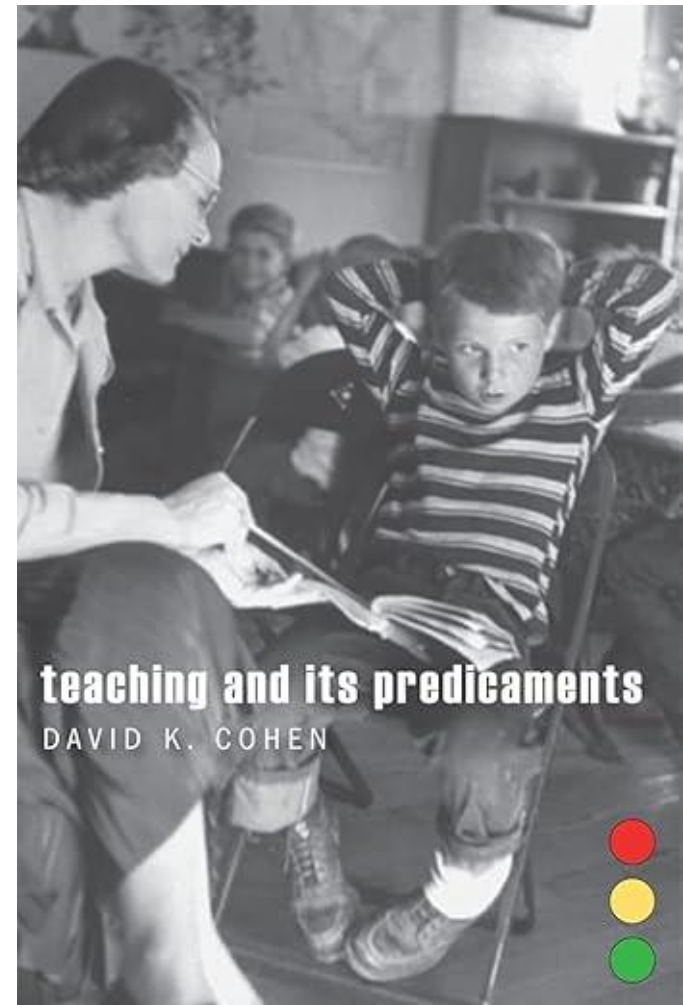
# Activity in All Three Circles As They Are Able

- Develop a deep understanding of new material in conjunction with questions and review resources.
- Target relevant material from earlier course (e.g., anatomy in Cardio/Pulm/Renal or relevant microbiology and pharmacology by system).
- Devote time to spaced practice with material from prior courses.
  - Example: independent use of a question bank to do a few system-specific questions, mixed system questions; utilizing flash cards to keep microbiology, pharmacology, biochemistry, or other topics fresh.



“Teaching and learning  
are sometimes connected,  
but often not”

Coverage is not enough



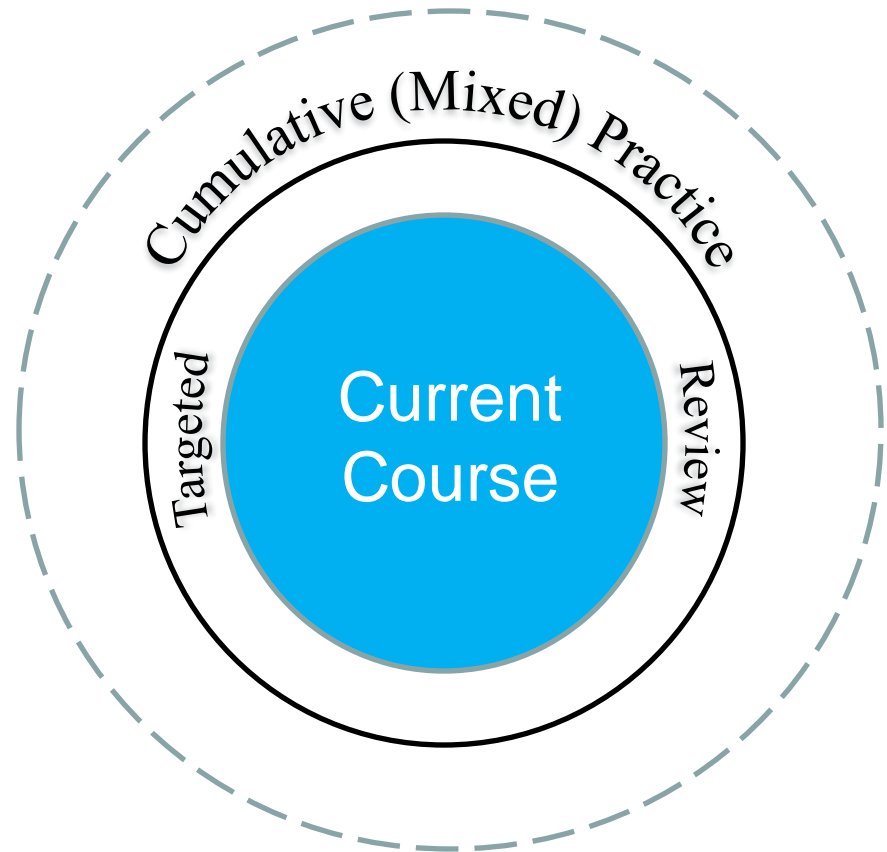
# Attentive Teaching: Session level

Expose student thinking and knowledge gaps; **engage** in constructive and interactive learning where teachers and learners meet; promote desirable difficulties, productive struggle and structure building<sup>15</sup>

- Weekly “Concept Reviews”: joint problem solving, worked examples, key misconceptions; developing conceptual frameworks to apply to medical problem solving
- Robust formative assessments; both concept reviews and formative can include prior topics
- Challenge is to help students become comfortable with initially poor performance
- Proper communication is necessary to challenge students with novel problems and subsequent goal setting

# Attentive Teaching: Session level

- Overcoming the reductive behavior of many students in the outer circle<sup>6,17</sup>
- Need exposure to how knowledge is achieved, why it might be true, and what broader domains of knowledge does it relate to<sup>6</sup>



# Across Courses: Cumulative Testing

*Primary goal is to stimulate learning, both before and after the exam<sup>16</sup>*

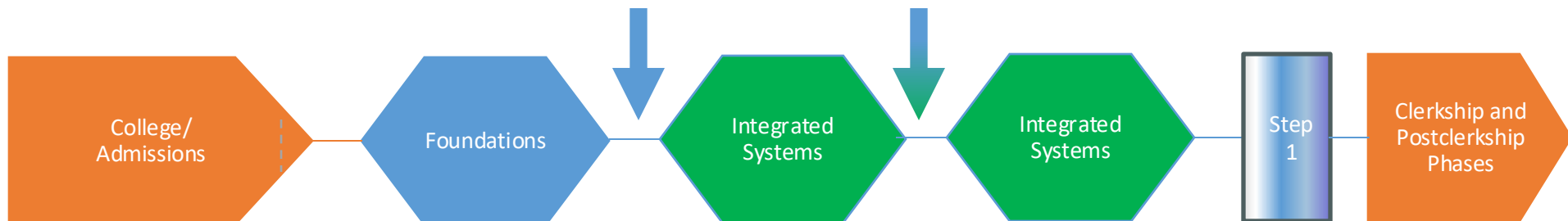
## Educational Effect

*Preparing for the test helps a student learn*



## Catalytic Effect

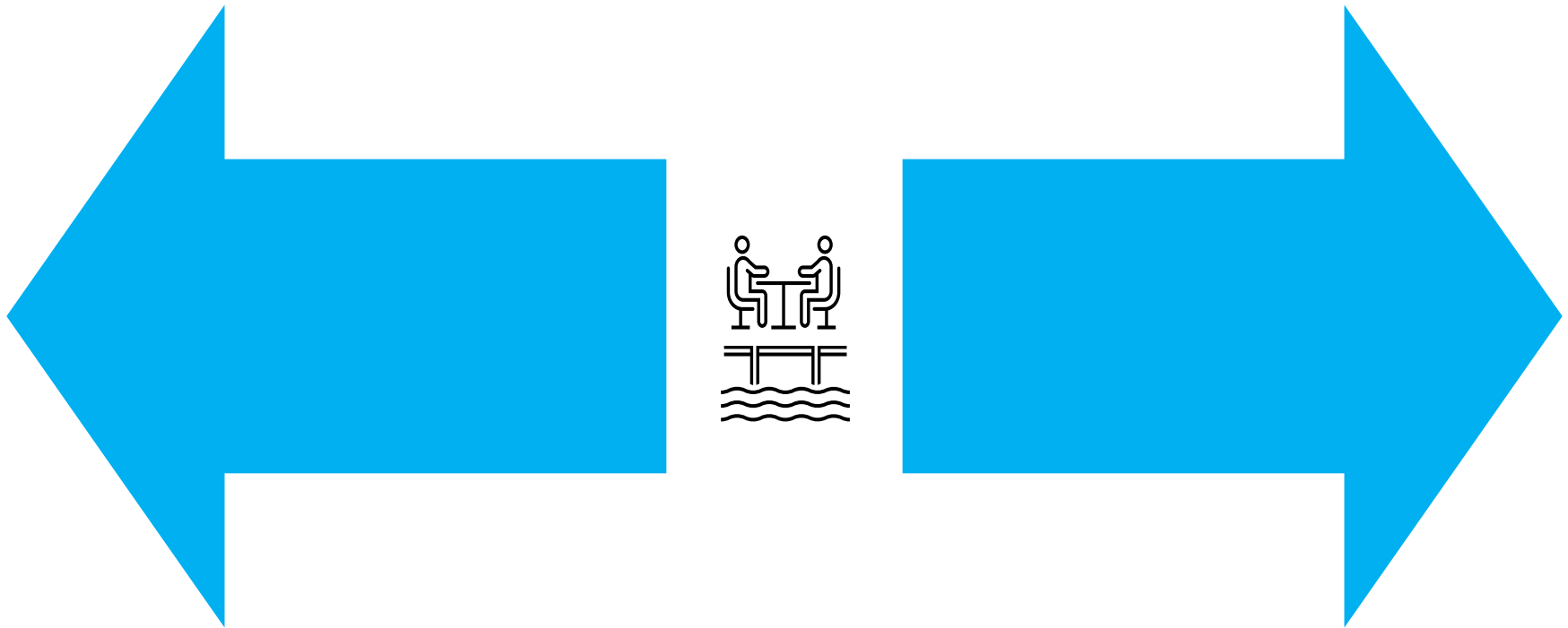
*"Provides results and feedback in a fashion that ...drives future learning forward"*



# Cumulative Exam Objectives

- Stimulate beneficial study practices (quizzing, cumulative review, spaced practice)
- Create an opportunity for consolidation of knowledge
- Provide feedback on strengths and weaknesses to guide study
- Catalyze interventions for students who need academic support
- Additional purposes include
  - providing students with an authentic practice opportunity (experience with cumulative exam questions from the National Board of Medical Examiners)
  - providing faculty with feedback on topical areas where students as a whole may need revised or supplemental instruction

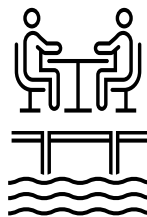
# Operating at Key Intersections and Gaps



# Operating at Key Intersections and Gaps

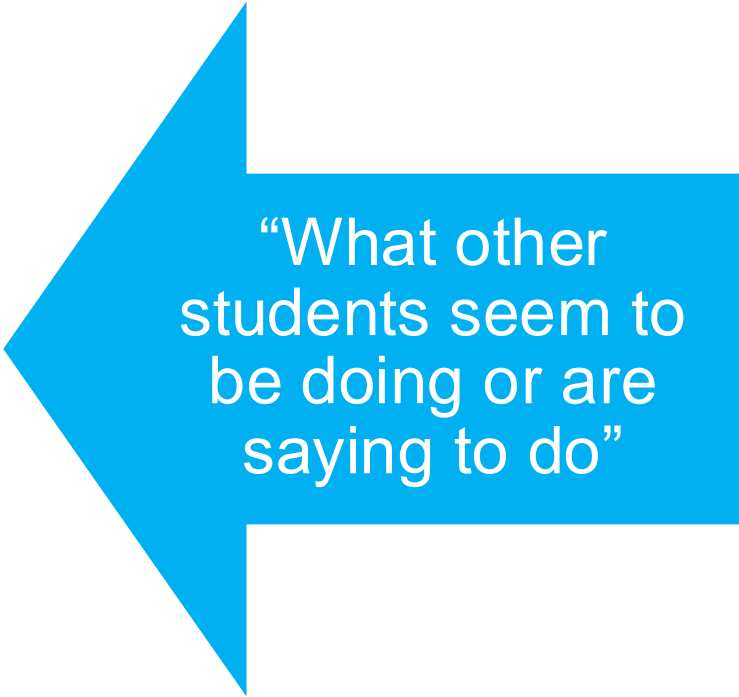


Planned  
Instruction &  
Assigned  
Resources

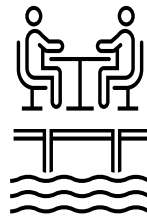


Self-Directed  
Learning and  
“Third Party”  
Resources

# Operating at Key Intersections and Gaps



“What other students seem to be doing or are saying to do”



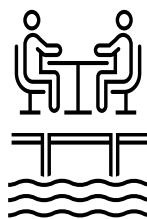
“What I think will work for me”

# Operating at Key Intersections and Gaps



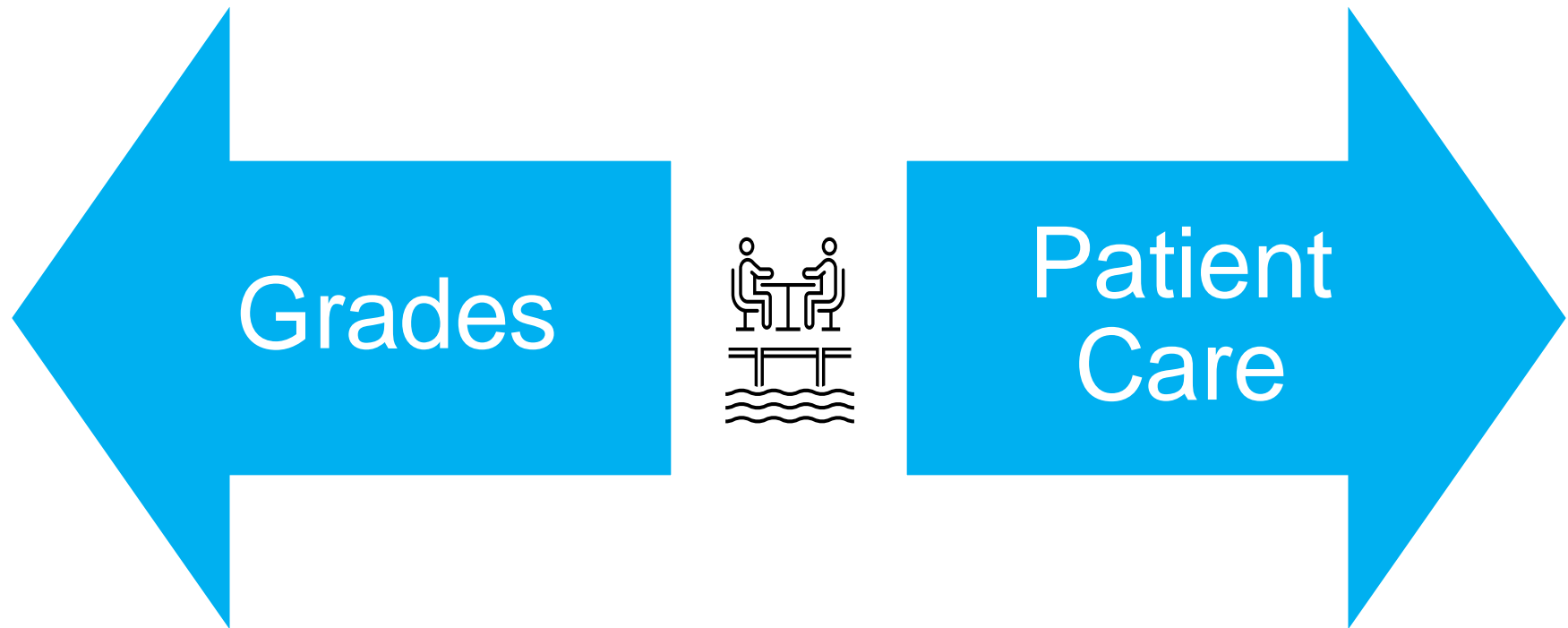
Short-Term  
Success

The diagram consists of two large blue arrows pointing in opposite directions, one to the left and one to the right. Between them is a small icon of two people sitting at a table. The left arrow contains the text 'Short-Term Success' and the right arrow contains the text 'Durable Knowledge and Skill'.



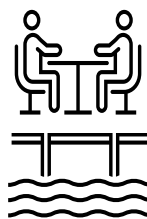
Durable  
Knowledge  
and Skill

# Operating at Key Intersections and Gaps



# Operating at Key Intersections and Gaps

“What I know I should  
be doing”  
(rationality, desire)



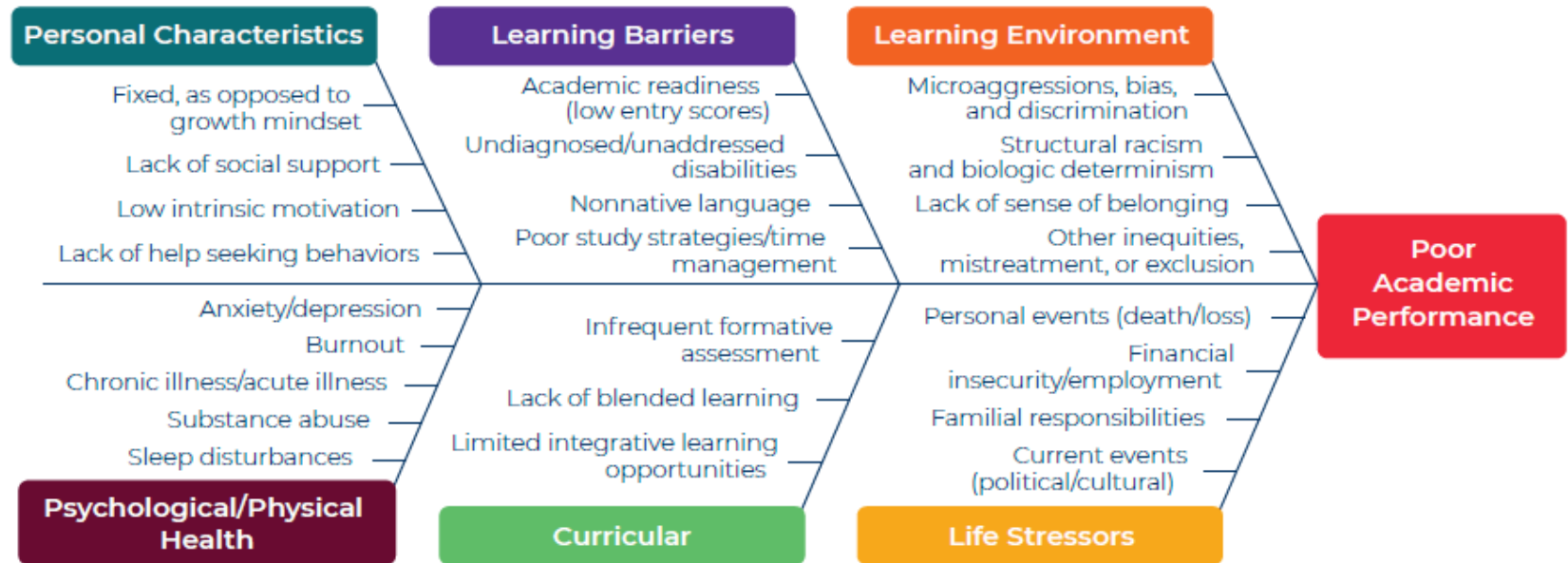
“What I end up doing”  
(self-doubt, low  
motivation, anxiety,  
circumstances, etc.)

# Special Insights From Talking To Students and Learning from their Performance

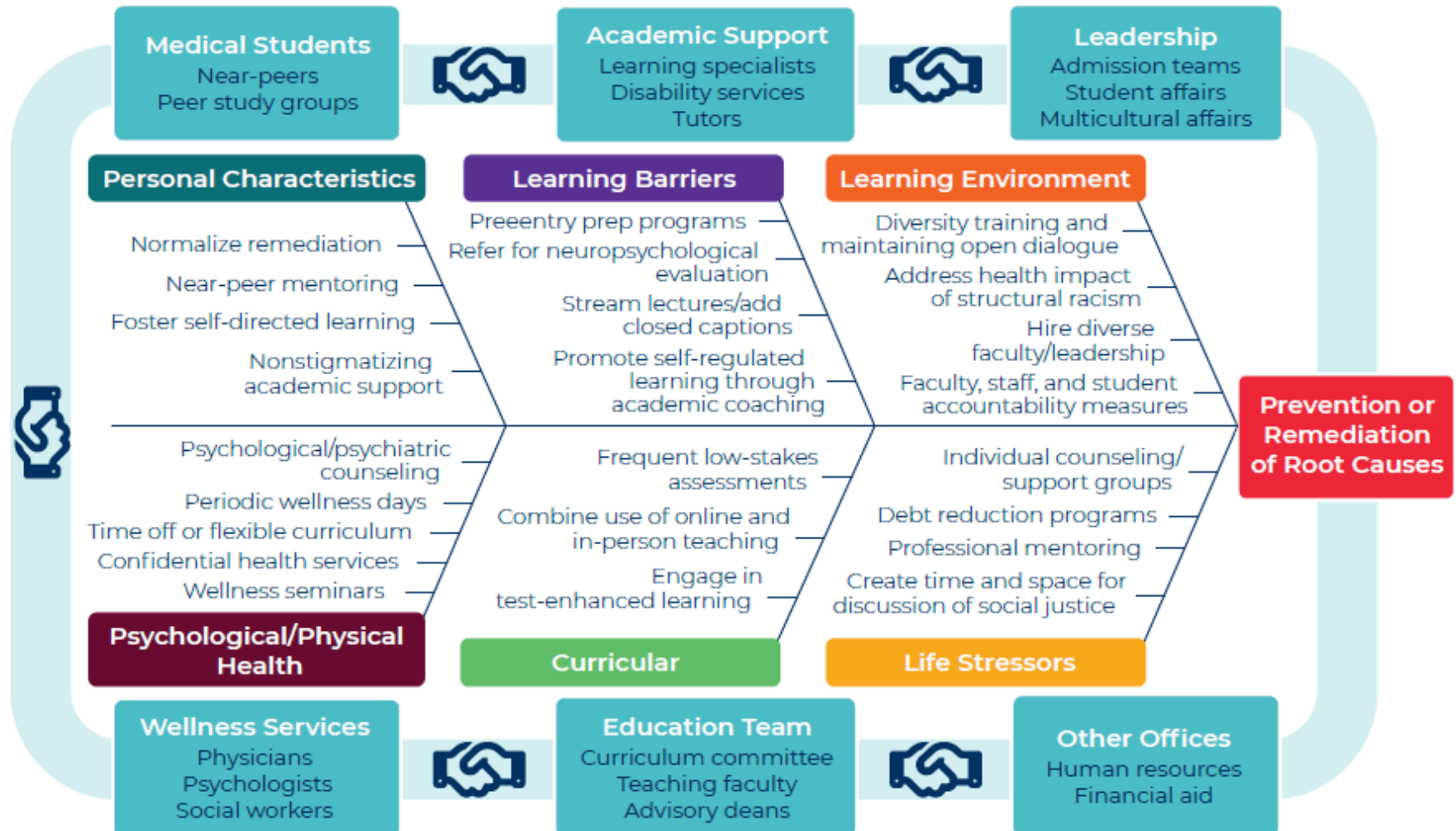
- See the fault lines in our curricular, instructional, and assessment practices and in the use of particular resources
- Hear common concerns expressed by students
- Combine evidence-based learning strategies with experience and knowledge of what works in our specific contexts
- Know how to help students overcome obstacles in our environments to learning



# Root Causes of Poor Academic Performance

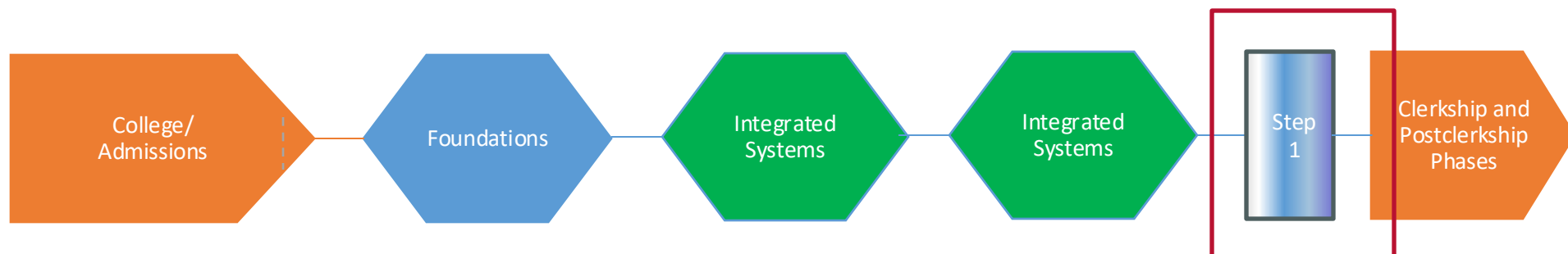


## Wraparound Support



# Ensuring Preparedness

- Transition to clerkships with “traditional” Step timing

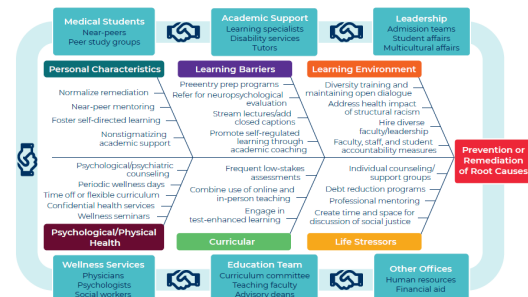
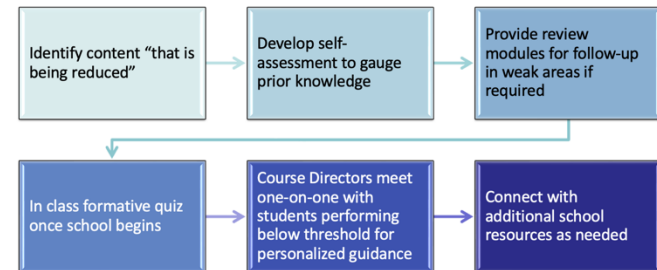


## Near-Peer Reviews for Those Struggling with Step 1

- Review sessions captured reasoning differences between better- and less-prepared students in stark relief
  - Tutors modeled how find simplest way to explain the constellation of evidence in a vignette and how to deal with uncertainty<sup>18</sup>
  - Struggling students often took complicated route to explain isolated facts in the vignette and ran from uncertainty

## Summary Keys to Student Preparation in a Reduced Basic Science Curriculum with Illustrations

- Activating and building upon prior knowledge<sup>1</sup>
- Exposing student thinking and knowledge gaps<sup>2,3</sup>
- Stimulating effective learning strategy use<sup>4</sup>
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# Discussion

