

Teaching Neurosciences Across the Education Continuum

Session Leads:

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Roy Strowd, MD, MS, MEd (rstrowd@wakehealth.edu)

Doris Kung, DO (kung@bcm.edu)

Galina Gheihman, MD (ggheihman@bwh.harvard.edu)

Clifford Saper, MD, PhD, FANA (csaper@bidmc.harvard.edu)

Neil Masangkay, MD, Tamara Kaplan, MD, & Dara Albert, DO [in absentia]



Disclosures

TM, DK, GG, and CS report no relevant disclosures.

Dr. Roy Strowd serves as consultant for Monteris Medical Inc, Novocure, Alexion, and receives an editorial stipend as Editor of *Neurology*[®]: *Education*. He has received research/grant support from the American Academy of Neurology, American Board of Psychiatry and Neurology, American Society for Clinical Oncology, and Jazz Pharmaceuticals, and has served as a paid lecturer for Kaplan, Inc, and receives royalties from Lecturio and Elsevier.

Objectives

- Reflect on successes and challenges in integrating fundamental neurosciences concepts along the continuum of medical education, from pre-clerkship to clerkship, GME, and CME
- Distinguish among innovative instructional methods, *including Team-Based Learning, Problem-Based Learning, and Peer Instruction*, and understand how to employ them to effectively teach basic neuroscience concepts
- Practice applying innovative instructional methods to integrate basic neurosciences along the continuum of medical education and receive expert feedback on session proposals

Introduction to Speakers



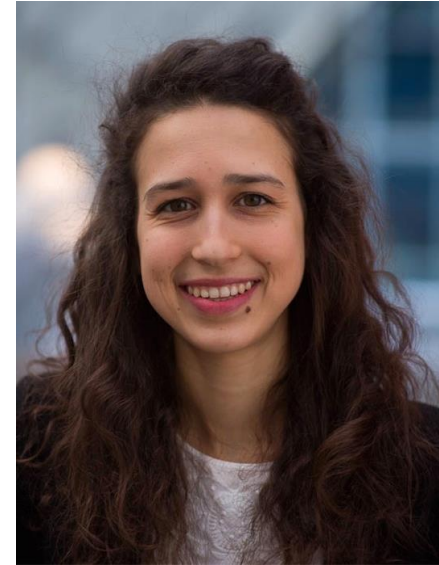
**Tracey A. Milligan,
MD, MS**



**Roy Strowd, MD,
MS, MEd**



Doris Kung, DO



**Galina Gheihman,
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**Clifford Saper,
MD, PhD**

Agenda

7:30 Welcome & Introduction

7:40 Think-Pair-Share (How have you seen neurosciences taught well?)

7:55 Introduction to Active Teaching Strategies

8:05 Group Activity: Your turn to design a session!

8:45 Present Back, Panel Feedback, & Discussion

9:20 Wrap-Up, Q&A

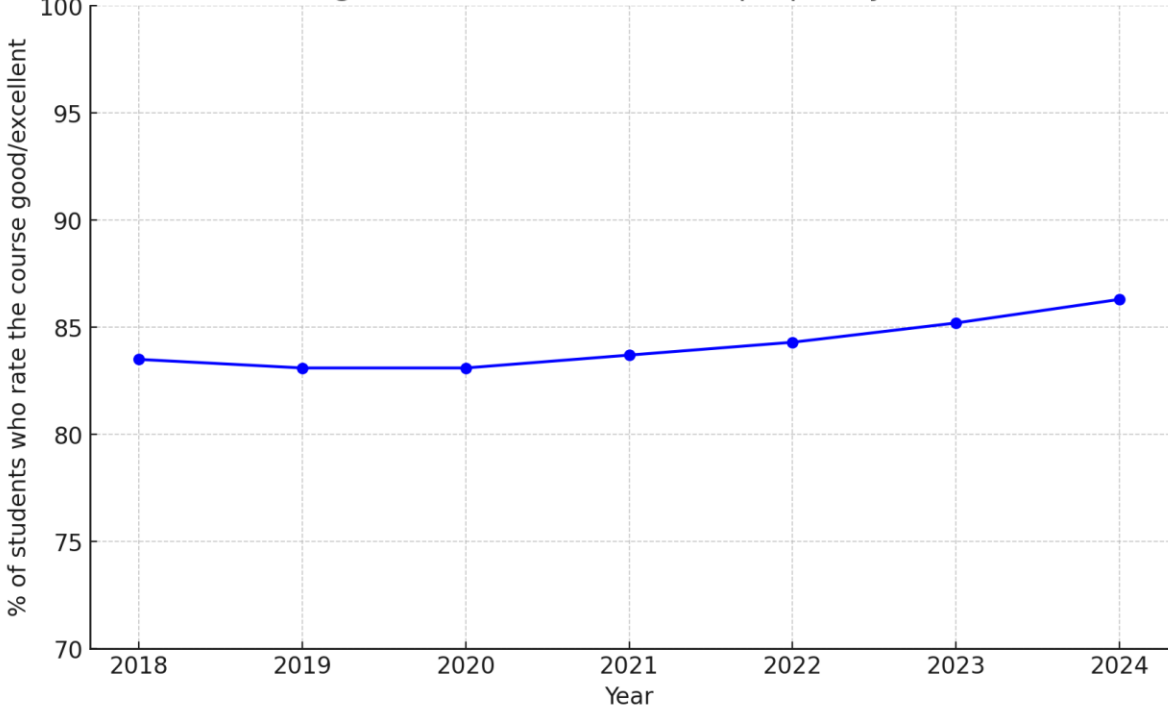
Why?

Section 1

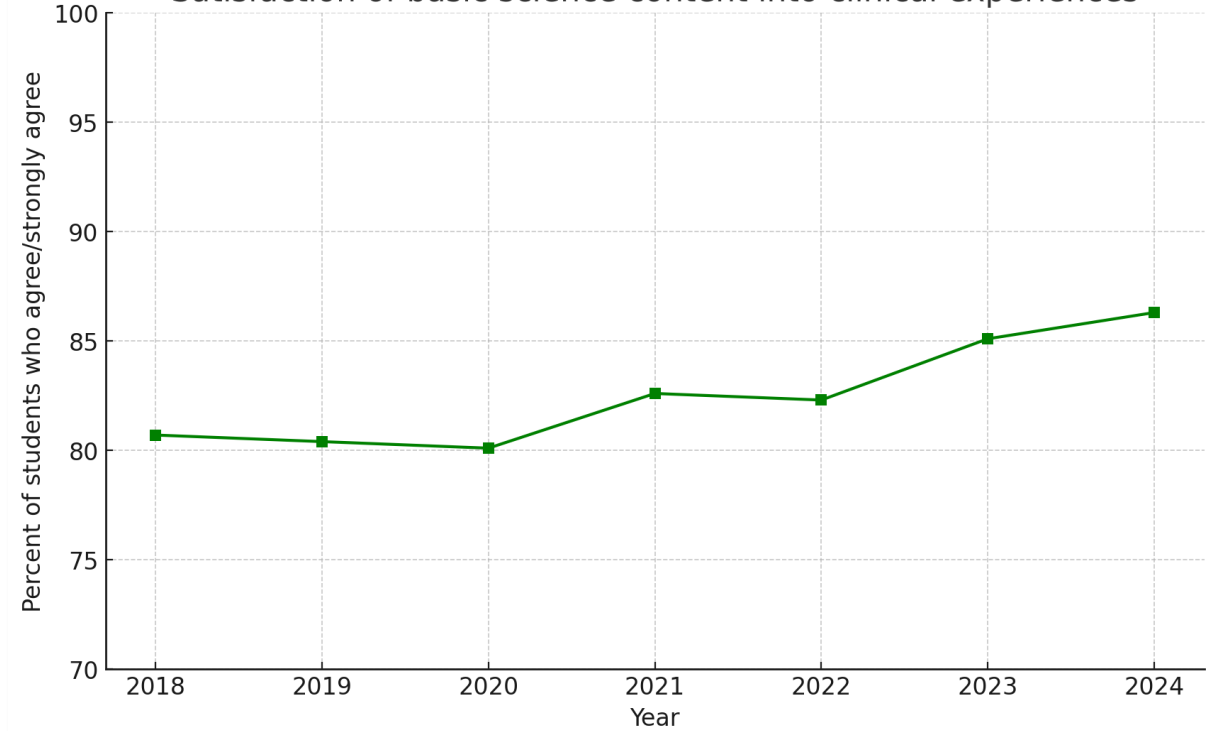
Evaluation of Education

2024 GQ Supplementary Benchmarking School Report

How well did teaching of the NEUROSCIENCES prepare you for clinical medicine



Satisfaction of basic science content into clinical experiences



Think-Pair-Share



- A collaborative teaching strategy; Lyman, F. (1981). The responsive classroom discussion: The inclusion of all students. In A. S. Anderson (Ed.), *Mainstreaming Digest* (pp. 109-113). University of Maryland Press.

What is an example of excellent neuroscience teaching you have seen?

- Share the specific context of the teaching (e.g., in the classroom, on the wards, in the clinic, elsewhere)
- What was the teaching method? Share the specifics of what was taught and how.
- Why do you think this teaching was effective?

What are some other effective methods you have encountered for teaching neurosciences?

 0

Nobody has responded yet.

Hang tight! Responses are coming in.

What challenges do you encounter when teaching neuroscience?

0

Nobody has responded yet.

Hang tight! Responses are coming in.

Question for the Panel:

- What strategies or suggestions do you have in facing these challenges?
- Provide an example of how you integrate the teaching of neuroscience effectively.

Introduction to Active Teaching Strategies

Doris Kung, DO



Interaction and Integration – Bringing Foundational & Clinical Sciences Together

Doris Kung

AUPN - September 14, 2024

NEAT

Why integrate the sciences?

- Adult learners learn best when it is meaningful to them
- Knowledge is best learned when the organization of the material matches how students will use that knowledge
- Transfer of information is best retained when students recognize how it compares to what they have experienced – using basic science concepts to elaborate on existing knowledge as they progress through clinical

Carnegie Report of 2010



INTEGRATE BASIC, CLINICAL,
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COMPETENCY BASED
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HABITS OF INQUIRY AND
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- Promotes Active involvement
- Increased attention and retainment
- Higher level of thinking
- Provide feedback to the teacher and the student in real-time
- Increased interaction improves the teacher-student relationship

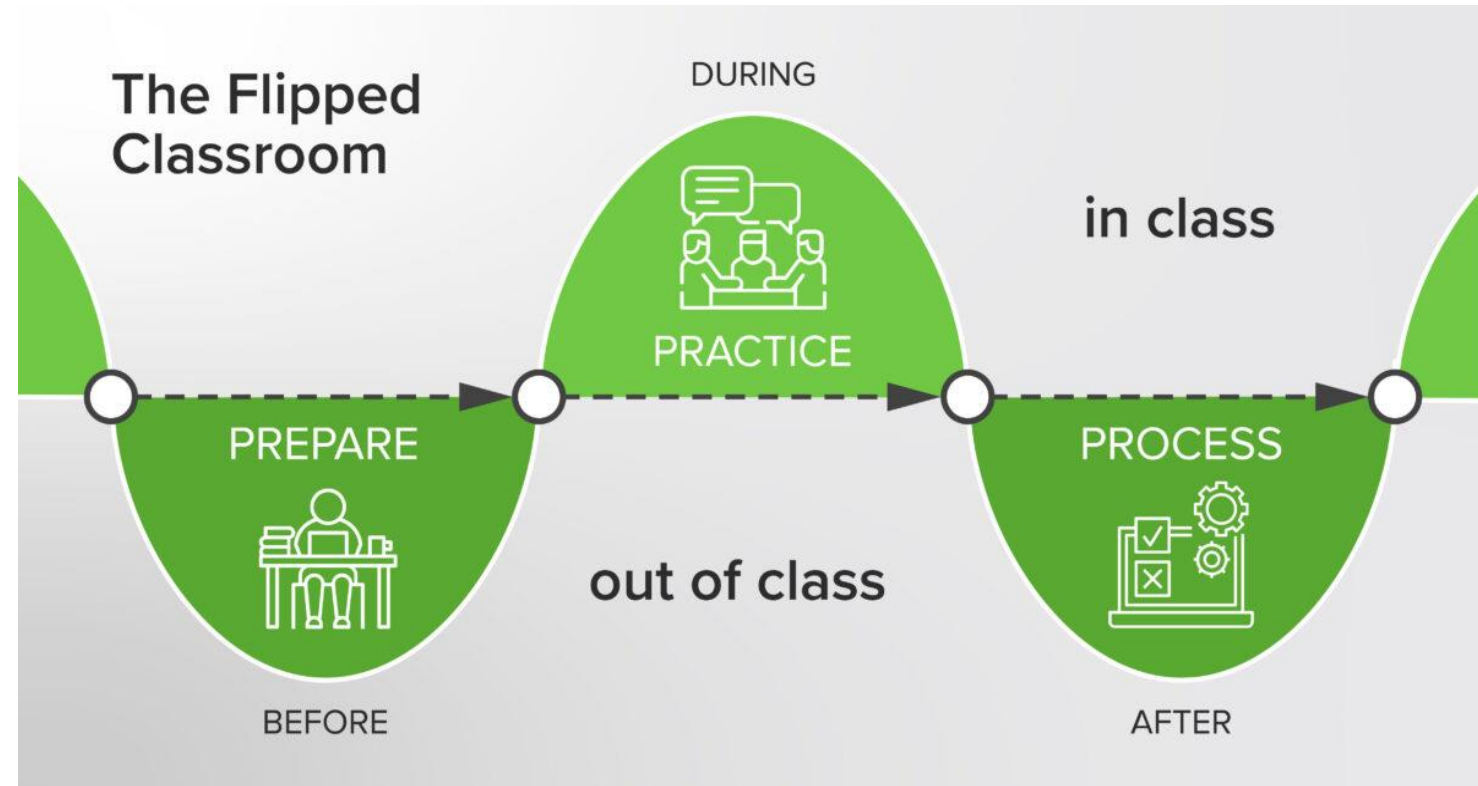


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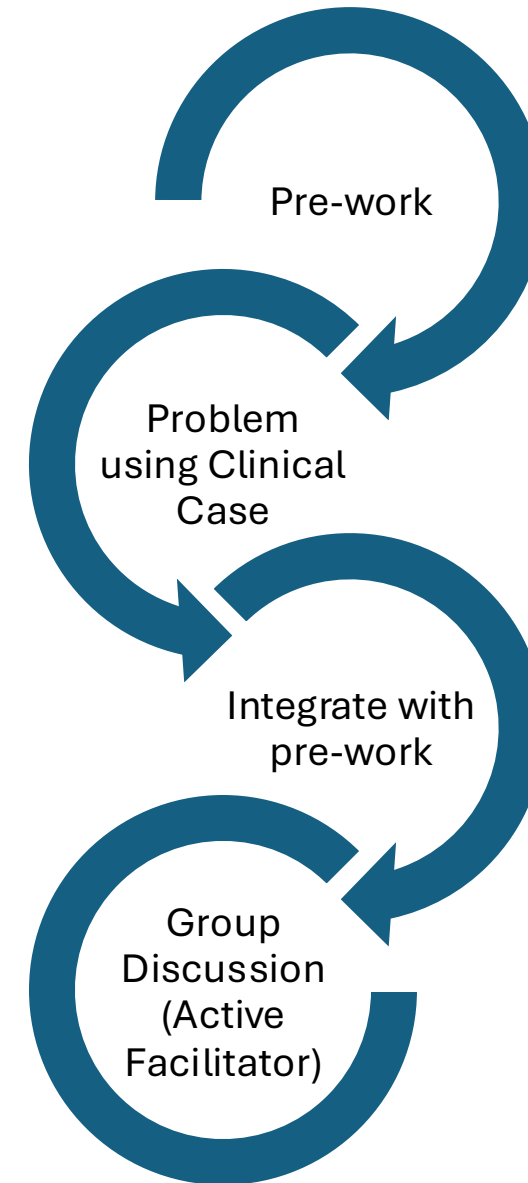
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- Assigned **out-of-classroom** activity
- **In-class** application activities
 - Think, Pair, Share
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 - PollEverywhere
 - Student presentations
- Encourages Higher-order thinking and problem solving
- In-class activities should reinforce key objectives, not just add more content

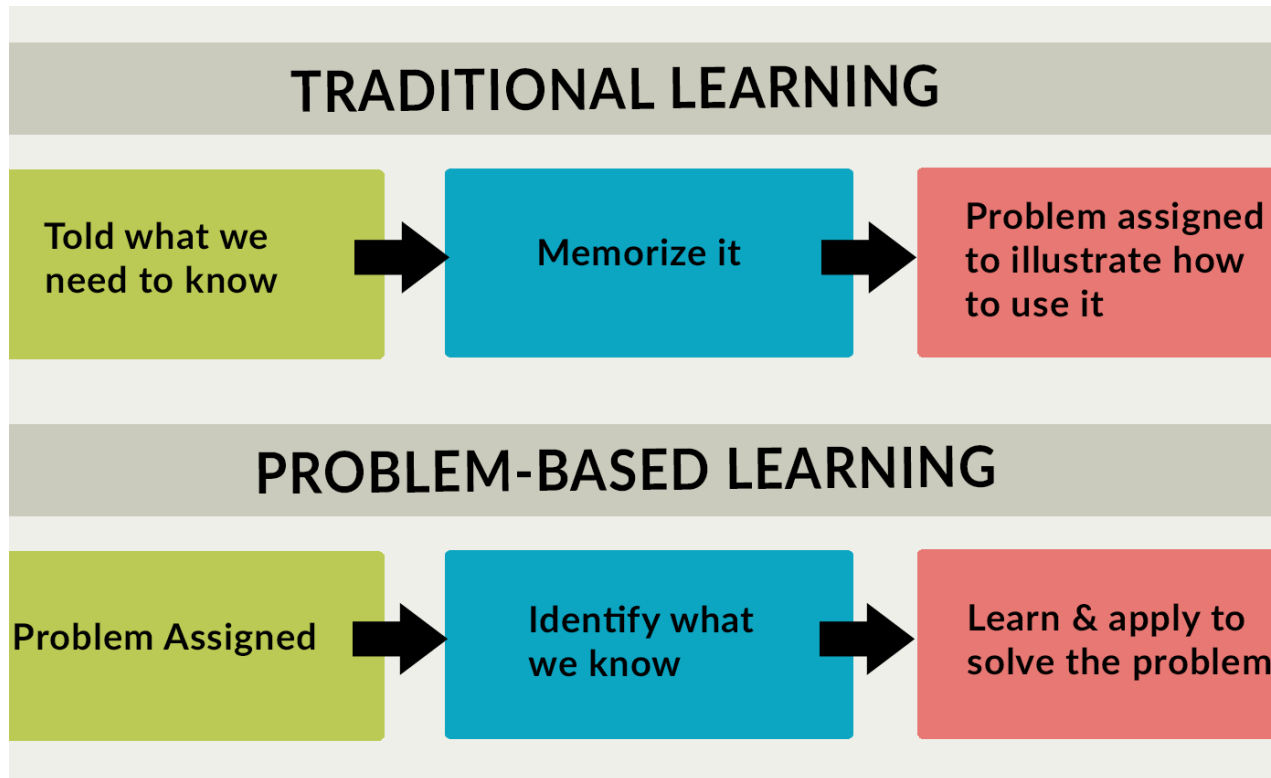


Case Based Learning

- Pre-work usually required
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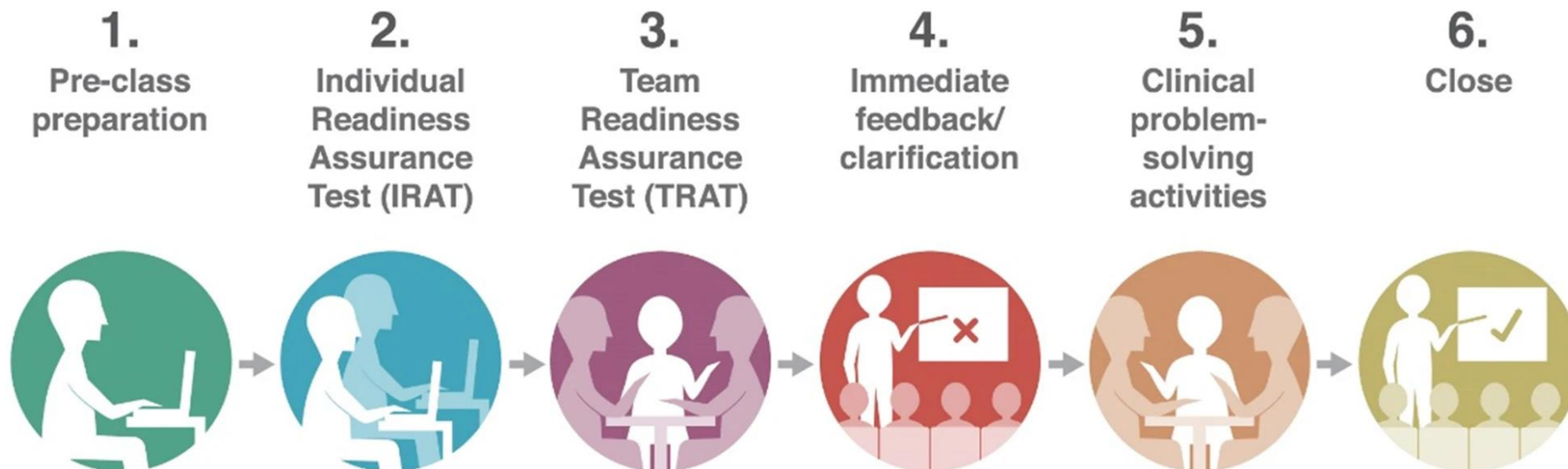
Problem Based Learning



- Problem introduced
- No pre-work required
- Learners identify the questions – faculty guides
- Go home to research those questions
- Bring it back and reflect as a group
- Focus: How to ask questions and critically analyze problems

Team Based Learning

- Pre-work is assessed via Individual Readiness Assurance Test (IRAT)
- In-class work is done in teams with a Team Readiness Assurance Test (TRAT) with feedback
- Application exercise follows to enhance critical thinking



Interactive methods in didactics

- Think-Pair-Share
- Brainstorming
- Concept mapping
- Role-Playing
- Gamification
- Peer instruction
- Improv
- Audience Response Systems/PollEverywhere

Comparisons

	Lectures	CBL	PBL	TBL
Key features	<ul style="list-style-type: none"> Objectives and content are provided No advance preparation necessary for student 	<ul style="list-style-type: none"> Content is assigned prior to class In-class time dedicated to applying knowledge to a clinical case 	<ul style="list-style-type: none"> Student-directed learning applied to real-world problems Open inquiry – students generate questions 	<ul style="list-style-type: none"> Instructor-directed content applied to real-world problems Collaborative learning
Instructor role	Prepares content for delivery	Assigns pre-work and facilitates in-class activity	Guides conversation as needed	Prepares homework, provides feedback after readiness assurance tests, and facilitates application exercises
Student role	Passive learner	<ul style="list-style-type: none"> Completes pre-work Participates in class activity 	<ul style="list-style-type: none"> Asks their own questions and creates learning objectives with guidance Returns to small group with answers after individual work 	<ul style="list-style-type: none"> Individual Readiness Assurance Test (pre-work) Team Readiness Assurance Test (in-class) Work in teams on application exercises
Pros	<ul style="list-style-type: none"> Learners can obtain much information in a short time Can accommodate large class sizes 	<ul style="list-style-type: none"> Learners apply their knowledge Learners focus on learning outcomes 	<ul style="list-style-type: none"> Encourages students to engage in the material Allows students to find the answers 	<ul style="list-style-type: none"> Immediate feedback provided Can be done in large classroom settings Facilitators can have meaningful discussions with learners
Cons	<ul style="list-style-type: none"> Learner participation and retention may be limited 	<ul style="list-style-type: none"> Instructor must prepare pre-work and in-class activities 	<ul style="list-style-type: none"> Multiple small groups and facilitators are needed Instructor must develop the activities 	<ul style="list-style-type: none"> Instructor must develop pre-work, tests, and in-class activities Individual grading may be difficult to assess Time in class may be long
Outcomes	<ul style="list-style-type: none"> Content acquisition Conceptual understanding 	<ul style="list-style-type: none"> Content acquisition Critical thinking Problem solving 	<ul style="list-style-type: none"> Content acquisition Critical thinking Inquiry Self-directed learning 	<ul style="list-style-type: none"> Content acquisition Critical thinking Communication and teamwork
Tips & Tricks	<ul style="list-style-type: none"> Useful for large audiences Adding interactive features can increase student engagement Examples: Think-pair-share; role play, audience response system 	<ul style="list-style-type: none"> Useful when clinical and basic science material is integrated Creating cases with a clinician and a basic scientist helps create a rich realistic case Example: Comprehensive Integrated Puzzles 	<ul style="list-style-type: none"> Useful when covering a broad set of objectives (e.g. basic science to health systems science topics) Facilitators may not need subject expertise 	<ul style="list-style-type: none"> Useful method to ensure accountability and participation Once TBL session is created there is less preparation with each iteration Modified TBL models exist

Now think about a topic you teach...

- Application time!
- Dr. Galina Gheihman will introduce you to the next activity

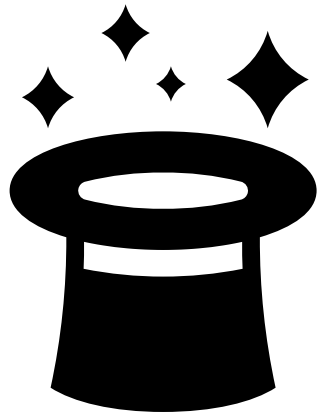


Group Activity: Your turn to design a session!

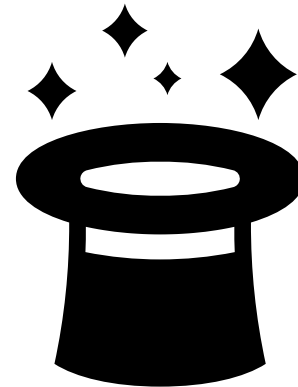
Galina Gheihman, MD

Instructions

1. Create groups of 5-6 individuals with those sitting nearby.
2. Select a group representative for the random drawing.



Choose a Topic



Choose a Learner Group

3. Complete the worksheet as a team to design a session (30 min).

Worksheet: Educational Design Roadmap

Topic	Learner Group
Gap / Needs (Specific to topic or learner group)	<i>What is the basic neuroscience principle you are teaching?</i>

Worksheet: Educational Design Roadmap

<p>Session Goal & Objectives</p>	<p><i>Goal:</i> Overall vision for the session</p> <p><i>Objectives:</i> Specific actions taken to achieve the goal</p>
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Worksheet: Educational Design Roadmap

Teaching &
Learning
Strategies
(Jot down
ideas about
possible
cases,
questions,
activities, etc.)

What active learning method could be a good fit for this session?

[\(See page 2 for a summary chart!\)](#)

Worksheet: Educational Design Roadmap

Potential Pitfalls or Challenges	Possible Solutions
1.	
2.	
3.	

Worksheet: Educational Design Roadmap

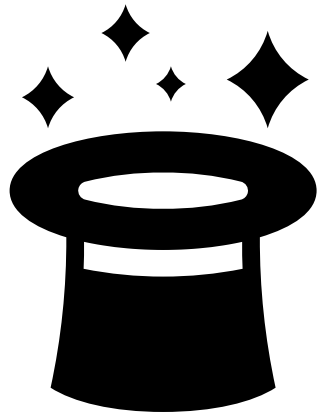
Session
Evaluation

Learner Assessment

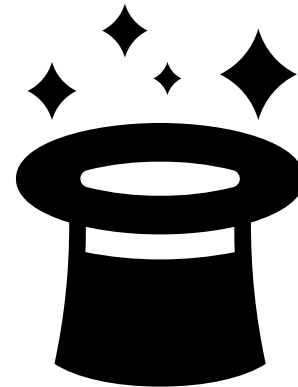
Session Assessment

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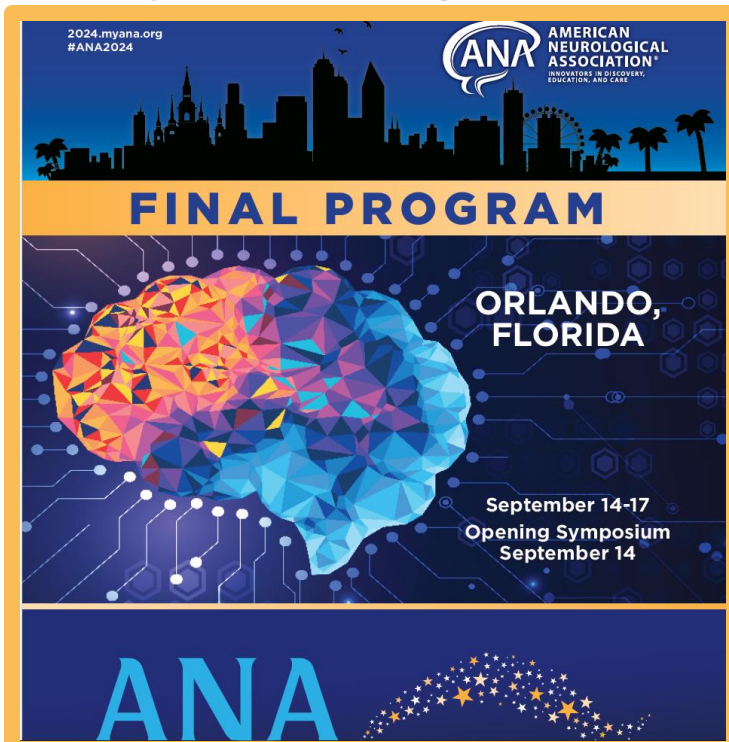


Present-Back & Panel Feedback



Wrap-Up and Next Steps

Teaching Neurosciences Across the Education Continuum- A new way of experiencing the ANA Annual Meeting!



Comparison of Active Learning Strategies

Strategy	Lectures	CBL	PBL	TBL
Key features	<ul style="list-style-type: none"> Objectives and content are provided No advance preparation necessary for student 	<ul style="list-style-type: none"> Content assigned prior to class In-class time dedicated to applying knowledge to a clinical case 	<ul style="list-style-type: none"> Student-directed learning applied to real-world problems Open inquiry—students generate questions 	<ul style="list-style-type: none"> Instructor-directed content applied to real-world problems Collaborative learning
Instructor role	<ul style="list-style-type: none"> Prepares content for delivery 	<ul style="list-style-type: none"> Assigns pre-work and facilitates in-class activity 	<ul style="list-style-type: none"> Guides conversation as needed 	<ul style="list-style-type: none"> Prepares homework, provides feedback after readiness assurance tests, and facilitates application exercises
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Strategy Pros	<ul style="list-style-type: none"> Learners can obtain much information in a short time Can accommodate large class sizes 	<ul style="list-style-type: none"> Learners apply their knowledge Learners focus on learning outcomes 	<ul style="list-style-type: none"> Encourages students to engage in the material Allows students to find the answers 	<ul style="list-style-type: none"> Immediate feedback provided Can be done in large classroom settings Facilitators can have meaningful discussions with learners
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ChatGPT 4o



I am leading a session on active teaching strategies to teach neuroscience in medical school, neurology residency and CME and want to end by having participants take what they have learned about methods to do this teaching with active learning strategies in this table and then apply it to the neuroscience content at the meeting. I will provide the content in my next entry. Provide information that I can specifically challenge and encourage the audience in using what they learned as they go through the session and think about teaching:

Tips from ChatGPT

- **Lectures:**

- *Example:* During a session like "The Dawn of Gene Therapy in ALS," ask: "How can you integrate think-pair-share into a lecture on RNA-targeted therapy for ALS to promote student reflection and immediate application of the material?"
- Encourage participants to think about how they might use an audience response system to test understanding of the genetic mechanisms of ALS as part of the lecture format.

- **Case-Based Learning (CBL):**

- *Example:* In the session on "C9orf72 ALS/FTD: Challenges and New Opportunities," ask: "What case scenarios can you create that integrate the knowledge of molecular mechanisms and the outcomes of previous drug trials?"
- Suggest developing a pre-class reading assignment on failed drug trials and using class time to apply that knowledge to patient cases involving genetic counseling or clinical decision-making.

- **Problem-Based Learning (PBL):**

- *Example:* For a topic like "Human Genetic Therapies for ALS," challenge the audience: "How would you create a student-driven problem that involves researching the current and future gene therapies for ALS, generating questions and identifying learning objectives for the class?"
- Push them to use the open inquiry model, allowing learners to explore the implications of FDA-approved treatments for SOD1 ALS in a PBL setting.

- **Team-Based Learning (TBL):**

- *Example:* For sessions like "Neuroinflammation and Neuroinfection," ask: "How can you structure a TBL session where learners individually and as a team evaluate emerging treatments for neuroinflammatory conditions?"
- Focus on using readiness assurance tests and team applications that explore clinical trial data and therapeutic developments from the session on genetic underpinnings of neuroinflammation.

More opportunities for some NEAT learning!

AAN Fall Conference

Saturday, October 26, 2024 | 1 – 2:30 PM PDT | Las Vegas/Online
C18: Neurology Education: Teaching on the Go: Effective Strategies for Busy Neurology Providers

NEAT Faculty Development Workshop

Tuesday, December 17, 2024 | 6 – 7 PM EST | Online via Zoom
Microteaching skills practice workshop with opportunity for peer feedback



Thank you!

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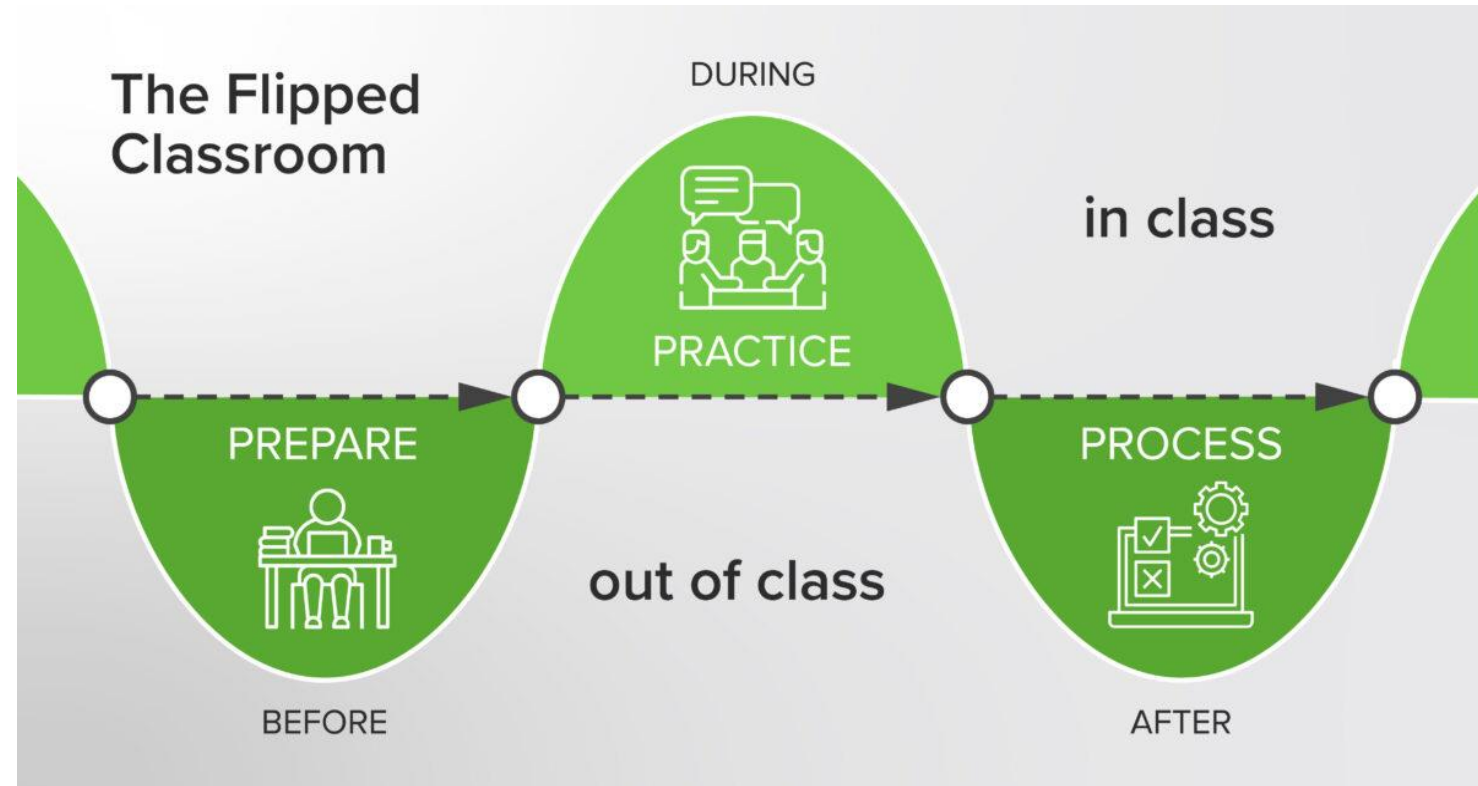


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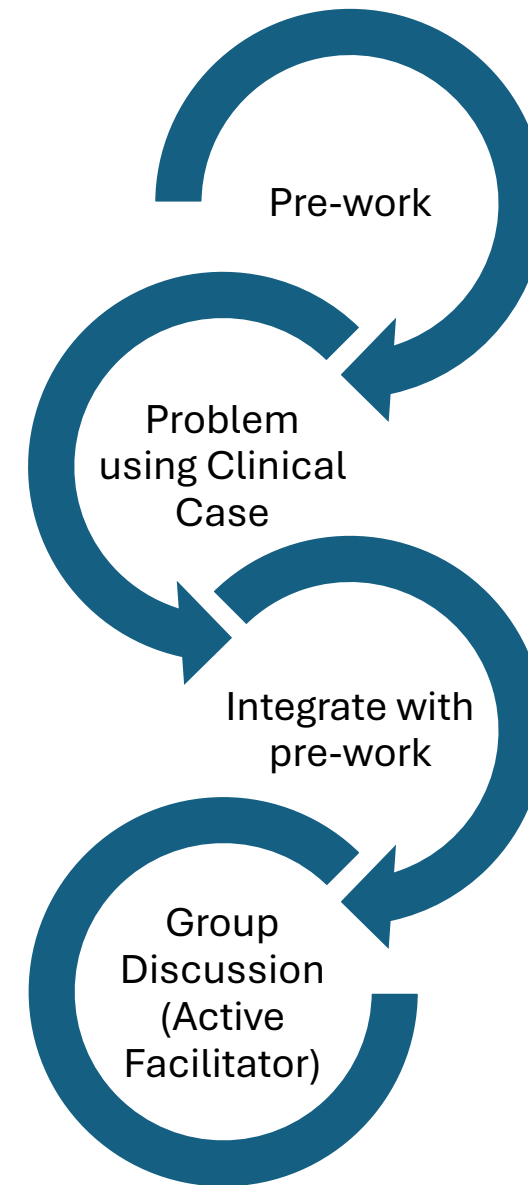
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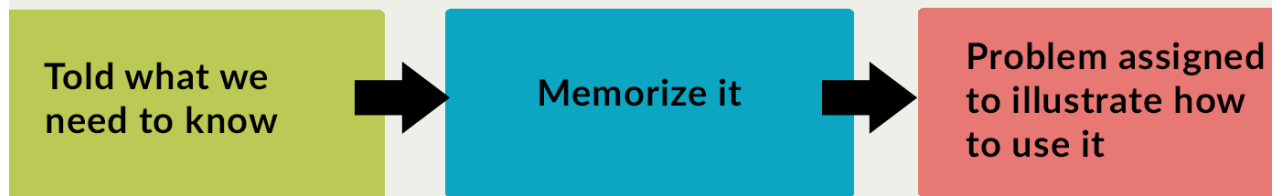
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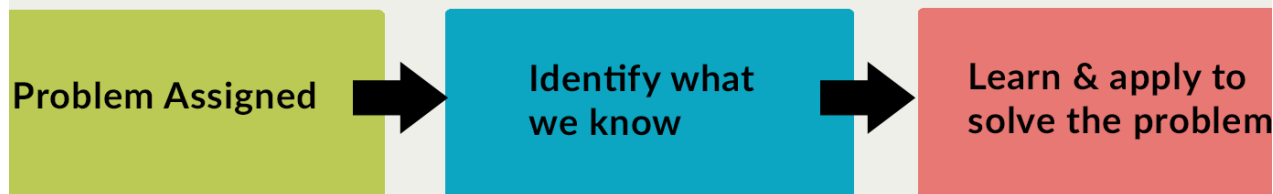


Problem Based Learning

TRADITIONAL LEARNING



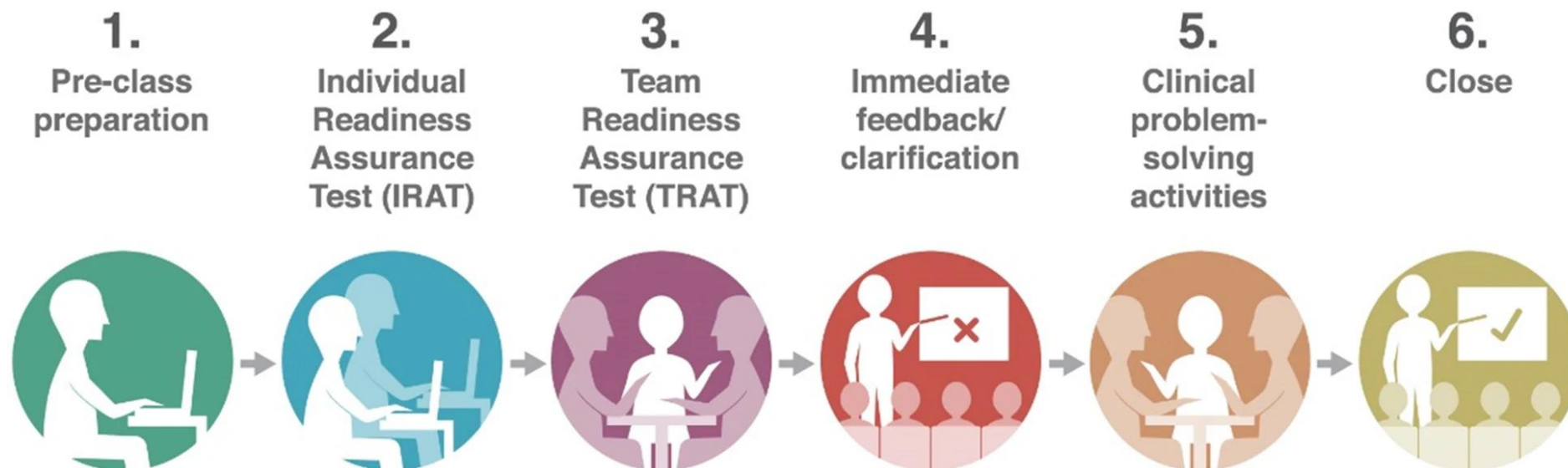
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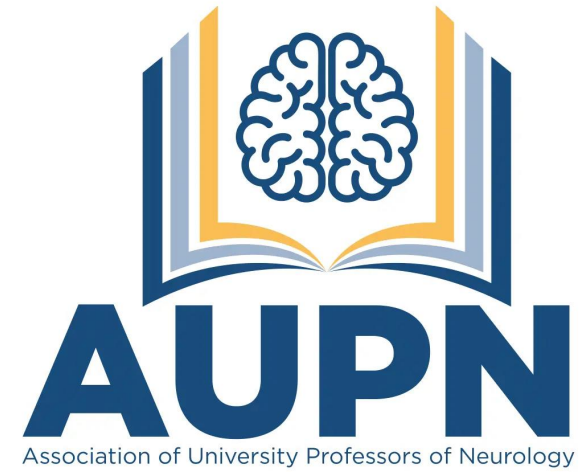
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Roy Strowd, MD, MEd, MS, FAAN

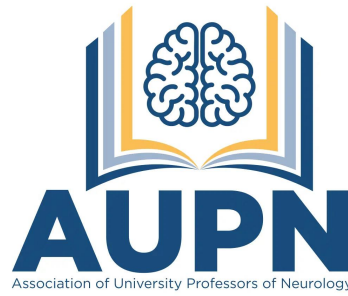
Associate Professor

Vice Dean for Undergraduate Medical Education

Editor, *Neurology: Education*

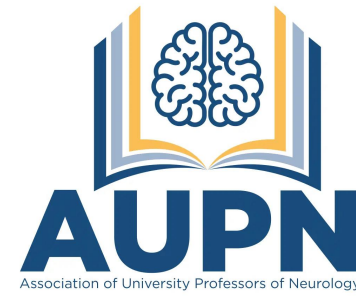
MEDICAL EDUCATION SCHOLARSHIP: HOW DO YOU GET STARTED AND HOW DO YOU KEEP THE TEMPO?

Disclosure



- Dr. Strowd serves a consultant for Monteris Medical Inc, Novocure, Alexion.
- **He receives an editorial stipend as Editor of *Neurology®: Education*.**
- He has received research/grant support from the American Academy of Neurology, American Board of Psychiatry and Neurology, American Society for Clinical Oncology, Southeastern Brain Tumor Foundation, and Jazz Pharmaceuticals.
- He has served as a paid lecturer for Kaplan, Inc.
- He receives royalties from Lecturio and Elsevier.

Why Get Involved in Scholarship?

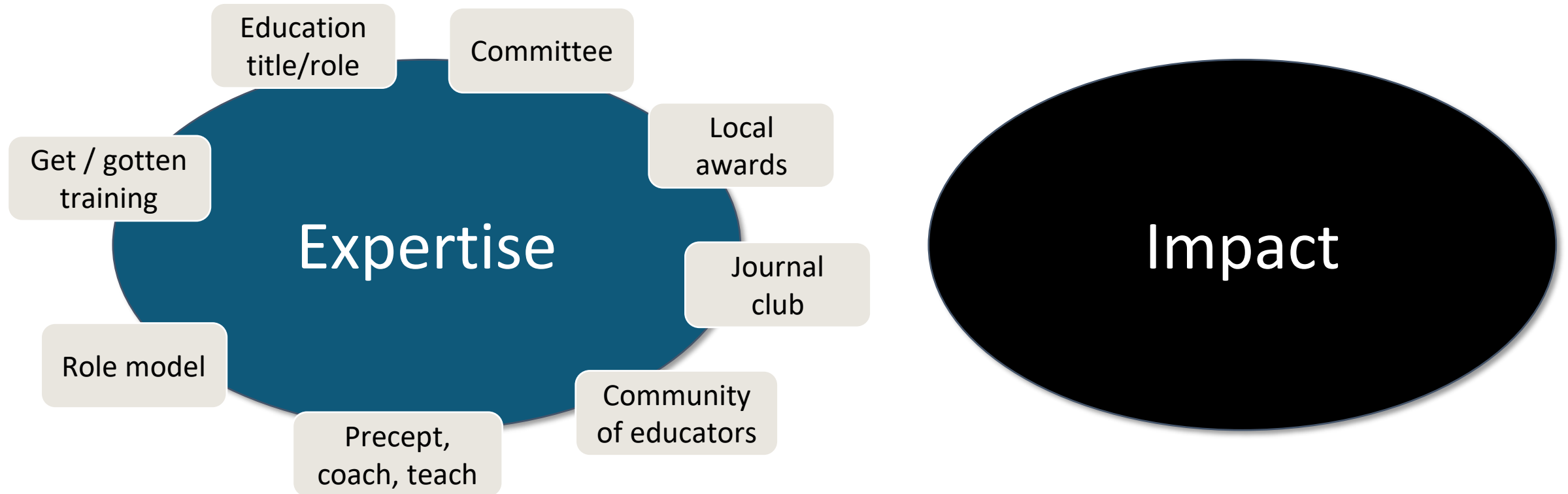


Expertise

Impact

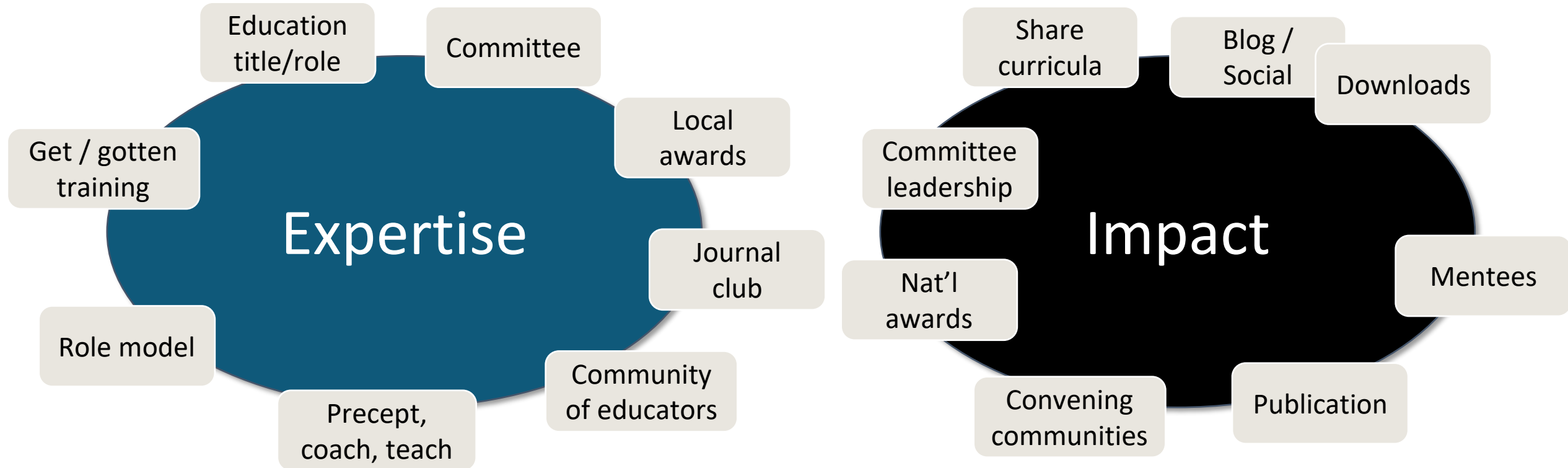
PARTS OF GETTING PROMOTED

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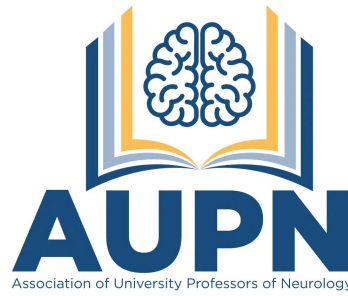
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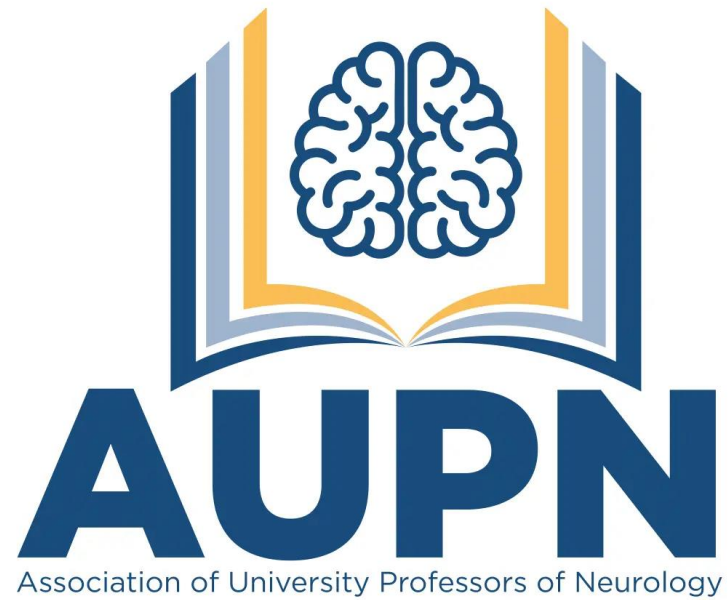
PARTS OF GETTING PROMOTED

Why Get Involved in Scholarship?



- Key for promotion and tenure
- Demonstrates impact of your teaching work
- Enhances teaching and training broadly
- Helps support identification of your expertise area(s)
- Improves how you teach
- Increases recognition of your “brand” locally and regionally
- Gain collaborations and colleagues
- Fun

STEP 1: TRUST YOUR OBSERVATIONS



Curriculum Innovation: A Standardized Experiential Simulation Curriculum Equips Residents to Face the Challenges of Chief Year

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Abstract

Introduction and Problem Statement

A chief resident's role incorporates administrative, academic, and interpersonal responsibilities essential to managing a successful residency program. However, rising chief residents receive little formal exposure to leadership training.

Objectives

To (1) define leadership styles; (2) understand the effect of cultural competence on leadership styles; (3) learn effective methods to advocate as the chief resident; (4) provide effective peer feedback; (5) provide effective supervisor feedback; (6) learn effective conflict management; (7) ensure psychological safety.

Methods and Curriculum Description

We developed a 1-day curriculum combining didactics and simulation activities for our program's rising chief residents. Implementation of our curricular design included a morning session focusing on small groups and didactic-based lectures on specific topics pertinent to leadership, along with a debriefing of a psychometric evaluation tool administered before the curriculum day. The simulation activity consisted of 3 group objective structured clinical examination (G-OSCE) scenarios: (1) providing a struggling junior trainee with feedback; (2) debriefing an adverse clinical outcome

- “I see the need to improve chief resident preparation”

Education Research: What Medical Students Value in Neurology Residents

A Qualitative Study to Inform Resident as Teacher Curricula

Harry W. Sutherland, MD, Jeremy J. Moeller, MD, MSc, FRCPC,* and Sara M. Schaefer, MD, MHS, FAAN*

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Abstract

Background and Objectives

Residents are responsible for much of the formal and informal teaching of neurology clerkship medical students. High-quality resident teachers can enhance clerkship satisfaction, decrease neurophobia, and increase specialty interest. To train such residents, some institutions have developed resident as teacher (RAT) curricula. Existing RAT curricula are highly variable, partly because of our limited understanding of medical student attitudes and expectations regarding the qualities and skills of effective resident teachers. We sought to identify important themes in resident teaching, based on qualitative analysis of written evaluations by students, to better inform future RAT curricula in neurology.

Methods

Clerkship student evaluations of residents from 2012 to 2023 at a single institution were collected and anonymized. The narrative comments were thematically coded using conventional content analysis in an iterative process of reconciliation and recoding. Randomly selected evaluations were analyzed in batches of 50 at a time until thematic saturation was achieved.

Results

A total of 200 evaluations yielded 6 themes with 27 subthemes: (1) Work-based learning,

- “I see the need to understand how residents inspire medical students into neurology”

Curriculum Innovation: A Resident-Created Multiple-Choice Question of the Week to Augment Case-Based Learning

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Neurology[®] *Education* 2024;3:e200119. doi:10.1212/NE9.000000000200119

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Abstract

Introduction and Problem Statement

Morning report (MR) has been a foundation of learning in many neurology residency programs. However, fortification of the high-yield learning points during MR cases may be achieved with supplementary educational initiatives to promote effective long-term retention and test-enhanced learning.

Objectives

During the 2020–2021 academic year, chief residents of our neurology training program sought to implement neurology certification board–style multiple-choice questions (MCQs) based on cases presented at MR to enhance case-based learning.

Methods and Curriculum Description

A chief resident was selected weekly to write a MCQ based on an instructive case presented in MR from the prior week. The National Board of Medical Examiners item writing guide and online tutorial were used as guidelines for constructing MCQs. MCQs featured a clinical vignette in the question stem, and images were added to augment select cases. The MCQs were distributed using Qualtrics, which generated a web link and tracked anonymous answers. The

- “I see the value of utilizing active learning instructional methods through a case-based learning approach”

Education Research: Epilepsy Monitoring Unit Staff Education Using a High-Fidelity Manikin

A Pre-Post Intervention Study

John R. McLaren, MD,* Fábio A. Nascimento, MD,* Joshua Chakranarayan, MD, Marcia Olandoski, MD, PhD, Poornachand Veerapaneni, MD, and Jay R. Gavvala, MD, MSCI

Neurology[®] *Education* 2024;3:e200120. doi:10.1212/NE9.0000000000200120

Abstract

Background and Objectives

Given the inherent risks of seizure provocation in the epilepsy monitoring unit (EMU), both miscommunication and incomplete training about the importance of when and why certain measures are taken can cause critical gaps in care for patients in an especially vulnerable state. To provide a framework that would help minimize these potential pitfalls, our objectives were 2-fold: (1) identify deficits in EMU safety and assessment using a checklist of predetermined items, including key measures essential to the care of EMU patients and (2) develop a simulation training program to address these deficits with education for staff on optimal practices.

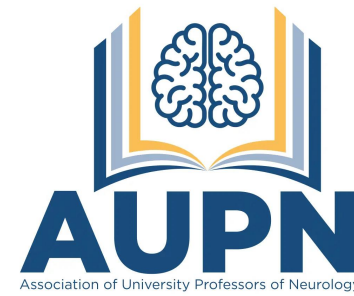
Methods

After creation of an EMU safety checklist, authors retrospectively reviewed video from 12 consecutive patients (time zero; T0) admitted to the Baylor St. Luke's EMU to assess checklist compliance and seizure response times (both electrographic and clinical). EMU staff were then trained in small teams with the help of a simulation program developed using a high-fidelity manikin. After training was complete, EMU practices and response times were reassessed in short-term (T1) and long-term (T2) follow-up intervals.

Correspondence

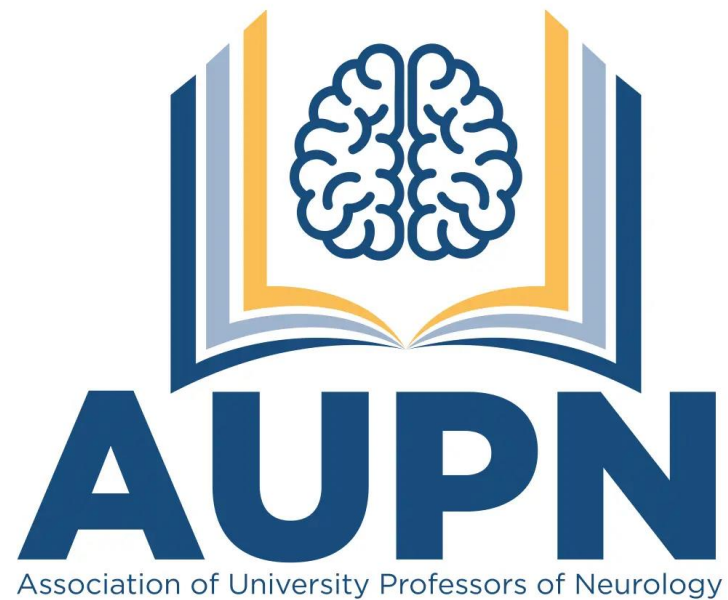
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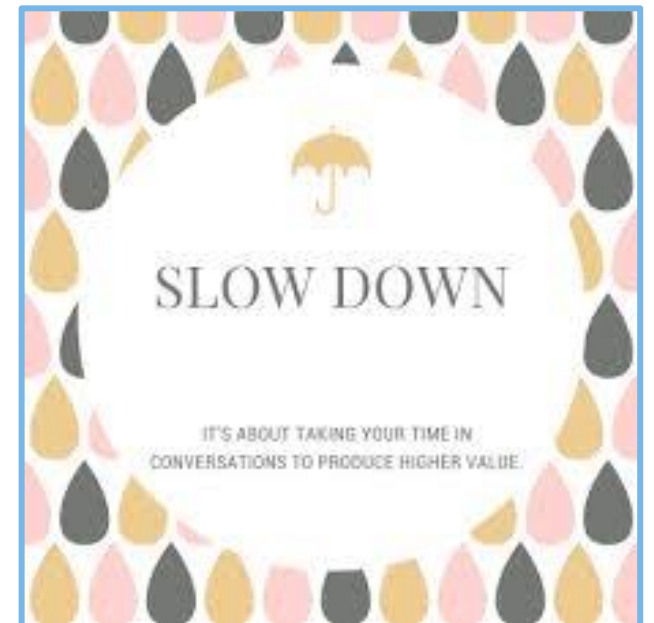
- “I see the need to improve staff readiness to manage patients in the EMU”

STEP 2: SLOW DOWN, READ, & LISTEN



What is the conversation in the literature?

- The scholarly literature is, in essence, a conversation in slow motion
- Effectively joining the conversation requires understanding what's being talked about, finding the space to make your contribution, and conveying the value of your voice
- Learning how to join the conversation involves mindful observation of and participation in conversations



Publication as a conversation ...

...studies that are presented within a strong conceptual framework... enter into a knowledge-building conversation with other works... Such studies link their work to the ideas that have come before – not just through the review of relevant previous studies, but also through shared theoretical concepts, interlacing research questions, attempts at replication and extension, or methodological innovation. In these ways, studies reflect higher-level ideas that assist readers to use the insights reported to think anew about the challenges they face in their local contexts. (Eva & Lingard, 2008)



*“The science of education should be about creating and sharing better ways of thinking about the problems we face – exposing our underlying metaphors and assumptions and examining the relative value of these things for interpreting the education issues we are individually and collectively trying to address in our own local contexts.”
Regehr (2010)*



Chief Preparation Project ...



The overall aim of this simulation-based and case-based scenarios).¹¹ Using the interactive, experiential- development of key leadership specific leadership concepts and skills are necessary for our development of key leadership skills necessary for the rising chief residents to learn before the start of their chief student role. The *Know, See* year. Our curriculum focuses on the direct teaching of these our combined experiential skills (associated with the *cognitive phase* of learning, through requiring declarative knowledge (the rising chief residents didactic/small group activities) and observation of our learners practicing these skills in group simulation-based newly acquired skill set scenarios (*associative phase*), wherein direct feedback is administered by faculty, the standardized participant, and their dynamics in the group or peers. Further reinforcement of the *autonomous phase* of be prepared to plan a course of learning is then observed as the rising chiefs begin their to perform the plan duties and are surveyed about specific frequencies of behaviors.¹²

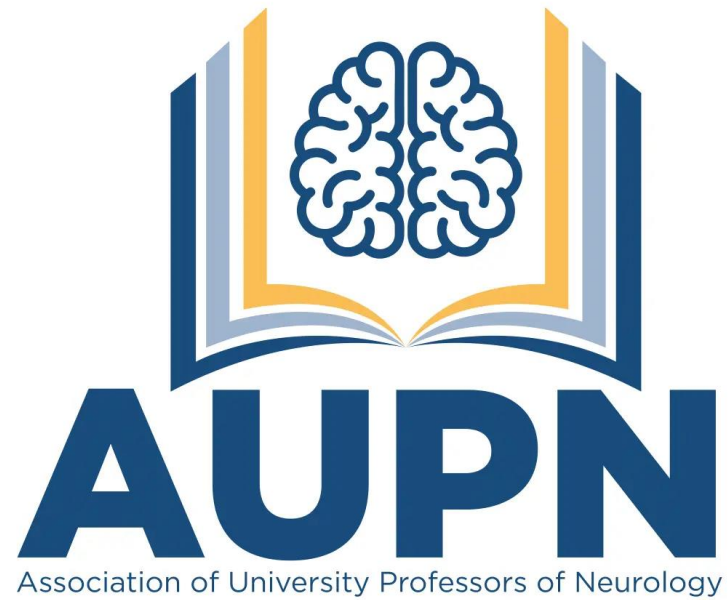
Table 2 Suggested Simulation Scenarios and Skills Workshop Topics for a RAT Curriculum Informed by the Results of This Study

Subtheme	Suggested RAT simulation or skills workshop
1a. Sets expectations	“1st day on rotation” conversation
1b. Student involvement in care	Overseeing student calling consult Overseeing student updating family
1c. Student autonomy over care	Overseeing student performing physical examination Overseeing student-led clinical encounter
1d. Helps students prepare/practice	Student pre-rounds presentation practice Guiding student through interpretation of diagnostic data
1e. Gives feedback	Post-rotation summative feedback using the A.D.A.P.T. framework
1f. Mentorship and coaching	Post-encounter teaching using the 1-min preceptor model
1g. Challenges students	(Can make the learner in the scenarios for 1c more passive or shy)
3a. Psychological safety	Skills workshop on phrases and behaviors that promote safety
3b. Clear communication	(Concurrent with above)

Abbreviation: RAT = resident as teacher.

Themes 1 and 3 seem most conducive to resident education. Themes 5 and 6 may be modifiers to these scenarios. Theme 4 is outside the scope of RAT curricula. Theme 2 subthemes along with how to delegate responsibilities to students, the importance of signposting work-based learning and their function as role models should also explicitly be covered in RAT curricula.

STEP 3: BE RIGOROUS



Do's

- It's a study ... get IRB oversight
- If you teach someone they will learn ... no surprise there
 - Pre / Post / Delayed Post → long term retention
 - Pre / Post ; compared to control or historical → causal
 - Pre / Post KSA → can you show behavior changes
- Learn something at a single institution
 - Can you incorporate multiple professions? (*patient centered*)
 - Can you study multiple disciplines? (*education centered*)
 - Can you **gain understanding** using qualitative data? (*contextual*)
- Identify collaborators at other institutions

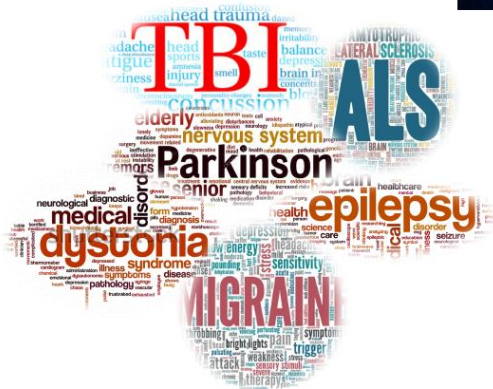
Don't

- Submit the pilot study
 - Build on the pilot and submit both

Don't

- Submit the pilot study
 - Build on the pilot and submit both

Pilot program



Final program



RESEARCH ARTICLE OPEN ACCESS

Curriculum Innovations: Improving Residents' Knowledge and Interest in Outpatient Neurology Through an Interactive Patient-Centered Didactic Series

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Neurology® Education 2023;2:e200043. doi:10.1212/NE9.000000000200043

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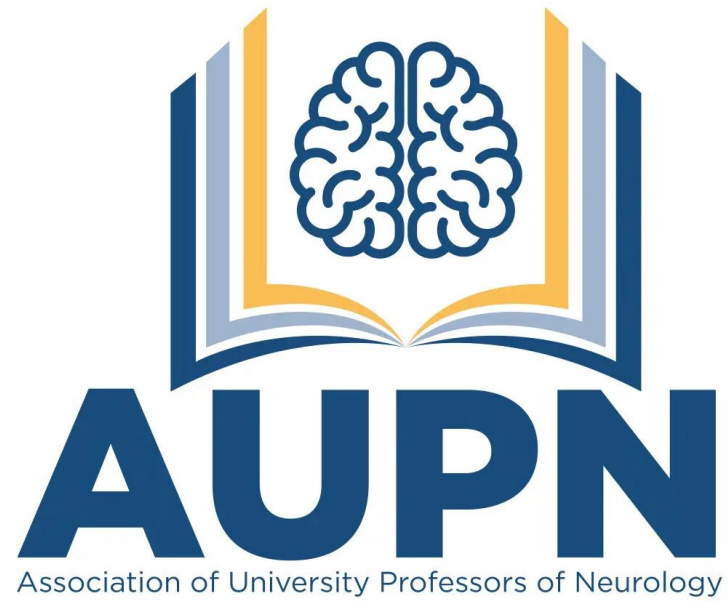
Don't

- Submit the pilot study
 - Build on the pilot and submit both
- Submit a trend
 - Power the study
 - Identify the optimal sample size
 - Conduct rigorous statistical analysis

Don't

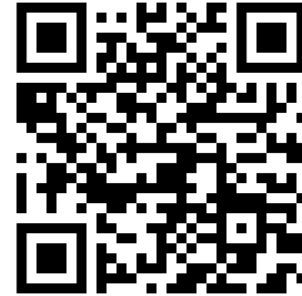
- Submit the pilot study
 - Build on the pilot and submit both
- Submit a trend
 - Power the study
 - Identify the optimal sample size
 - Conduct rigorous statistical analysis
- Publishing on being the first
 - “No published studies have been reported” → is it important?
 - “First time a curriculum has been developed ...” → how do you know?

STEP 4: JUMP IN



Get Started ...

- As a peer reviewer (best writers, great readers)
- As a blog / commentary writer
 - Work in Progress
 - Preliminary findings/study
- Conference abstract writer (or reviewer)
- Join a journal club ... *AB Baker-Neurology: Education* journal club
- Write a review or methods paper
 - Review in neurology education
 - Methods in education research
- Write a viewpoint





THANK YOU

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