Teaching to Learn:
The Practical Application of Learning Theory

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Pause and Reflect

- What type of teaching do you do?
  - Environment
  - Number of learners
  - Content (medical knowledge v. skills v. attitudes)
- Which teaching situations are difficult?

Learning Objectives

1. Describe the steps of the learning cycle and match them with their respective neuroanatomic locations

2. Describe techniques for building on learners' existing knowledge

3. Identify and describe five strategies to increase learner involvement in the learning process including double planning, ratio, cold call, no opt out and right is right

Caveats

- Tested K-12
  - Difference children vs adults
- Data for skills – B
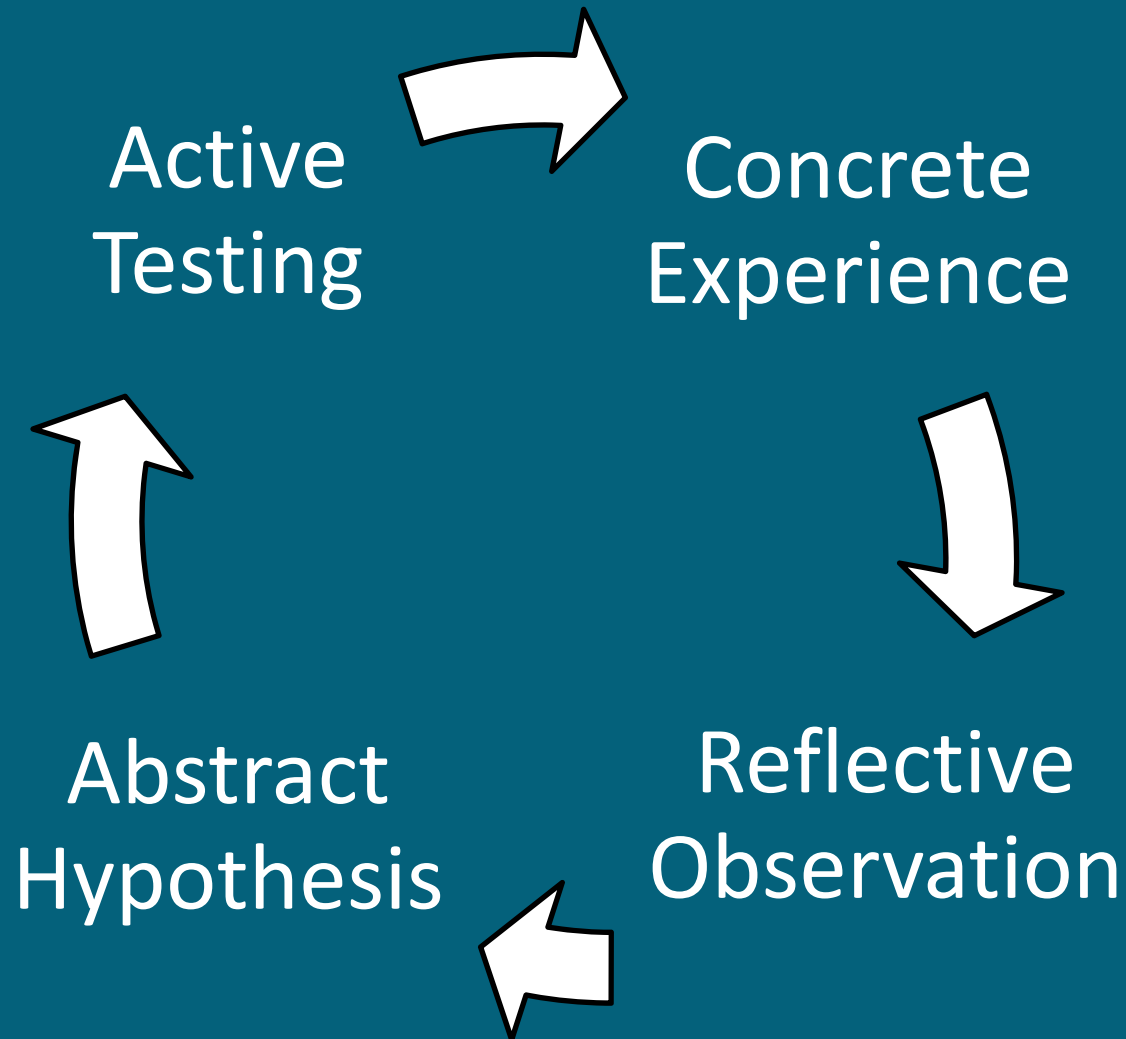 - NRCT
  - Still impressive
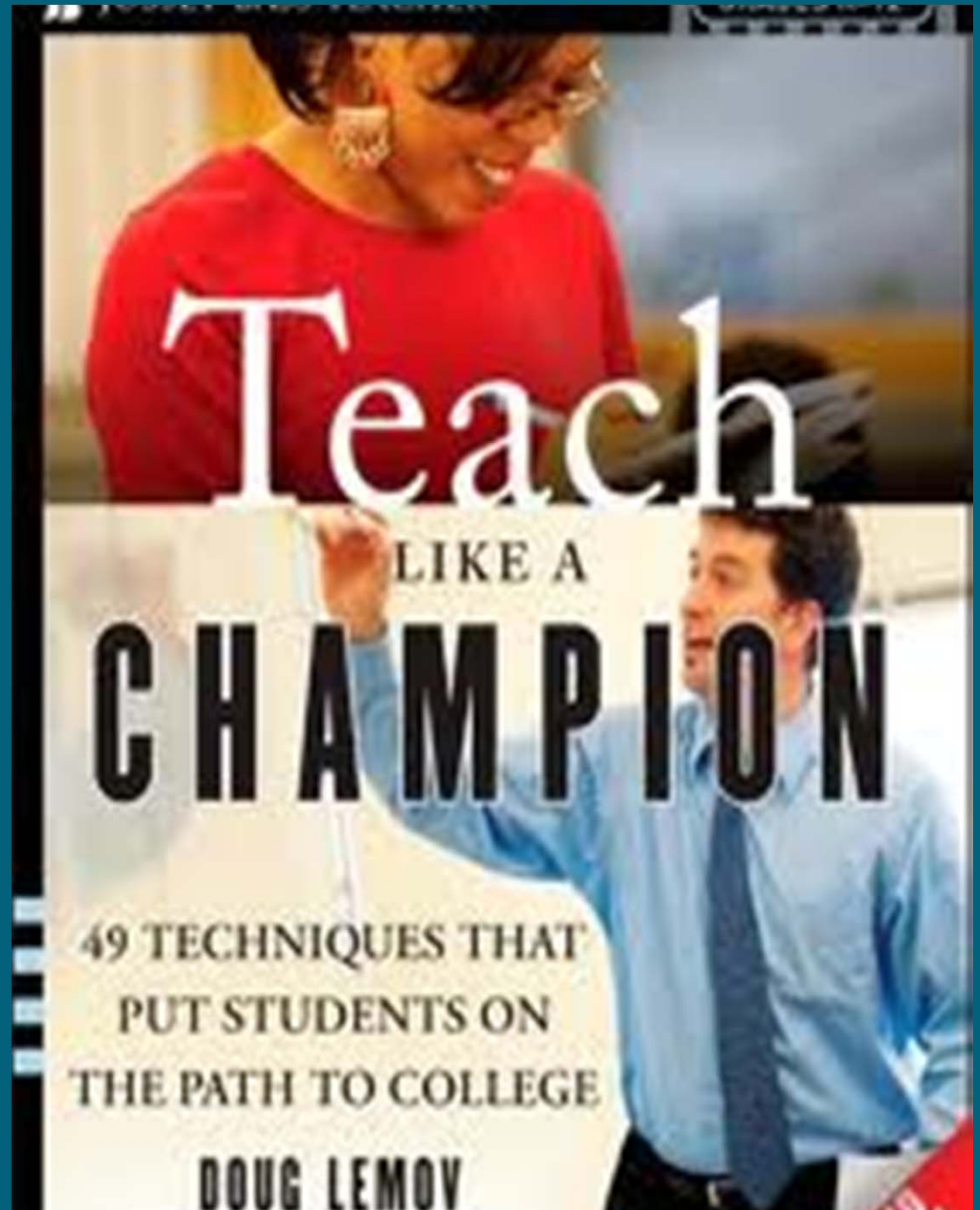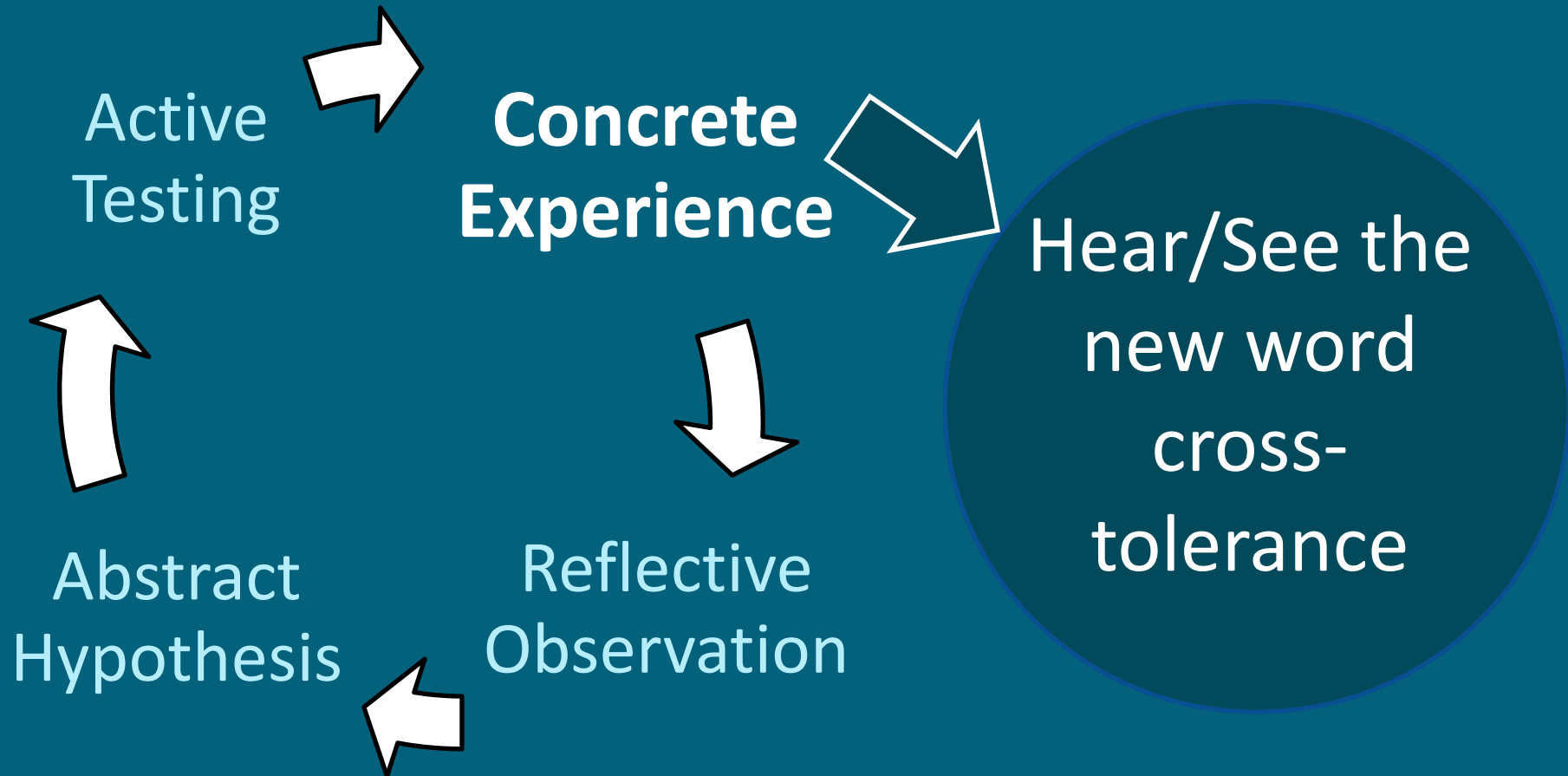
Other Books of Note

- Art of Changing the Brain: Enriching the Practice of Teaching by Exploring the Biology of Learning (ACB)

- Why Don't Students Like School? (WDS)

- How learning works (CMU)

Overview of the Neurobiology of Learning
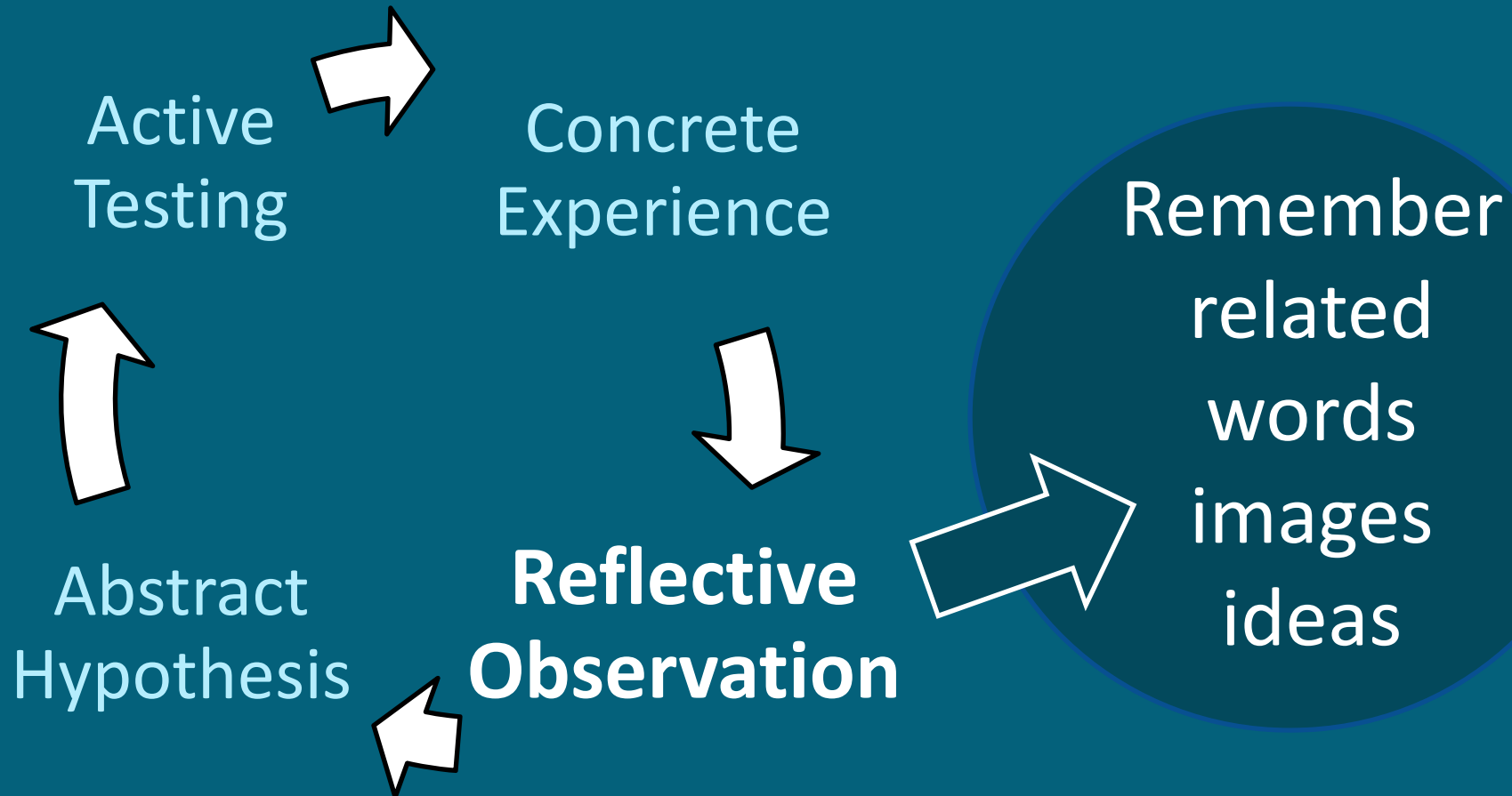## (for non-neurobiologists)

The Learning Cycle

Active Testing

Concrete Experience

Reflective Observation

Abstract Hypothesis

ACB 17

The Learning Cycle: An Example

Active Testing

Concrete Experience

Hear/See the new word cross-tolerance

Abstract Hypothesis

Reflective Observation

The Learning Cycle: An Example

Active Testing

Concrete Experience

Abstract Hypothesis

Reflective Observation
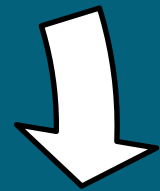
Remember related words images ideas

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The Learning Cycle: An Example

Active Testing

Concrete Experience

Reflective Observation

Abstract Hypothesis

Generate new words or ideas

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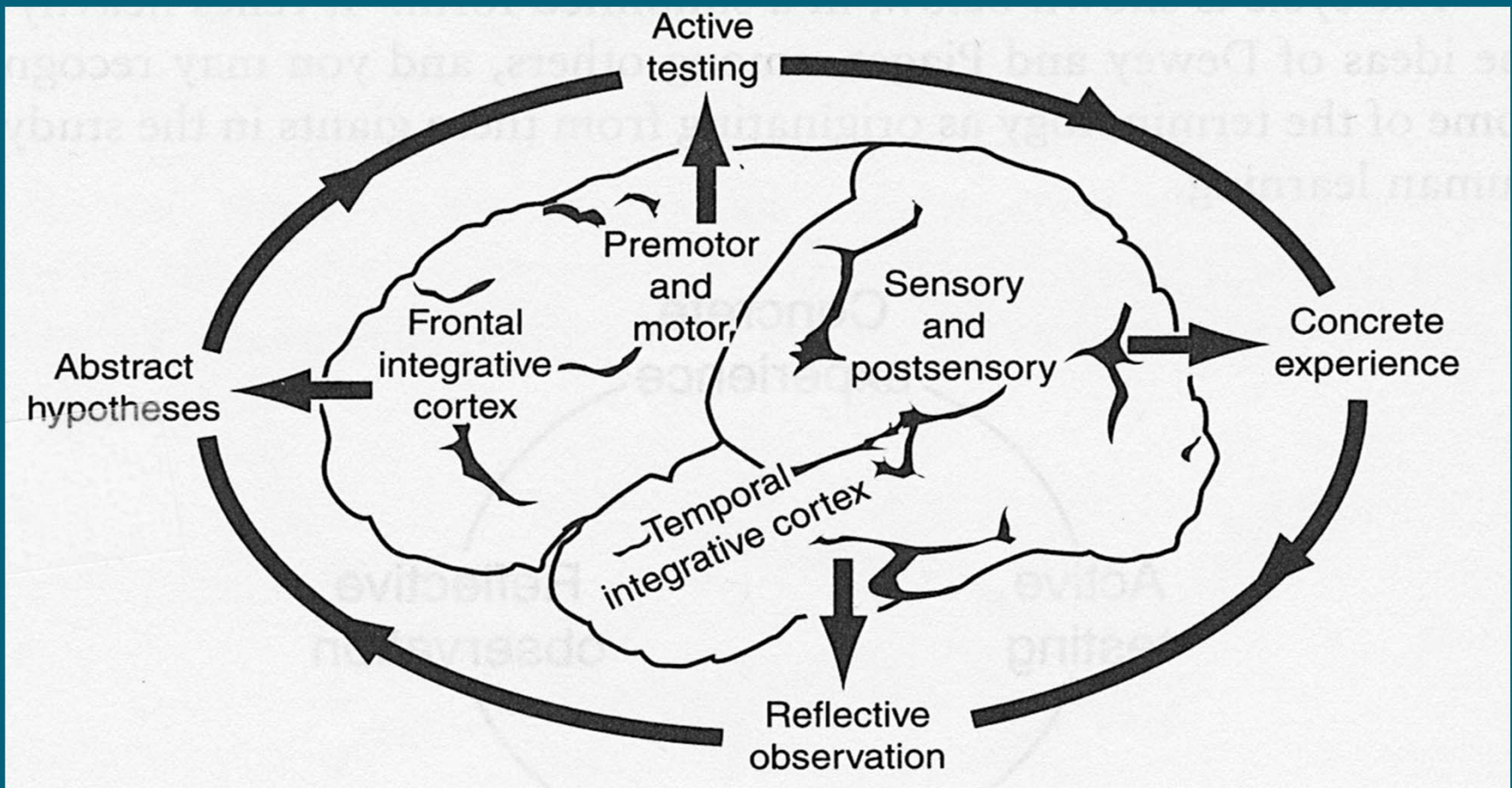# The Learning Cycle: An Example

Speak/
Write new
words
or ideas

**Active
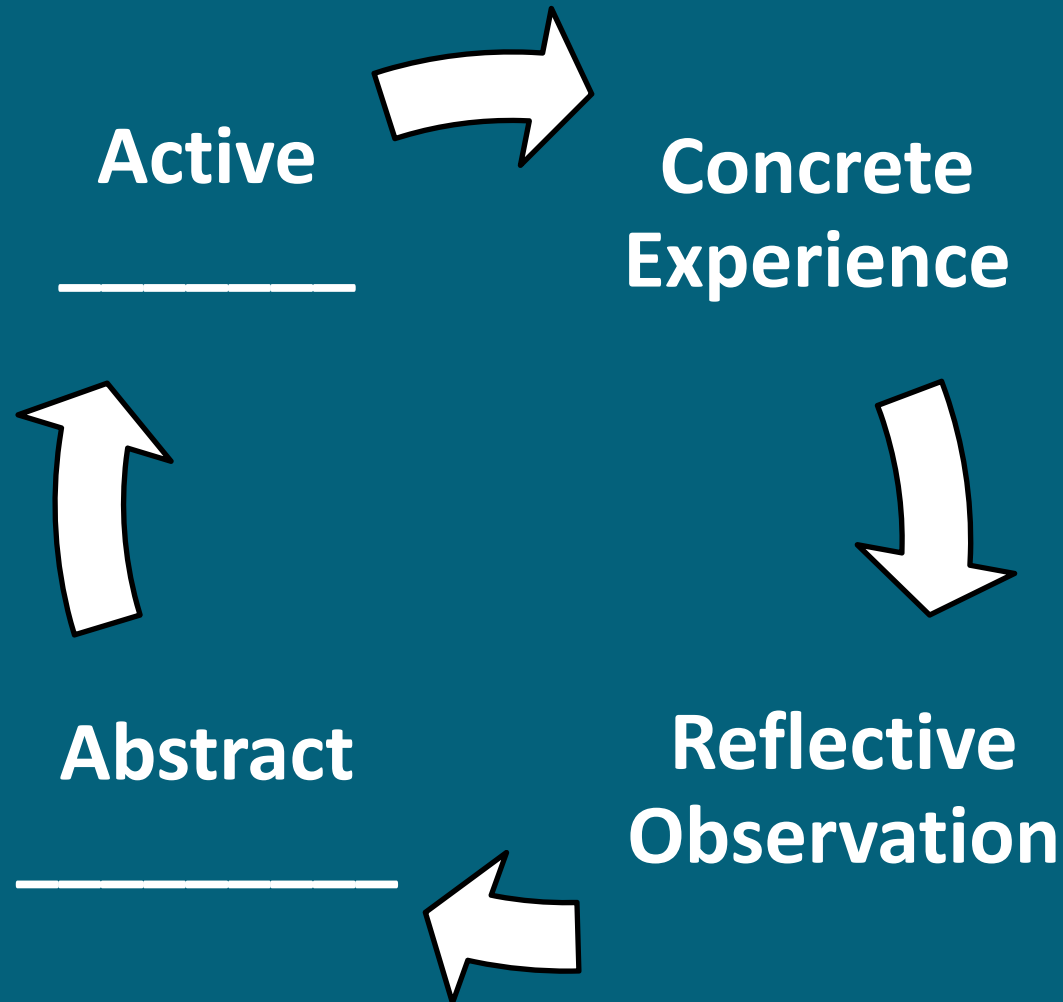Testing**

Concrete
Experience

Abstract
Hypothesis

Reflective
Observation

ACB 17

Neuroanatomy and the Learning Cycle

The Learning Cycle

Active _____

Concrete Experience

Reflective Observation

Abstract _____

ACB 17

Thinking and Memory

Space

Environment → Working Memory ← Environment

Working Memory ↕ Long-Term Memory (neuronal networks)

Facts → Long-Term Memory (neuronal networks) ← Procedures

WDS p. 3, 14

Summary

- Learning cycle mirrors neuroanatomy
- Successful thinking relies upon
    1. Environment
    2. Working memory
    3. Long term memory (facts and procedures)

Techniques for Building on Existing Knowledge

"The single most important factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly."
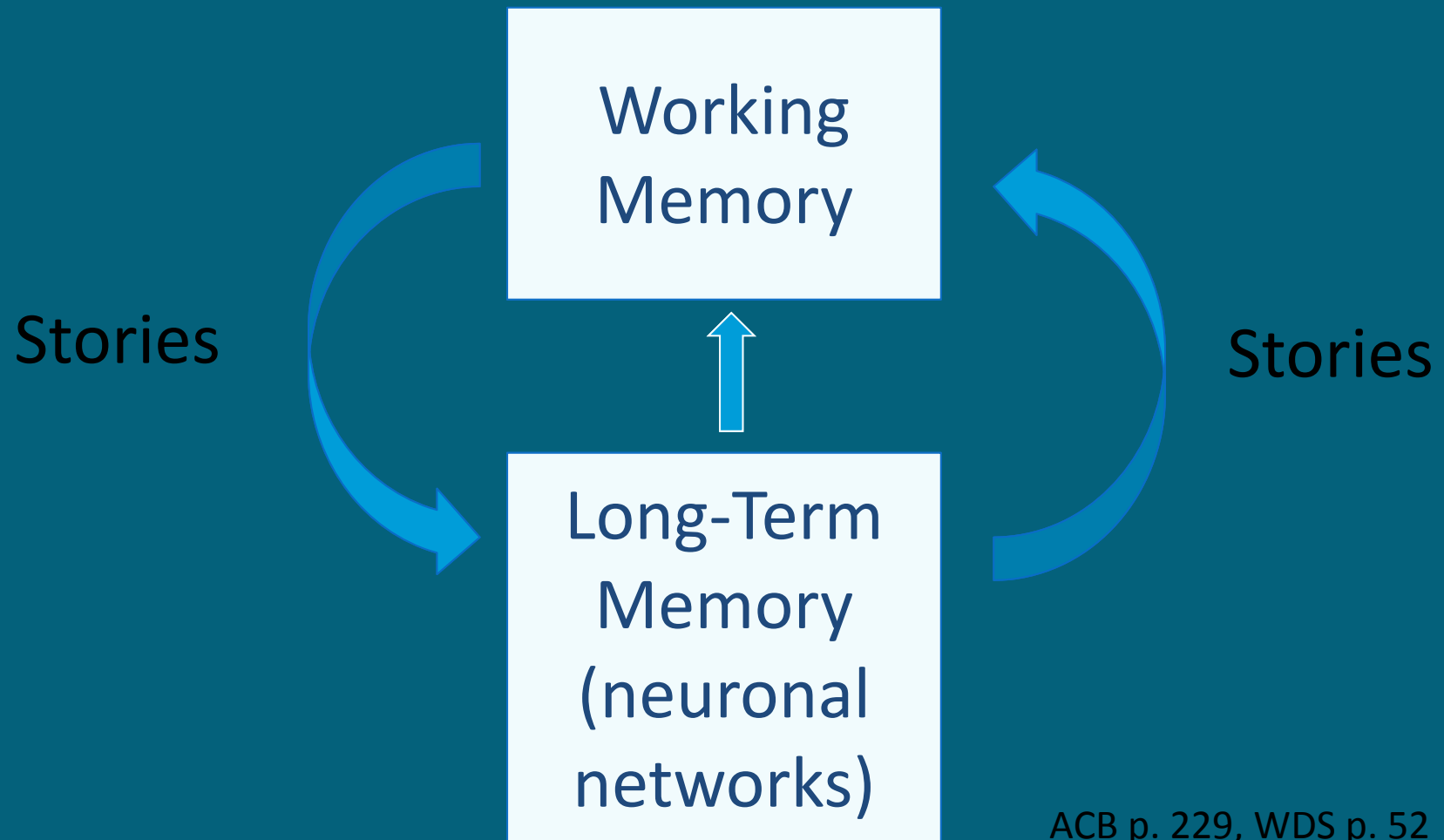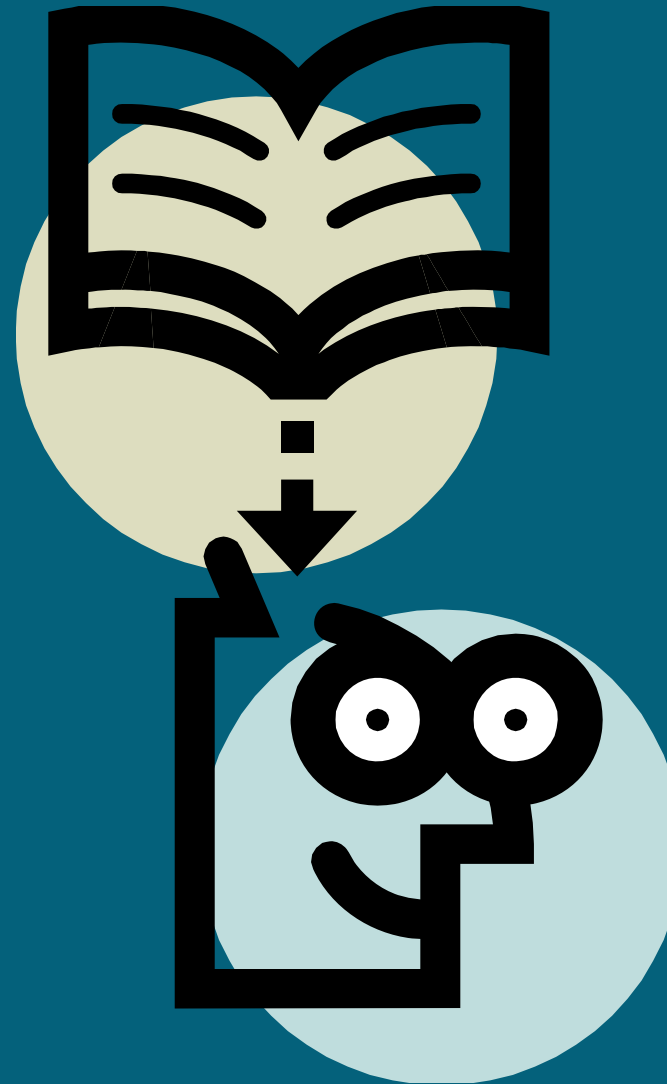
--David Ausubel

Scaffolding

Build on Learners' Existing Knowledge

Working
Memory

Stories

Stories

Long-Term
Memory
(neuronal
networks)

ACB p. 229, WDS p. 52
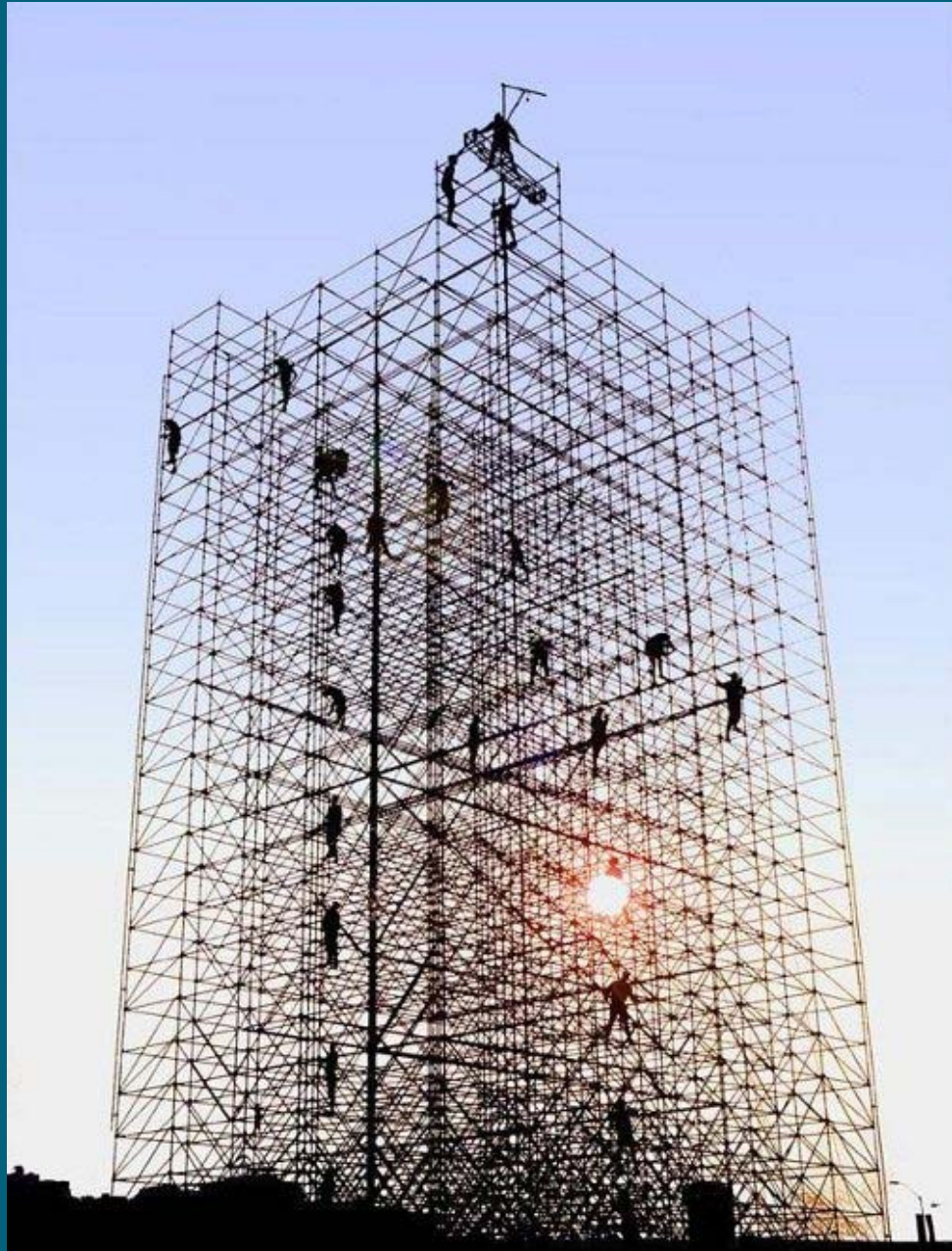
Brains Remember Stories

Build on Existing Neuronal Networks

- Ask learner's peers to describe connections they have made
  - What does this new information bring to mind?
  - What does that make you think of?
- Use metaphor/simile/analogy
- Focus on correct learner response rather than reinforcing wrong information

Build on Existing Neuronal Networks

- Stretch it:
  - –Reward correct answer with follow-up question
  - –Encourage further reflection/another pass through learning cycle

Summary

- Build on Existing Knowledge
  - Learning builds on prior knowledge, the pre-existing "neuronal network"
  - Medical education should begin with patients (concrete) rather than principles (abstract)

Increase Learner Engagement

5 Strategies to Increase Learner Engagement

- Double Planning
- Ratio
- Cold Call
- No Opt Out
- Right is Right

Excellent teachers plan well

- Double planning: consider what learners are doing while you're talking
  - Outline with key words missing
  - Write summary statement at pause
  - Re-create diagram in notes
  - Preparing to answer question out loud

TLC 65, 92

Excellent teachers plan well

Ratio: how to get learners to do more of work
- "Unbundle" a question to increase participation
- Half-statements
- Feign ignorance
- Ask "why," "how," and for evidence
- Volleyball not ping pong

Ensuring Student Involvement

- Cold call
  - Systematic—increased teaching efficiency
  - Positive
  - Predictable—distributes work fully, authoritatively
  - Scaffolded (easy → hard)
  - Keeps learners accountable—all go through cycle

TLC 111

Cold Call Clip

Ensuring Student Involvement

- No Opt Out: The Moment of "I Don't Know"
  - Have you noticed moments when you've received silence or some form of "I don't know" and accepted it
  - Don't let "I don't know" be the last word
  - Even unwilling/unknowledgeable learners can participate in part of the learning cycle

TLC 28

No Opt Out

- Consider alternative responses
  - "Take a little more time to speak your thoughts. I'll wait."
  - "Give it some more thought. I'll be back."
  - "Let's see how you might begin to answer. I'll come back to you shortly."
  - "We can work on this problem together. I'll bring it back to you in a moment."
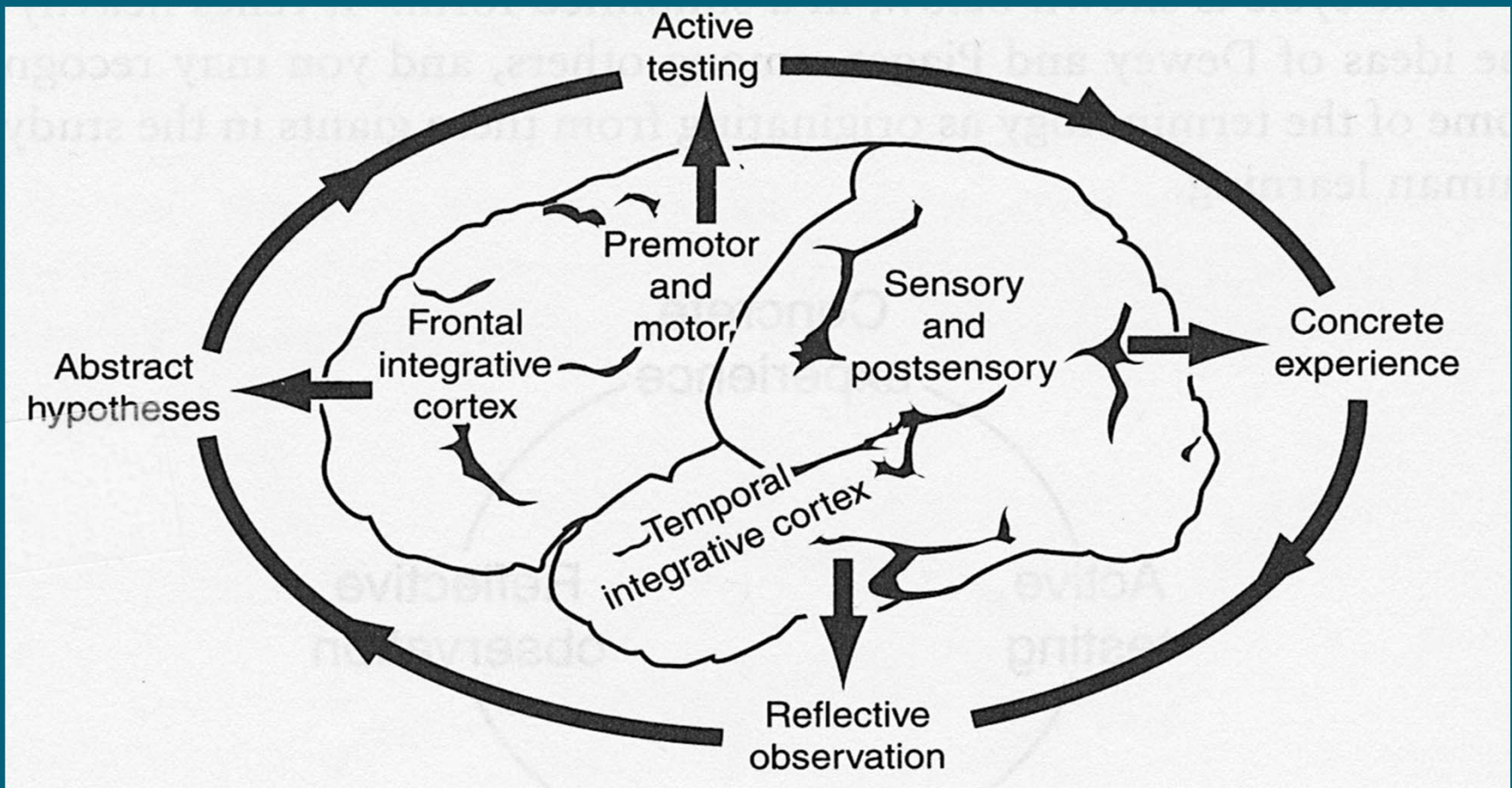
TLC 28

No Opt Out Clip

Ensuring student involvement

- Right is right
  - Must be precise in answers
  - Close isn't good enough
  - Build on/correct existing neuronal networks
  - Emphasize high expectations

Right is Right Clip

Conclusion

Learning Cycle Mirrors Neuroanatomy

ACB 18

Build on Existing Knowledge

Ensure Active Learning

Questions?

Acknowledgements

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    - University of Minnesota

References

- Art of Changing the Brain: Enriching the Practice of Teaching by Exploring the Biology of Learning, James E. Zull, 2002 Stylus Publishing

- Why Don't Students Like School?, Daniel T. Willingham, 2009 Jossey-Bass

- Teach Like a Champion, Doug Lemov, 2010 Jossey-Bass

- How People Learn, National Research Council, 2000 National Academy Press

- Talent is Overrated, Geoff Colvin, 2008 Portfolio

- How Learning Works: Seven Research Based Principles for Smart Teaching. Susan Ambrose, ed., 2010, Wiley, John & Sons

- Friedlander MJ et al. What can medical education learn from the neurobiology of learning? Acad Med. 86: 415-420, 2011

One take home point

- Write

- Practice

- Give us feedback
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