20 years of education teaching and research: all in one slide!

Sylvain Coderre

Kevin McLaughlin

Faculty/Presenter Disclosure

- **Faculty:** Dr. Sylvain Coderre

- **Relationships with commercial interests:**
  - None in last 2 years

Objectives

- Present a framework (one slide!) that applies for:
  - Teaching
  - Course design
  - Curricular design
  - Mentoring students
- Present some data (both local and others) supporting the framework
- 3 tips to being a better colleague
- 3 tips to being a better administrator

How teachers can help learners build storage and retrieval strength

Janeve Desy[a], Kevin Busche[a], Ronald Cusano[b], Pamela Veale[a], Sylvain Coderre[a] and Kevin McLaughlin[a]

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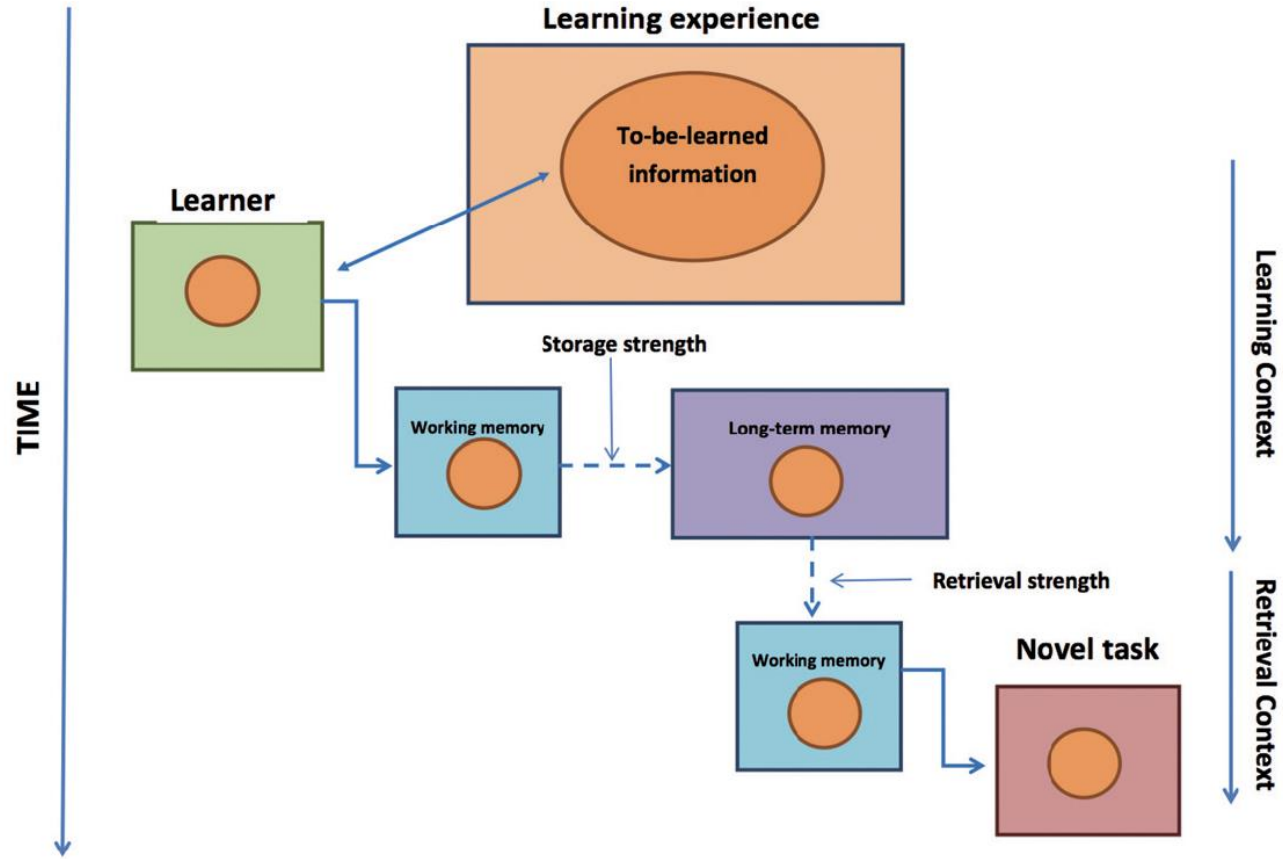

Figure 1. Steps involved in successful storage and retrieval of to-be-learned information.

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What is learning?

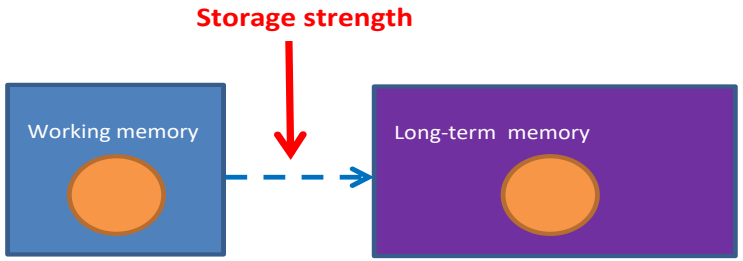
- Learning is an enduring change in behavior or in the capacity to behave in a given fashion which results from practice or other forms of experience

    - Schunk, Learning theories, 5th ed, 2008

Two phases of learning

- Acquisition
- Retrieval

Building storage strength



Improve processing by avoiding cognitive overload:

too much too fast

mindwandering/attention decrement

distractions

multitasking

Cognitive load

- Mohamed R, Raman M, Anderson J, McLaughlin K, Rostom A, Coderre S. Validation of the NASA-TLX as a tool to evaluate the learning curve for endoscopy training. Can J Gastroenterol Hepatol 2014; 28:155-59.
- Coderre S, Anderson J, Rikers R, Dunckley P, Holbrook K, McLaughlin K. Early use of magnetic endoscopic imaging in novice colonoscopists: improved performance without increase in workload. Can J Gastroenterol 2010;24:727-32.

Cognitive Load Theory

- The central notion of cognitive load theory is:
  - instructional approaches should take account of the structures (and limits) that constitute human cognitive architecture.

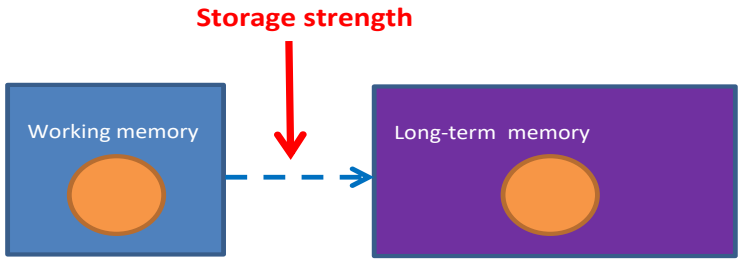
- This architecture consists of:
  - an effectively unlimited long-term memory (LTM)
  - LTM interacts with a working memory (WM) that is very limited in capacity and duration

  For new, yet to be learned information, the processing capacity is limited to only 4 ± 1 elements, and if not rehearsed, the info. is lost within 20-30s

Paas F, Renkl A, Sweller J. Cognitive load theory and instructional design: recent developments. Educ Psychol 2003;38:1-4.

VanMerrienboer J, Sweller J. Cognitive load theory in health profession education: design principles and strategies. Medical Education. 44 (2010): 85-93

Building storage strength



Improve processing by avoiding cognitive overload:

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Laptop multitasking hinders classroom learning for both users and nearby peers

Faria Sana [a], Tina Weston [b,c], Nicholas J. Cepeda [b,c,*]

[a] McMaster University, Department of Psychology, Neuroscience, & Behaviour, 1280 Main Street West, Hamilton, ON L8S 4K1, Canada
[b] York University, Department of Psychology, 4700 Keele Street, Toronto, ON M3J 1P3, Canada
[c] York University, LaMarsh Centre for Child and Youth Research, 4700 Keele Street, Toronto, ON M3J 1P3, Canada

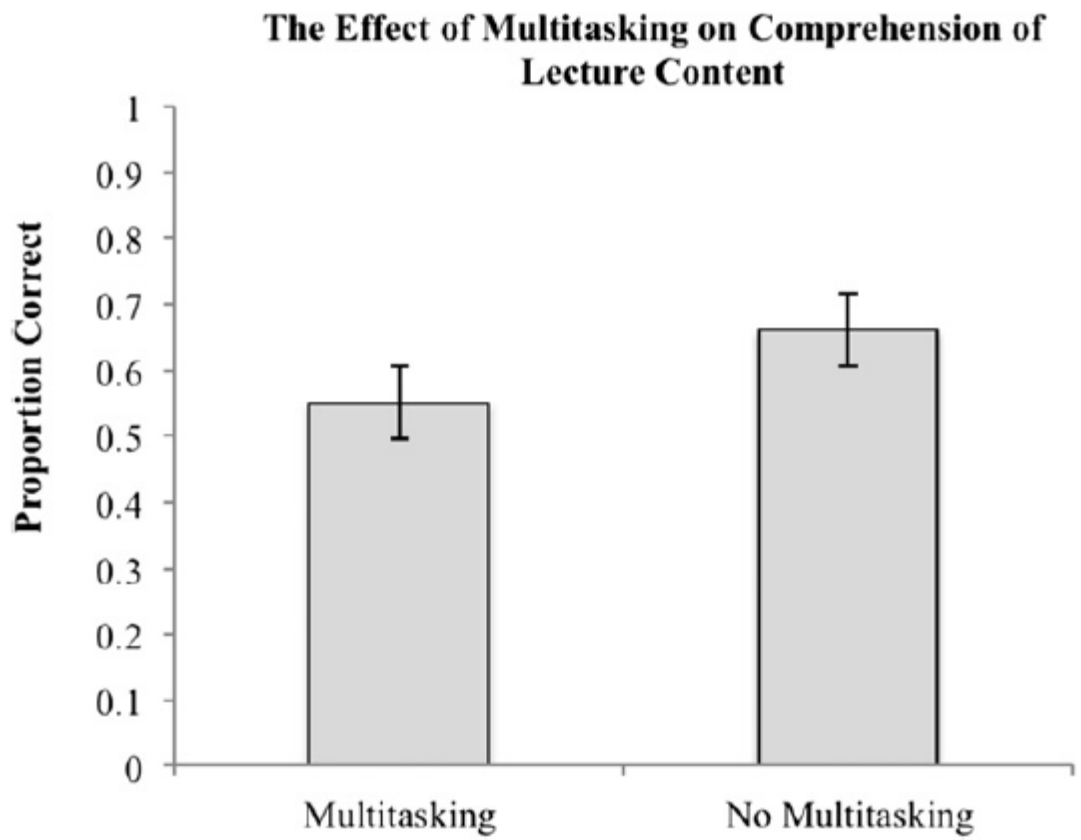

Fig. 1. Proportion correct on the comprehension test as a function of condition (multitasking vs. no multitasking). Multitasking lowered test performance by 11%, $p < .01$. Error bars represent standard error of the mean.

Laptop multitasking hinders classroom learning for both users and nearby peers

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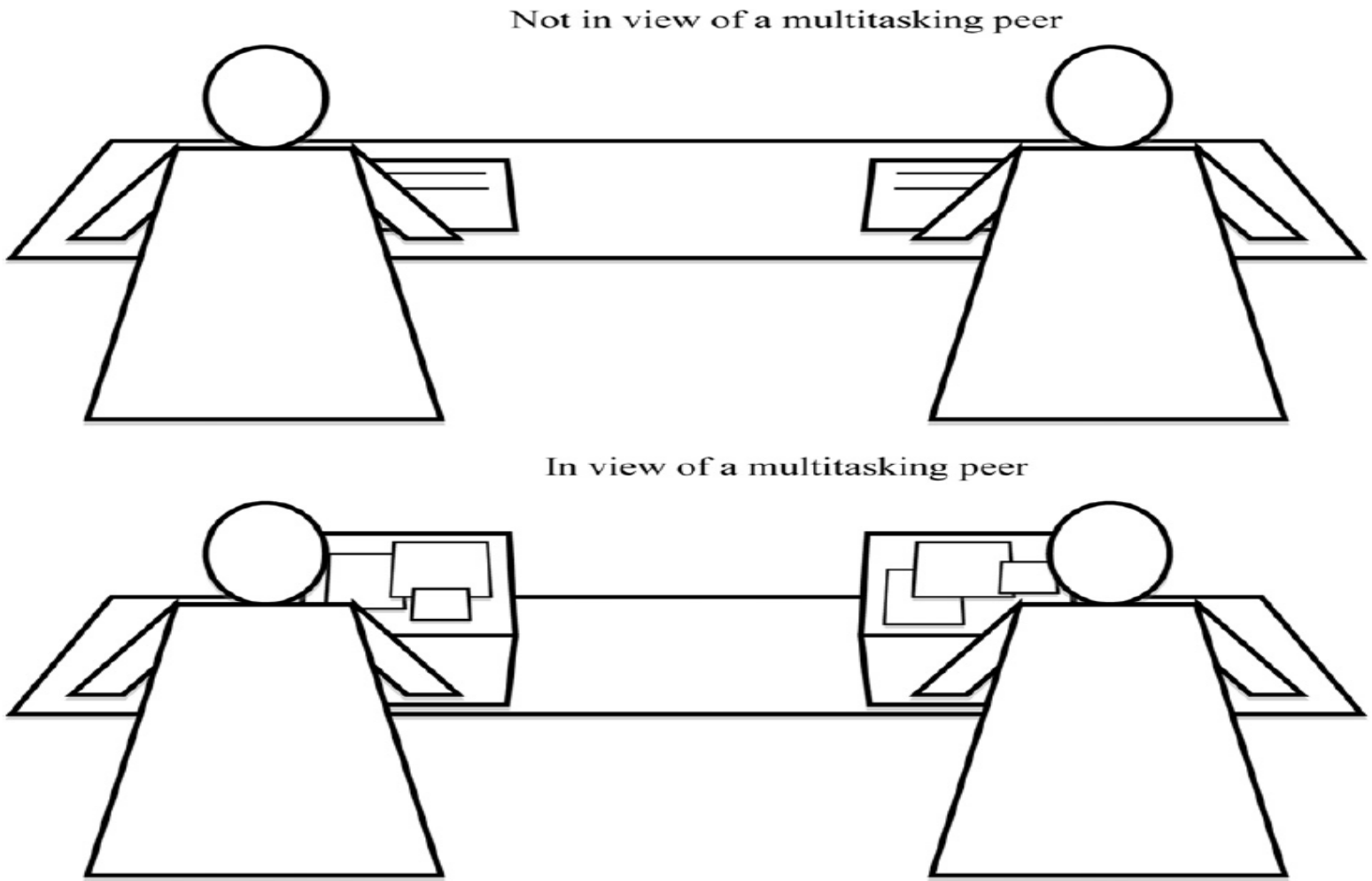

Computers & Education 62 (2013) 24–31

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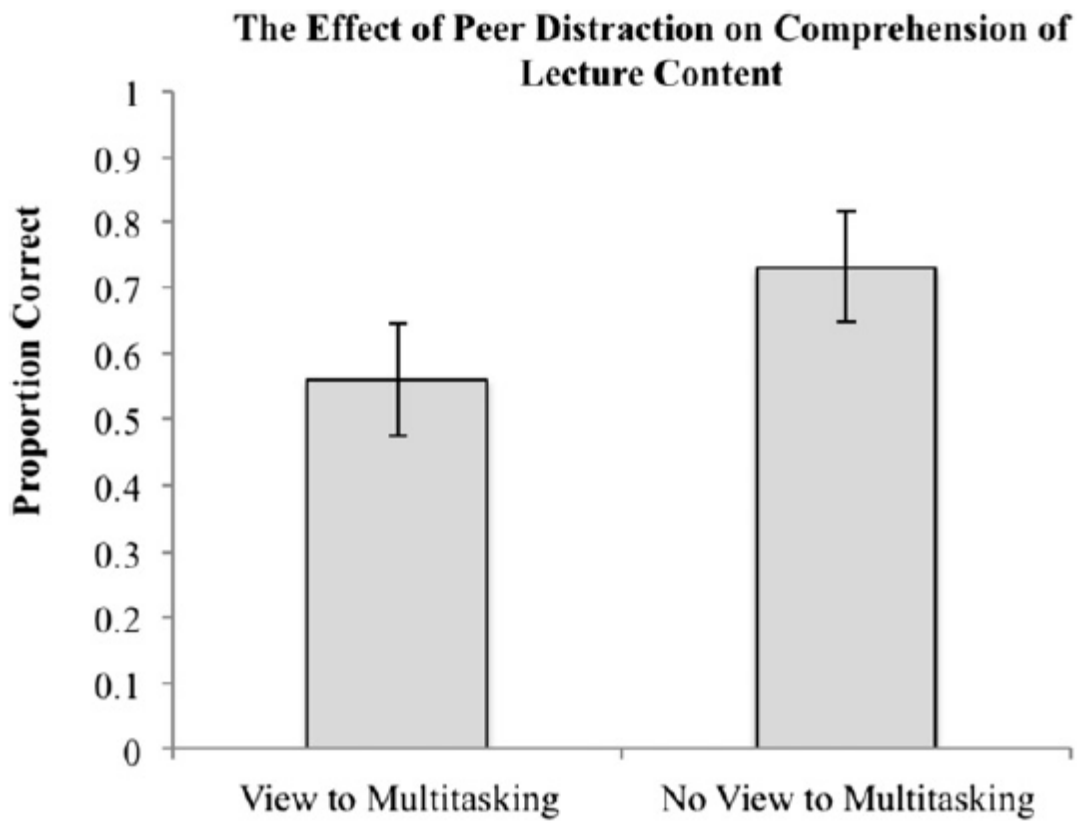
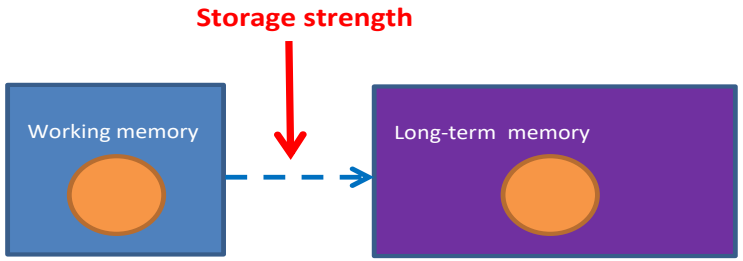


Fig. 3. Proportion correct on the comprehension test as a function of condition (view to multitasking vs. no view to multitasking). Being in view of multitasking peers lowered test performance by 17%, $p < .001$. Error bars represent standard error of the mean.

Building storage strength



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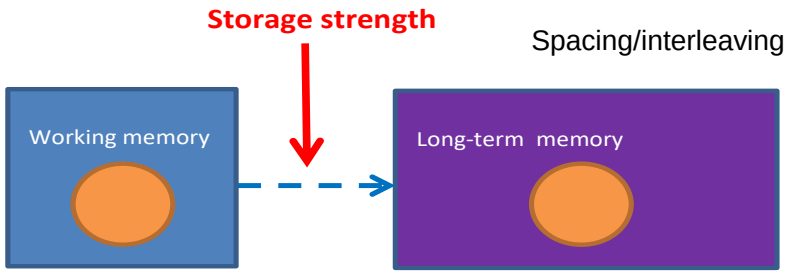
Building storage (encoding) strength

Provide Organizational structure

Improve encoding through “desirable difficulty”:

Improving understanding (causal explanations)

Spacing/interleaving content



Improve processing by avoiding cognitive overload:

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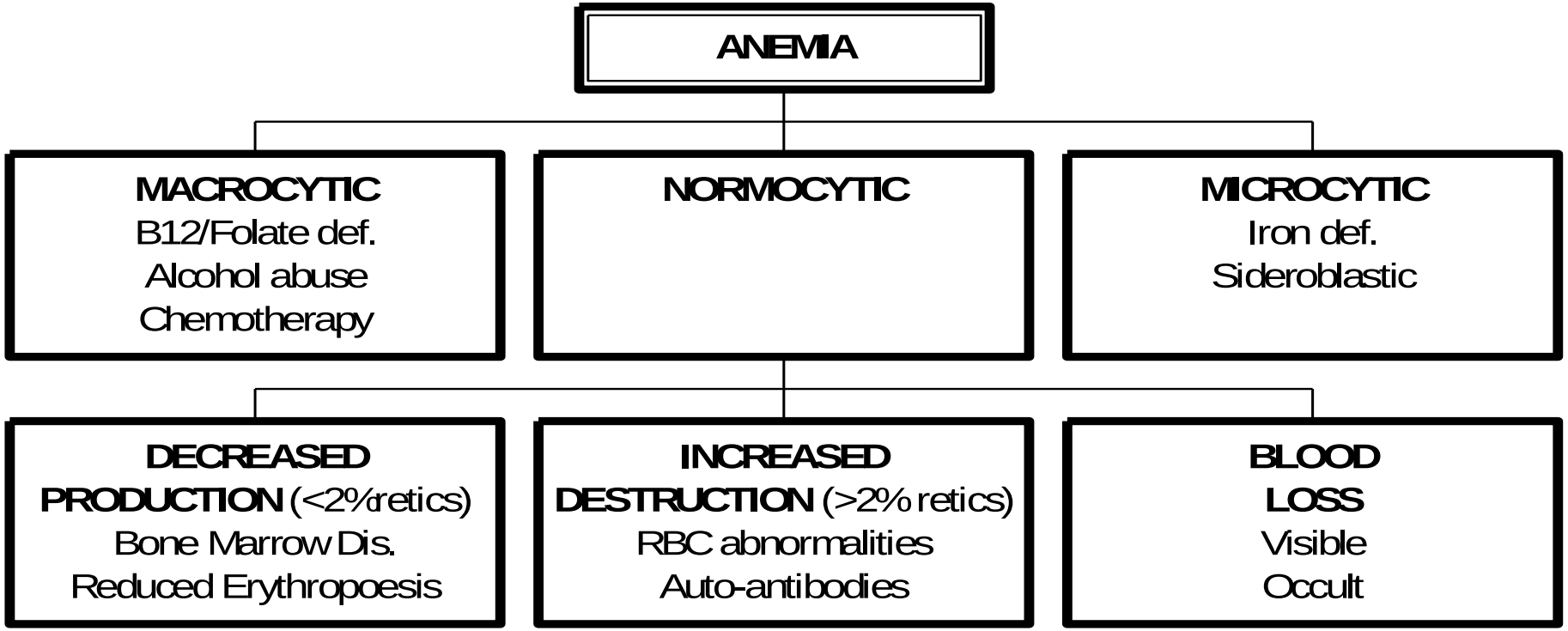
ANEMIA



Aplastic anemia/rbc aplasia
Myelodysplasia
Renal failure

Sickle cell Spherocytic Coombs pos.
Thalassemia HMO shunt Drug related
TTP/HUS

- Coderre S, McLaughlin K, Jenkins D. Qualitative differences in knowledge structure are associated with diagnostic performance in medical students. Adv Health Sci Educ Theory Pract 2009;14:677-84.
- McLaughlin K, Coderre S, Mortis G, Mandin H. Expert-type knowledge structure in medical students is associated with increased odds of diagnostic success. TLM 2007;19:35-41.
- Coderre S, Mandin H, Harasym P, Fick G. The effect of diagnostic reasoning on diagnostic success. Med Educ 2003;37:695-703.

Independent variable	*Baseline Level*	*OR (95% CI)*	*p. value*
Diagnostic reasoning			
Scheme-Inductive	Hypothetico-deductive	5.12 (2.65, 9.91)	<0.0001
Pattern Recognition	Hypothetico-deductive	10.34 (4.35, 24.58)	<0.0001
Pattern Recognition	Scheme-Inductive	2.02 (0.84, 4.84)	0.1148
Expertise			
Expert group	Non-expert group	7.69 (3.56, 16.58)	<0.0001
Clinical Presentation			
Nausea and vomiting	Liver enzymes	5.41 (2.09, 14.01)	0.0005
Diarrhea	Liver enzymes	1.04 (0.50, 2.15)	0.9108
Dysphagia	Liver enzymes	0.46 (0.22, 0.93)	0.0295

Hruska P, Hecker K, Coderre S, McLaughlin K, Cortese F, Doig C, Beran T, Wright B, Krigolson O. Hemispheric activation differences in novice and expert clinicians during clinical decision making. Adv Health Sci Educ Theory Pract 2016; 21: 921-33

Clinical decision-making engaged the prefrontal cortex (PFC) in both novices and experts

In novices we observed activations in left hemisphere neural regions associated with factual rule-based knowledge

In experts we observed right hemisphere activation in neural regions associated with experiential knowledge.

Conclusion

- When you are starting out as a chef: you need a cookbook!

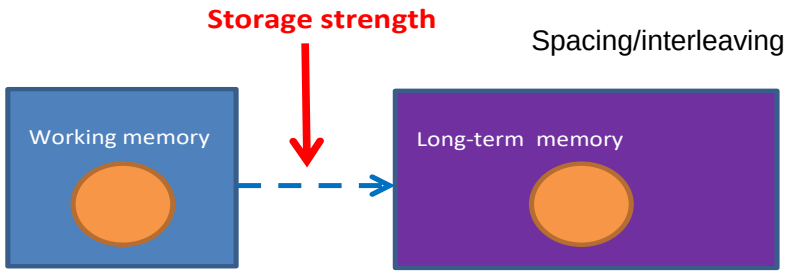
Building storage (encoding) strength

Provide Organizational structure

Improve encoding through “desirable difficulty”:

Improving understanding (causal explanations)

Spacing/interleaving content



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Coderre S, Ripstein I, Veale P, McLaughlin K. Are we failing to "build on the scientific basis of medicine"? CMEJ 2018; 9: e97-100.

Woods NN. Science is fundamental: the role of biomedical knowledge in clinical reasoning. *Med Educ*.2007;41:1173-7.

Rikers RMJP, Schmidt HG, Moulaert V. Biomedical knowledge: encapsulated or two worlds apart? *Appl Cog Psychol*. 2005;19:223–31.

Woods NN, Brooks LR, Norman GR. The value of basic science in clinical diagnosis: creating coherence among signs and symptoms. *Med Educ*. 2005;39*:*107-12.

The value of basic science in clinical diagnosis: creating coherence among signs and symptoms

Nicole N Woods, Lee R Brooks & Geoffrey R Norman

Table 1 Scores (percent correct) on the diagnostic test immediately after instruction and 1 week later

	Immediate		Delayed	
	Mean	**SD**	**Mean**	**SD**
Probability ($n = 18$)	0.54	0.16	0.43	0.17
General science (n = 18)	0.52	0.16	0.52	0.21

*Medical Education 2005; **39**: 107–112*

Burak K, Raman M, Paget M, Busche K, **Coderre S,** McLaughlin K. A mixed methods study on the effect of flipping the undergraduate medical classroom. Educ Sci 2017; 7:83.

Compared to students in the traditional classroom, students in the flipped classroom had

- *significantly lower mean (SD) ratings of their learning experiences (3.48 (1.10) vs. 4.50 (0.72), $p < 0.001$, $d = 1.10$)*
- *better performance on the hepatology content of the end-of-course examination (78.0% (11.7%) vs. 74.2 (15.1%), respectively, $p < 0.01$, $d = 0.3$).*

This is the "broccoli" of medical education

Making Things Hard on Yourself, But in a Good Way: Creating Desirable Difficulties to Enhance Learning

Elizabeth Ligon Bjork and Robert A. Bjork
University of California, Los Angeles

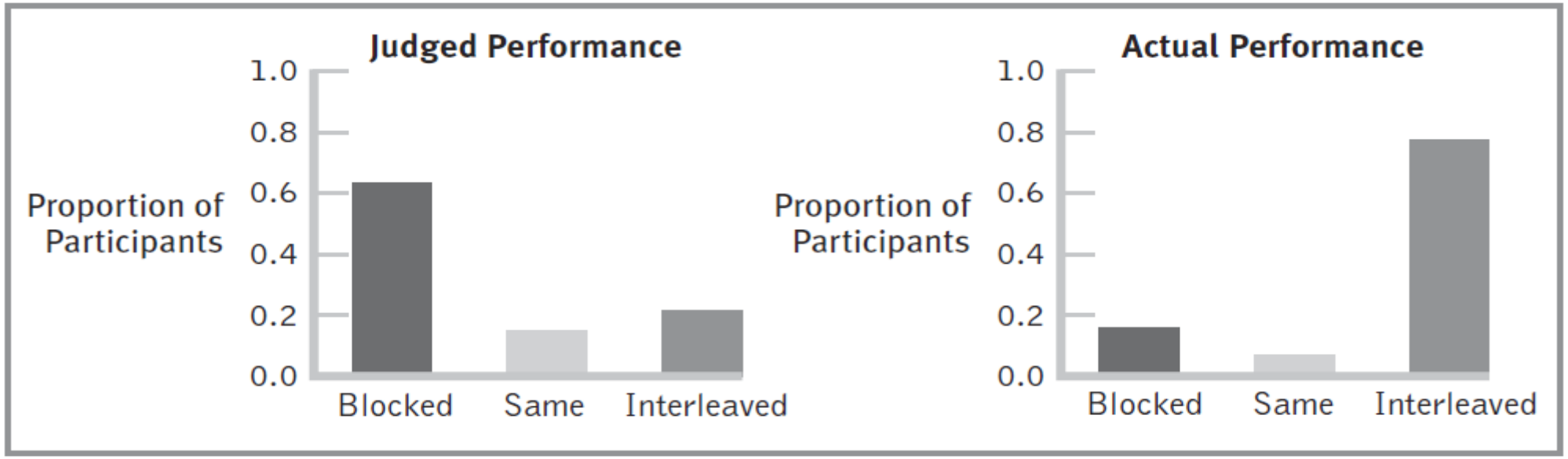

FIGURE 1 The left panel shows the proportion of participants who selected "blocked," "interleaved," or "the same" in response to the question: "Under which condition do you believe you learned better?" The right panel indicates the proportion of participants who actually performed better in the blocked or interleaved conditions or performed the same in the two conditions. (Kornell & Bjork, 2008)

http://bjorklab.psych.ucla.edu/pubs/EBjork_RBjork_2011.pdf

Building storage (encoding) strength

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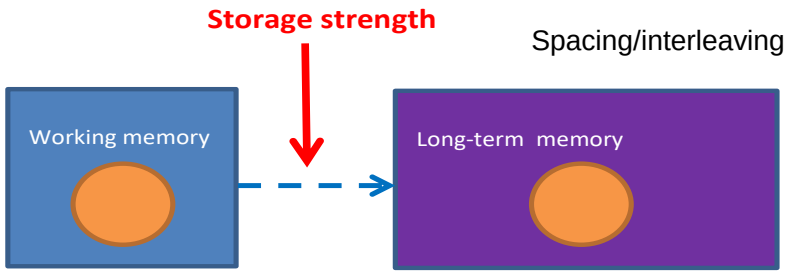
Improve encoding through “desirable difficulty”:

Improving understanding (causal explanations)

Spacing/interleaving content



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Building retrieval strength

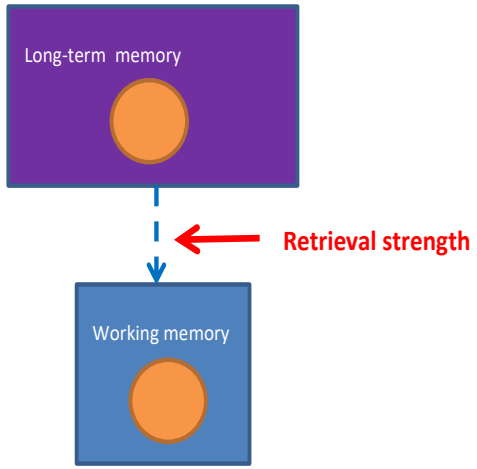
Improve retrieval through:

encoding in the retrieval context (more likely to retrieve in initial learning context matches retrieval context)

practicing retrieval (test-retest)

dispersing rather than block teaching

MOST DANGEROUS FIVE WORDS IN MEDICAL EDUCATION: “We have already covered that”.



Comparative effects of test-enhanced learning and self-explanation on long-term retention

Douglas P Larsen,[1] Andrew C Butler[2] & Henry L Roediger III[3]

Table 1 Mean proportions of correct answers on the initial learning tests in the testing with self-explanation (TE) and testing without self-explanation (T) conditions

Learning activity	Test 1	Test 2	Test 3	Test 4
TE	0.74	0.63	0.77	0.86
T	0.72	0.61	0.68	0.78

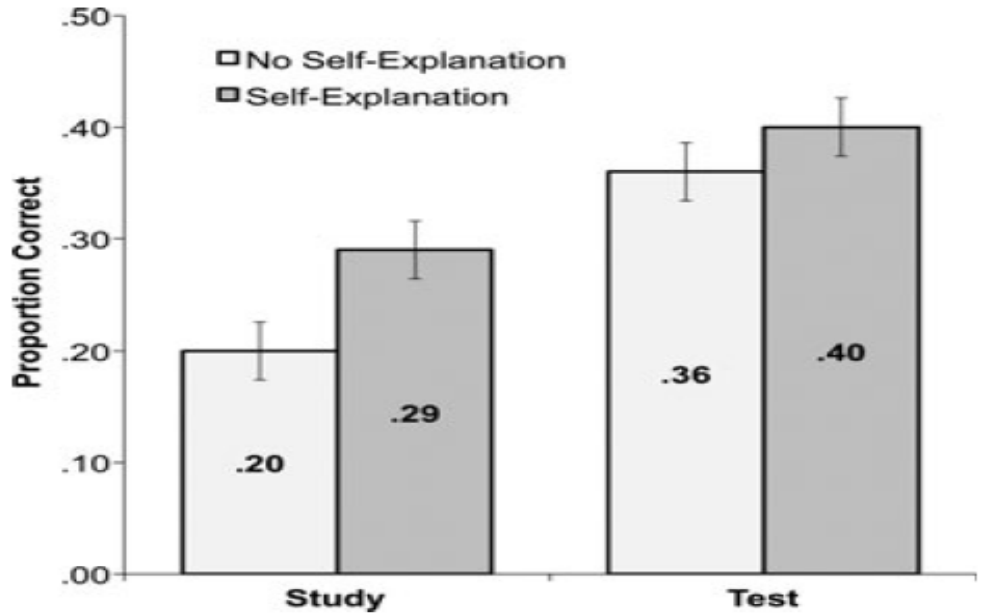


Figure 1 Mean proportions of correct answers on the final application test as a function of testing (test versus study) and self-explanation (self-explanation versus no self-explanation). Error bars represent 95% confidence intervals

McLaughlin K, Coderre S. The potential and conditional benefits of retrieval practice on learning. Adv Health Sci Educ Theory Pract 2015; 20: 321-4.

- Raman M, McLaughlin K, Rostom A, Violato C, Allard J, Coderre S. Teaching in small portions dispersed over time enhances long-term knowledge retention. Med Teach 2010;32:250-55.

Teaching in small portions dispersed over time enhances long-term knowledge retention

MAITREYI RAMAN[1], KEVIN MCLAUGHLIN[1], CLAUDIO VIOLATO[1], ALAA ROSTOM[1], JP ALLARD[2] & SYLVAIN CODERRE[1]

Table 2. Baseline, 1-week and 3-month test scores (%) post-curriculum delivery.

	Baseline test	One- week post	*P* Baseline vs. 1-week post	Three-month post	*P* Baseline vs. 3-month post
DD group (*N* = 10)	46.39 ± 6.14	81.67 ± 8.57	0.001	65.28 ± 9.88	0.02
MD group (*N* = 10)	53.75 ± 10.69	78.75 ± 4.43	0.001	58.93 ± 12.06	0.18

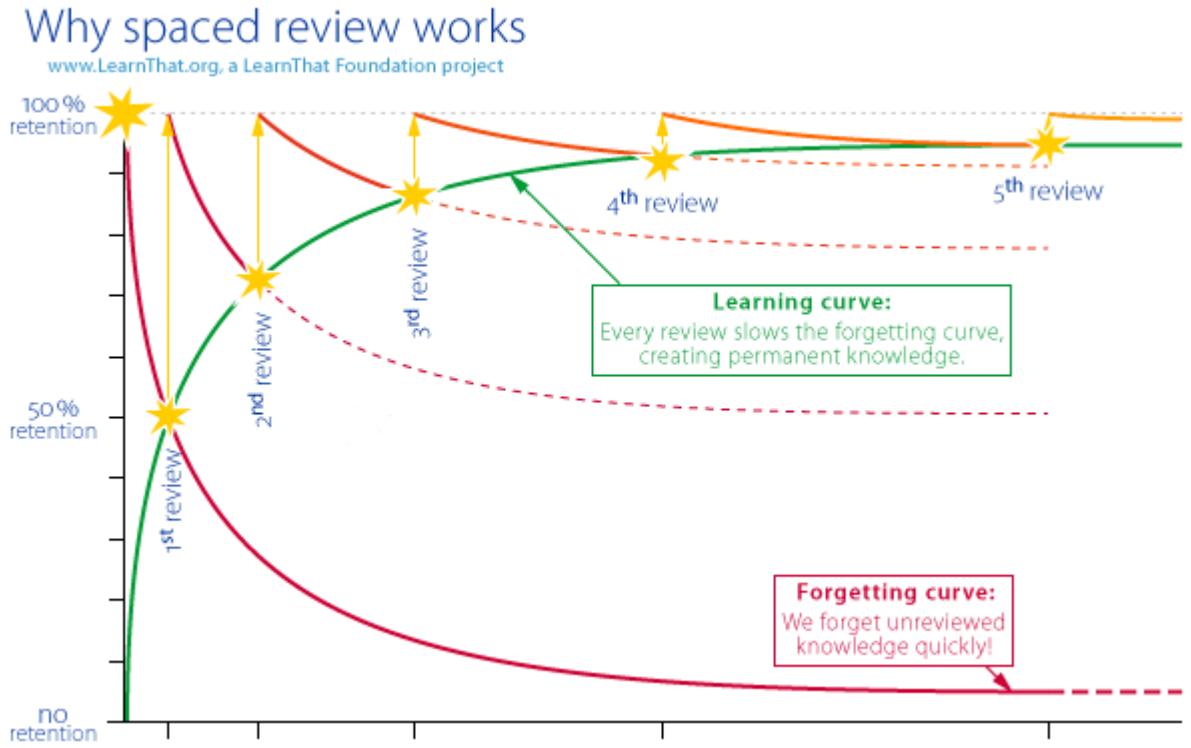
Proposed mechanisms:

Contextual variability

Study-phase retrieval

2010; 32: 250–255 MEDICAL TEACHER

Building storage strength through interleaving content



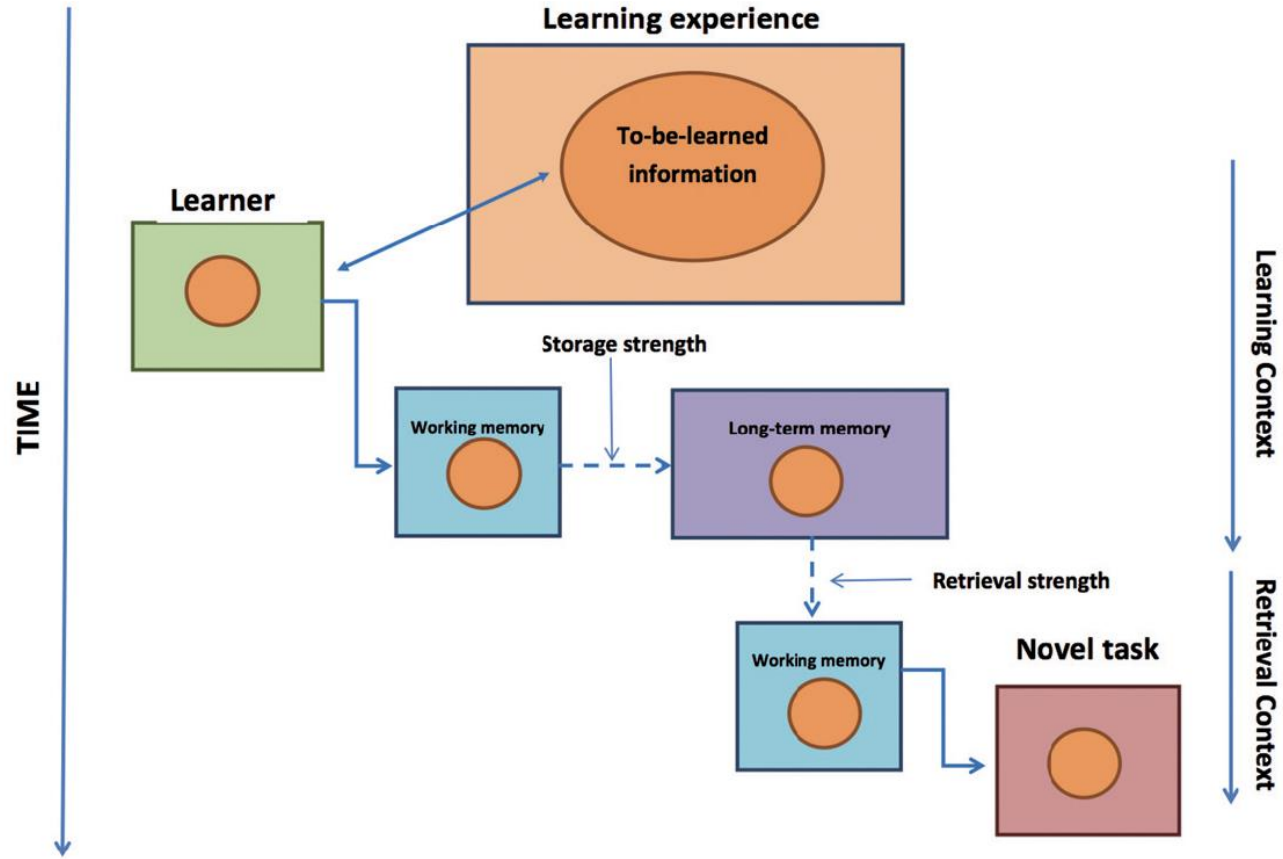


Figure 1. Steps involved in successful storage and retrieval of to-be-learned information.

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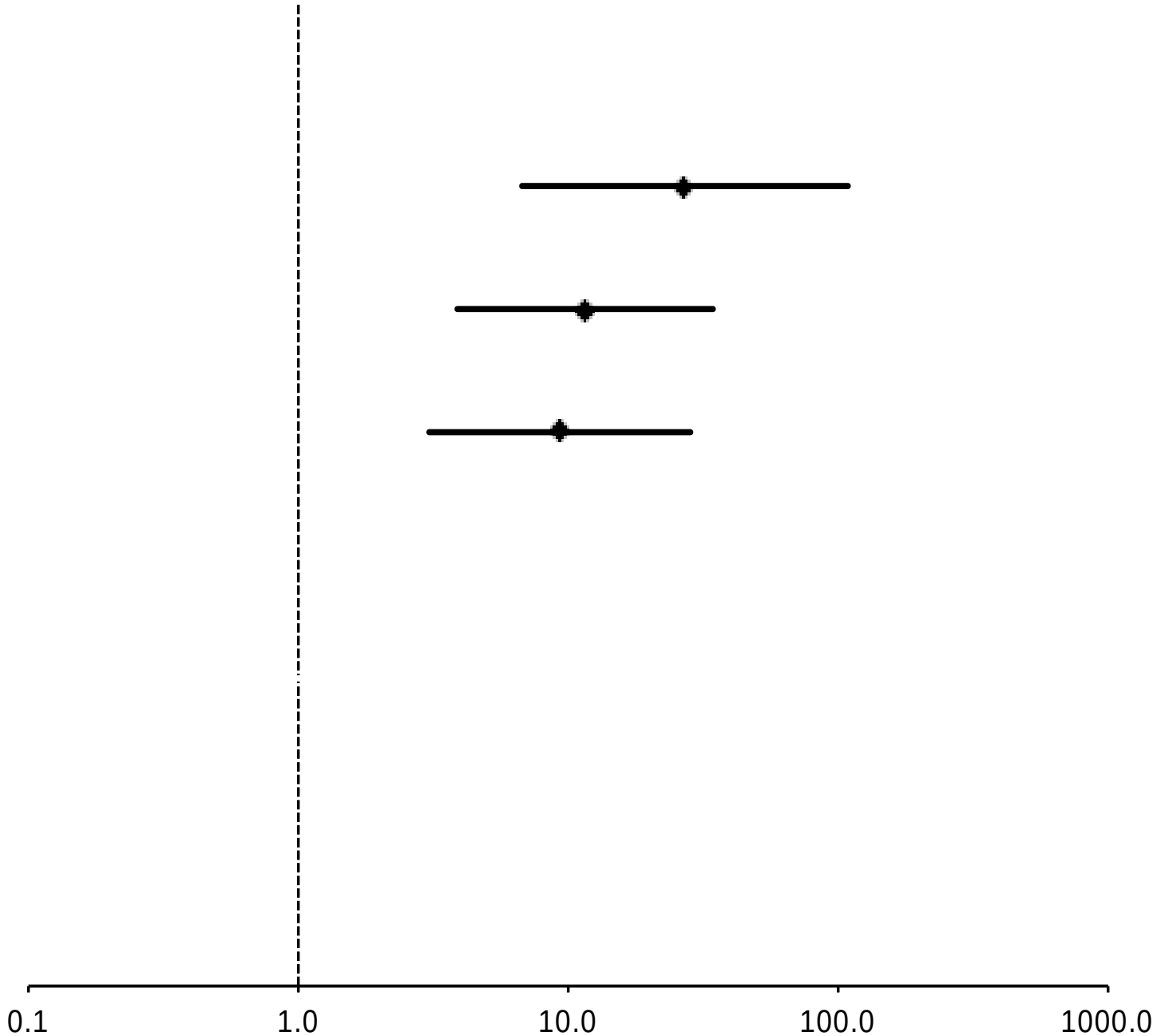
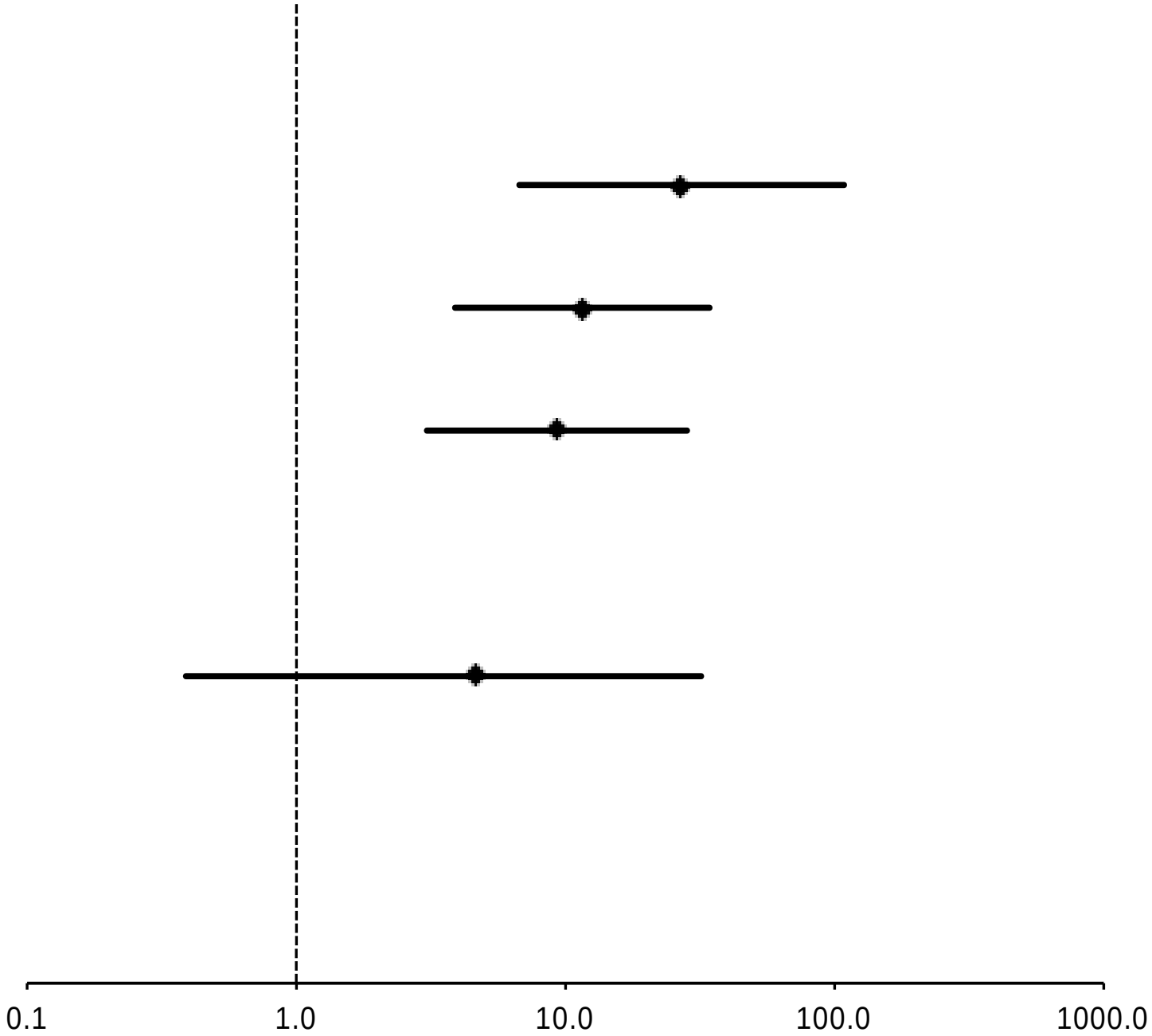


Graduating class	Odds Ratios (95% CI)	*p* value
Class of 2013	OR = 27.08 (6.74, 108.83)	**<0.001**
Class of 2014	OR = 11.68 (3.93, 34.72)	**<0.001**
Class of 2015	OR = 9.37 (3.08, 28.41)	**<0.001**



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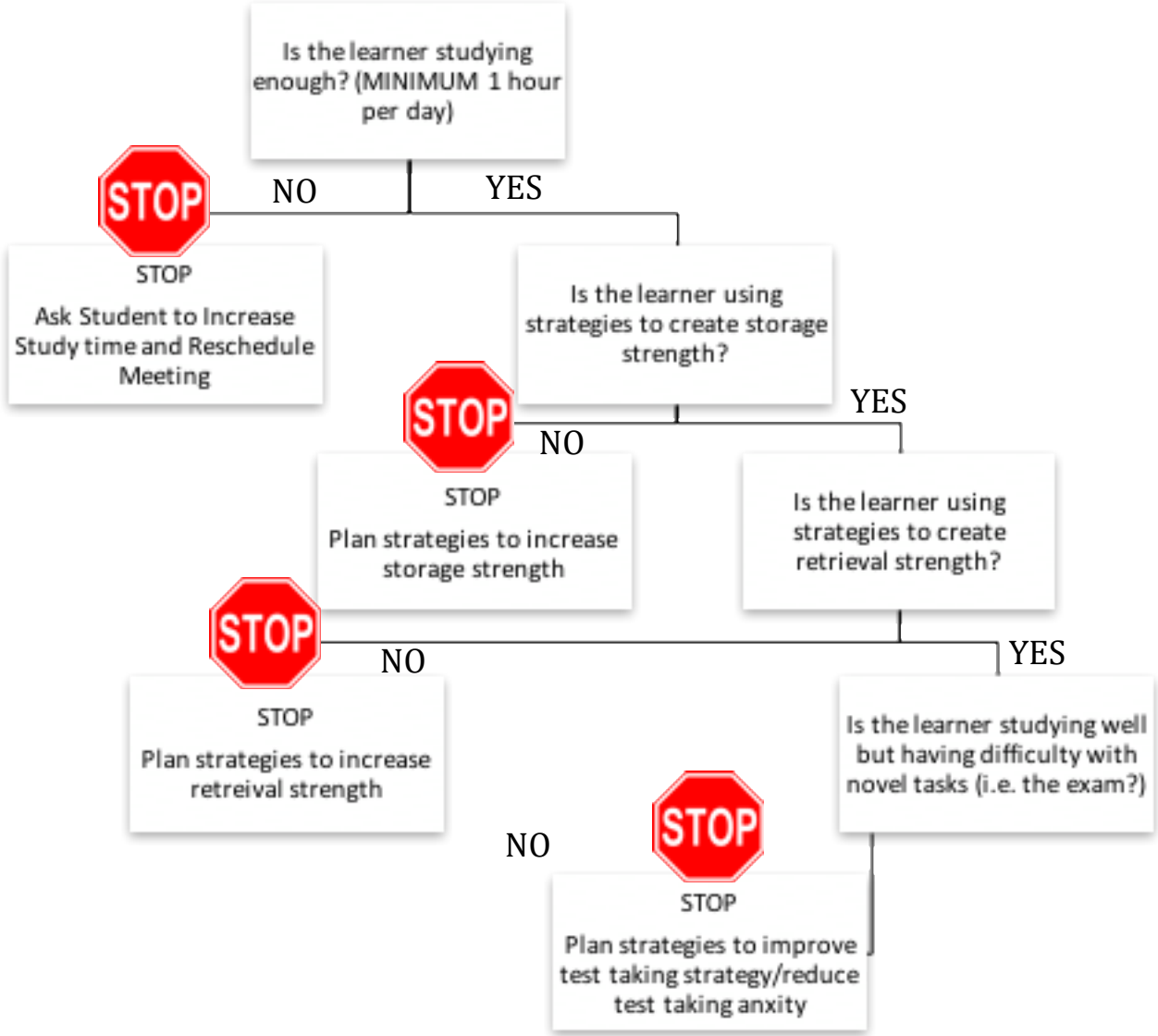
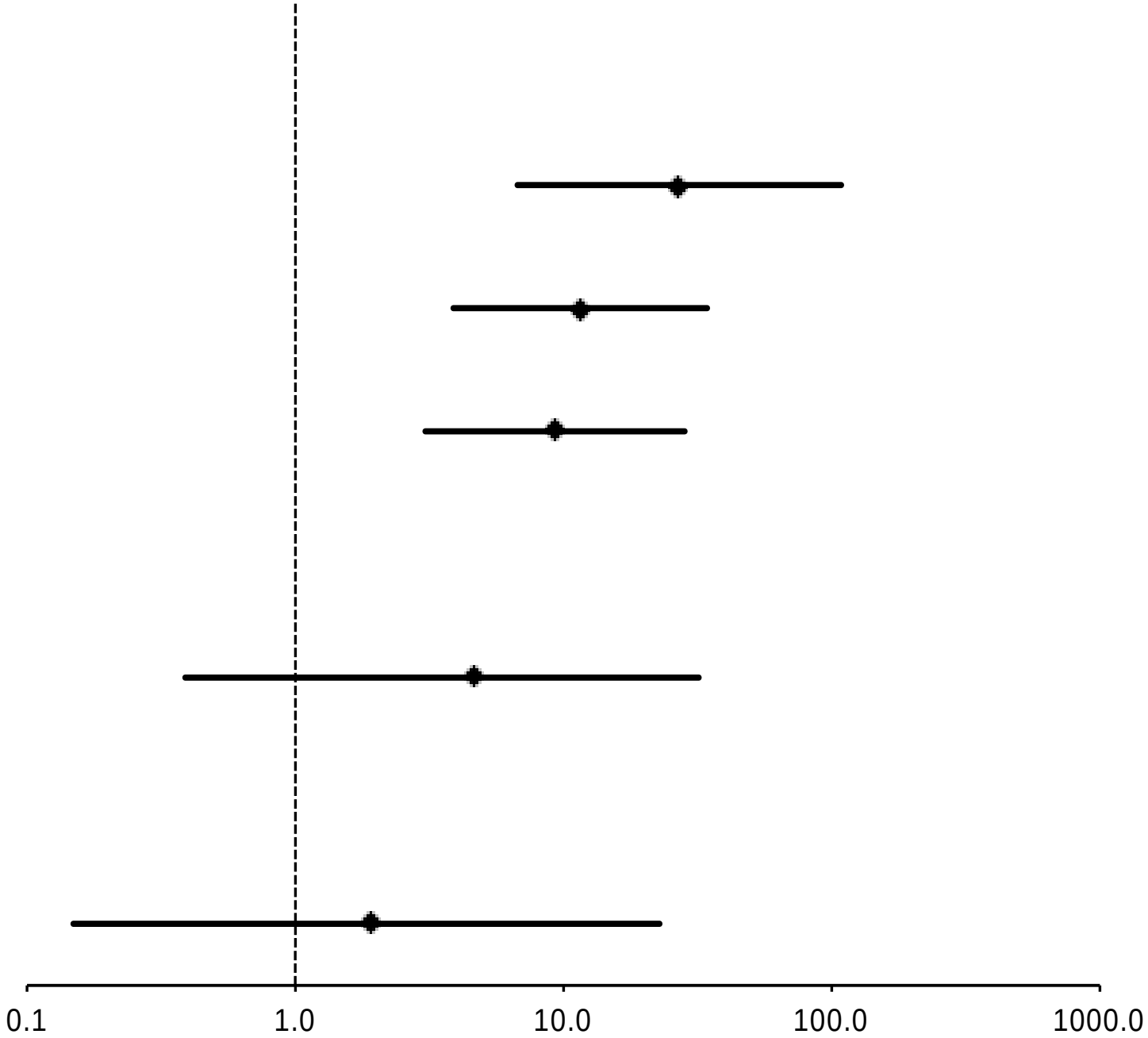
Class of 2016 *	OR = 4.63 (0.39, 31.89)	**0.06**

Odds ratio of MCC failure for students with preclerkship GPA<= 76 vs. GPA >76

* MCC Part 1 review course


Is the learner studying enough? (MINIMUM 1 hour per day)
NO
YES
STOP
STOP
Ask Student to Increase Study time and Reschedule Meeting
Is the learner using strategies to create storage strength?
STOP
NO
YES
STOP
Plan strategies to increase storage strength
Is the learner using strategies to create retrieval strength?
STOP
NO
YES
STOP
Plan strategies to increase retreival strength
Is the learner studying well but having difficulty with novel tasks (i.e. the exam?)
NO
STOP
STOP
Plan strategies to improve test taking strategy/reduce test taking anxity



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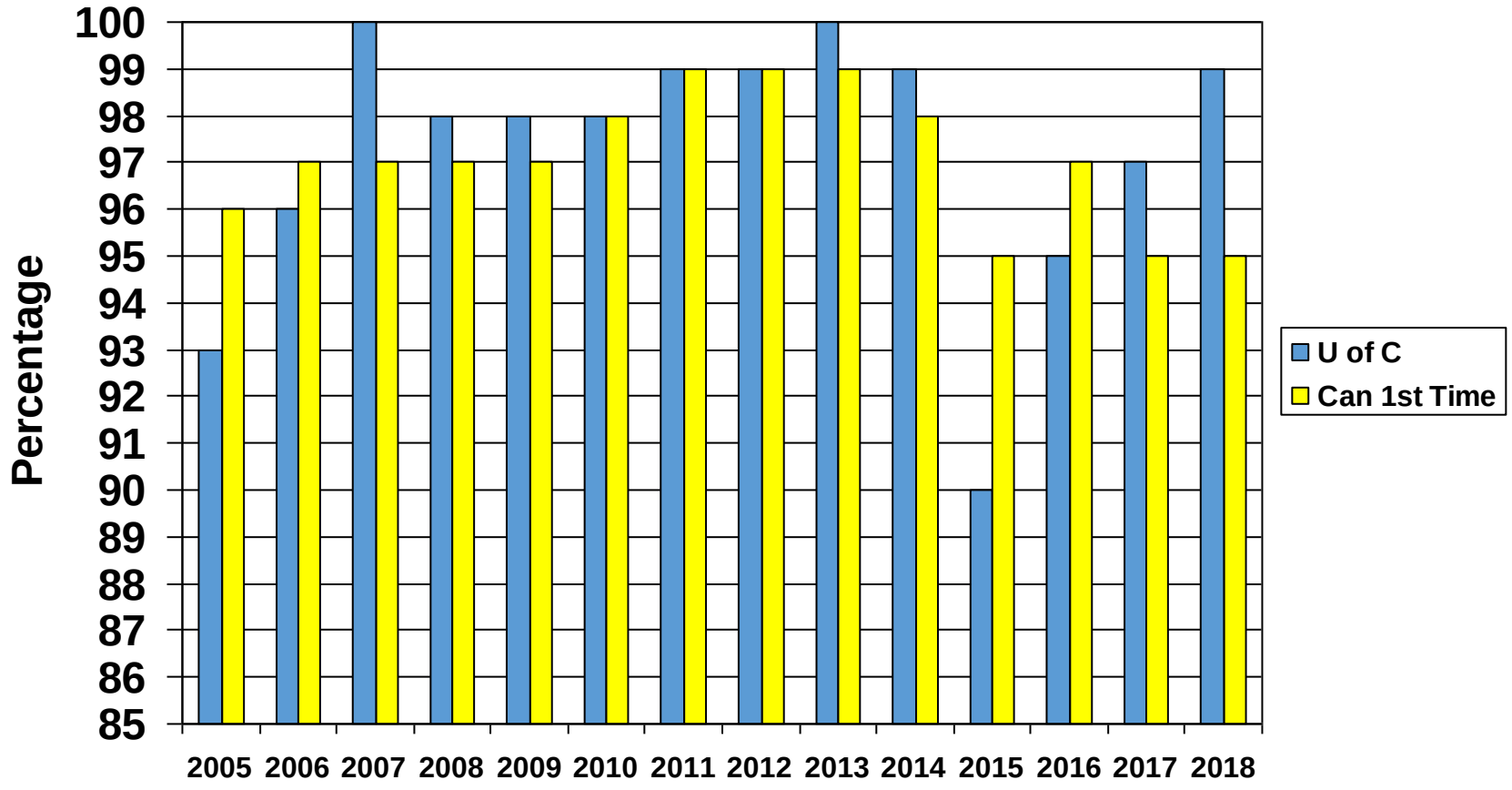
Class of 2017#	OR = 1.91 (0.15, 23.04)	**0.6**

* MCC Part 1 review course

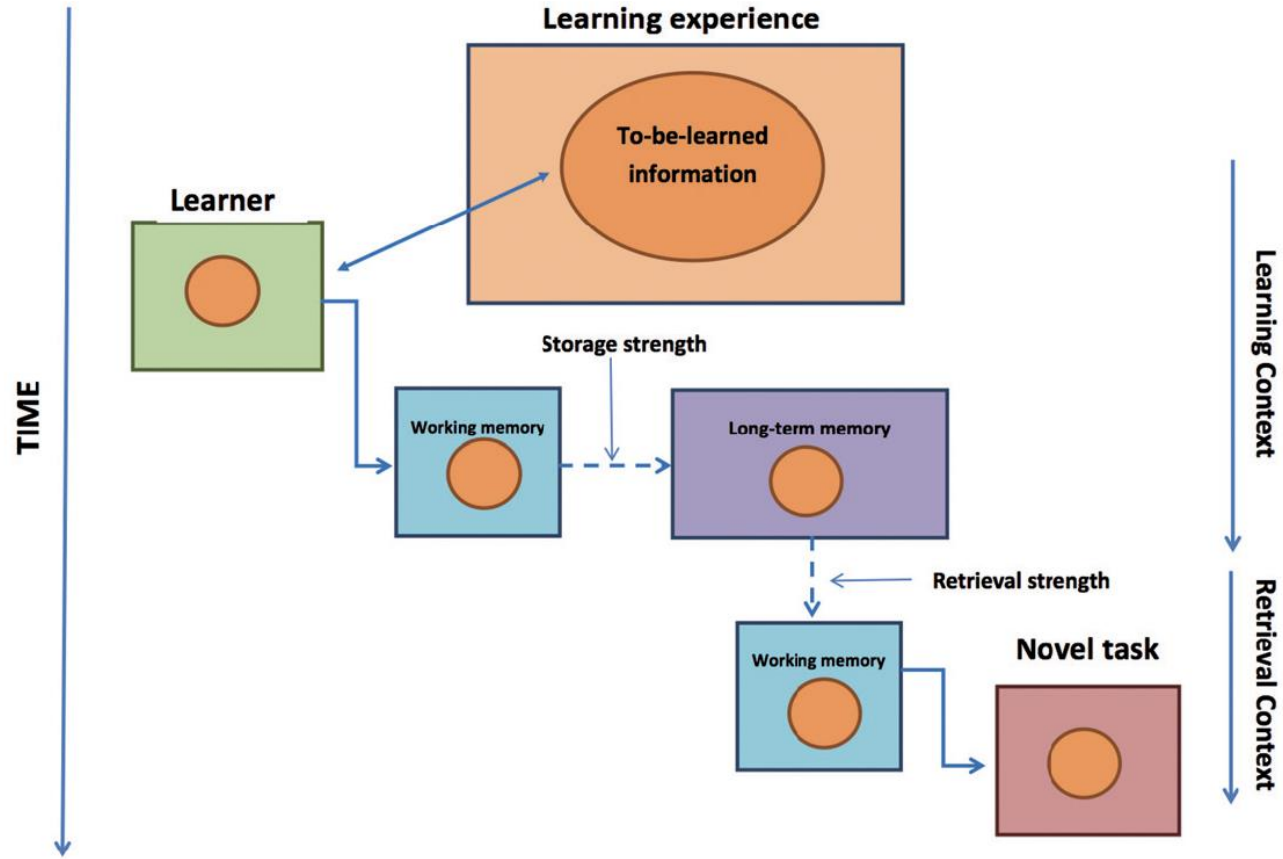
\# Academic mentoring for poorly performing students

Pass Rate on the MCC Part 1 Exam: Calgary vs. Canadian First-Time Test Takers



Data source: MCC

2015 pass score increased from 390 to 427; 2018 new exam/scoring format - pass score 226; M=250, SD 30



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Words of wisdom: 3 tips to be a better colleague

- Be kind and diligent
- Finish what you start
- Find someone great and ride their coattails! (KM)

Greg Hammond

The winners of the recent 50th Canadian Medical Inter-provincial Bonspiel, held in Edmonton, March 22 to 24 are, from left, Hilary Foltinek and skip Dr. Kelly Burak of Calgary, who are to be married this month, and Dr. Sylvain and Heidi Coderre, a couple recently moved from Quebec to Calgary who have taken up curling with great enthusiasm. This foursome outcurled 23 other teams.

Doctors' bonspiel still 'rocks' even after half a century

by Joe McAllister

EDMONTON | For years, doctors in Western Canada who curl have made a springtime habit of attending the Inter-provincial Bonspiel. In late March, this year, they made the trip to Edmonton to take part in the 50th anniversary edition of the event.

This year 24 teams participated, many of them mixed teams, said Dr. Greg Hammond of Winnipeg, who has been involved in the bonspiel for a number of years.

Teams are mainly composed of doctors, although not exclusively, since some spouses or partners also participate on the teams.

Four teams of residents or medical students were involved this year. Although most teams are from Western Canada, the bonspiel welcomes and encourages teams from Eastern Canada to participate.

Winners in the competitive A event get a crest and a traditional "blue blazer" to mount it on.

A highlight of this year's event was a social evening. It included a visit to Fort Edmonton with a traditional dinner that included buffalo stew, followed by cards and other games of chance.

The wrap-up banquet, where the trophies are presented, involved the telling of many tall tales from past bonspiels.

"It's a great combination of good competitive curling and fun with colleagues," wrote Dr. Hammond.

He regaled participants with memories of curlers like Dr. Harry Collins, described as a heavy hitter who always curled in natty galoshes, or Dr. Hal Richards, who curled five games in one day—one month after having old-fashioned gallbladder surgery.

Next year's bonspiel will take place in Saskatoon from April 3 to 5, 2008. Contact Dr. Brent Chappell, tel: (306) 477-1000 for more information. Curlers and cheerleaders are welcome.

Words of wisdom: 3 tips to be a better administrator

- Haste makes waste: be diligent in everything you do
- When unsure, decisions made on compassion (be kind) are rarely wrong (and harder to criticize!)
- Be transparent and always follow-up with people

Objectives

- Present a framework (one slide!) that applies for:
  - Teaching
  - Course design
  - Curricular design
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- Present some data (both local and others) supporting the framework
- 3 tips to being a better colleague
- 3 tips to being a better administrator