# TEAM-BASED LEARNING IN LARGE CLASSES: LESSONS LEARNT FROM SCALING, SUSTAINING AND COVID-19

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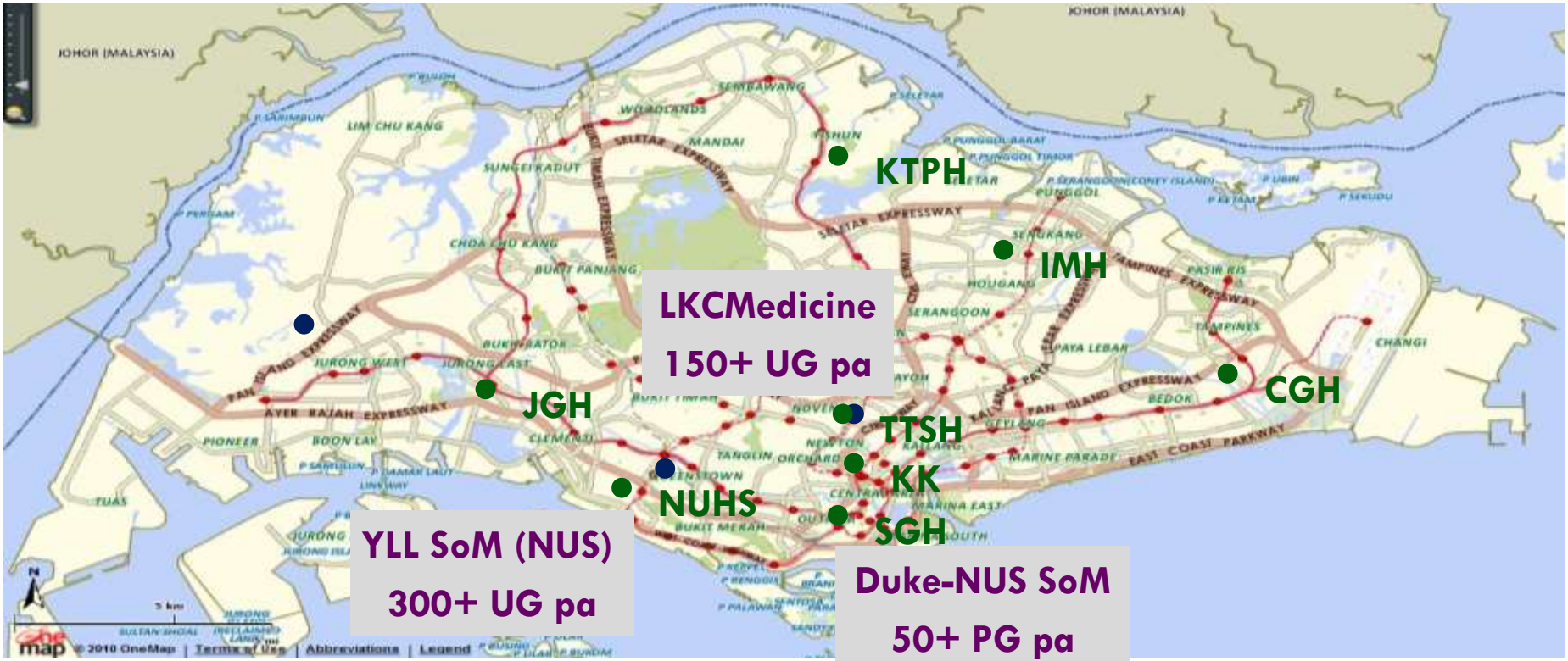
What are the students doing in the video?

A. Discussing the lecture
B. Doing a test
C. Studying for the final examination
D. Having fun

# Singapore Medical Schools pre-2013



# LEE KONG CHIAN SCHOOL OF MEDICINE

Joint medical school

5 year MBBS, developed collaboratively

Quality and regulatory standards of both institutions

18 year collaboration agreement

Imperial College London

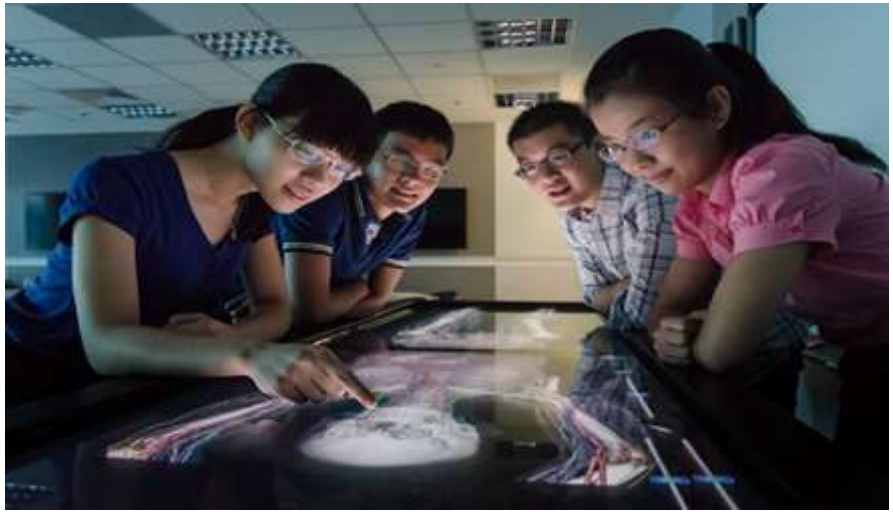
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

National Healthcare Group

# Years 1 & 2: Integrated Science in Context

| Y1 & Y2 | | | | | Exams |
|---|---|---|---|---|---|
| | Introduction to Medical Sciences | Cardiorespiratory | Renal & Endocrine | Musculoskeletal & Skin | |
| | GI, Blood & Infection | Neuro, ENT & Eyes | Reproductive Medicine & Child Health | Mental Health, Ageing & Family | |

# Technology for learning

# Innovative Anatomy Teaching

# LEARNING CLINICAL SKILLS

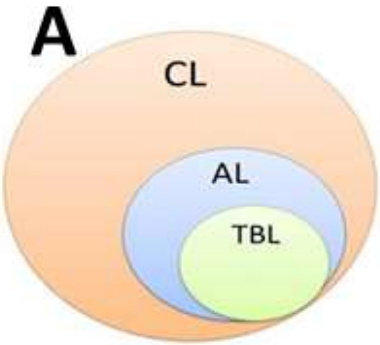
**Clinical Communication**

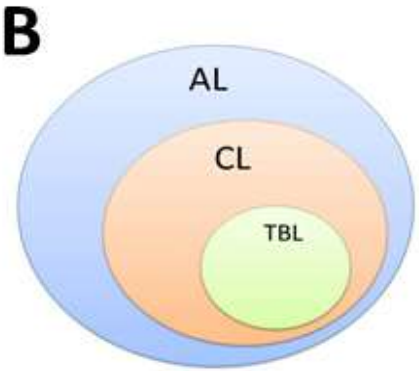
**Practical Skills**

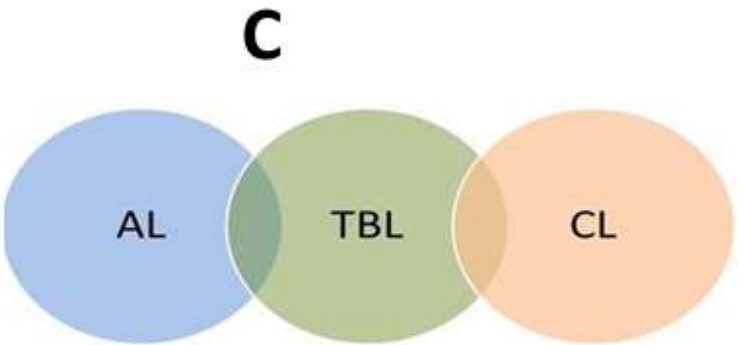
**Clinical Methods**

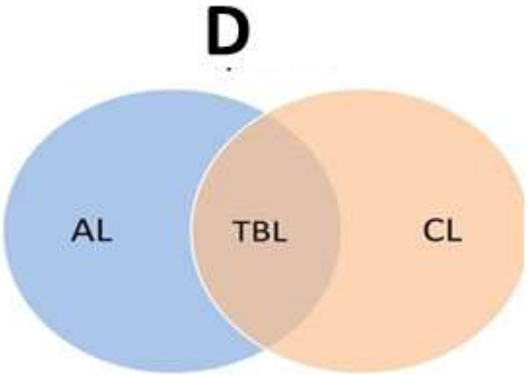

D
iRA
tRA
AE
Discussion &
Conclusion

# WHICH OF THE FOLLOWING DIAGRAMS BEST REPRESENTS THE RELATIONSHIP BETWEEN COLLABORATIVE LEARNING (CL), TEAM-BASED LEARNING (TBL) AND ACTIVE LEARNING (AL)?

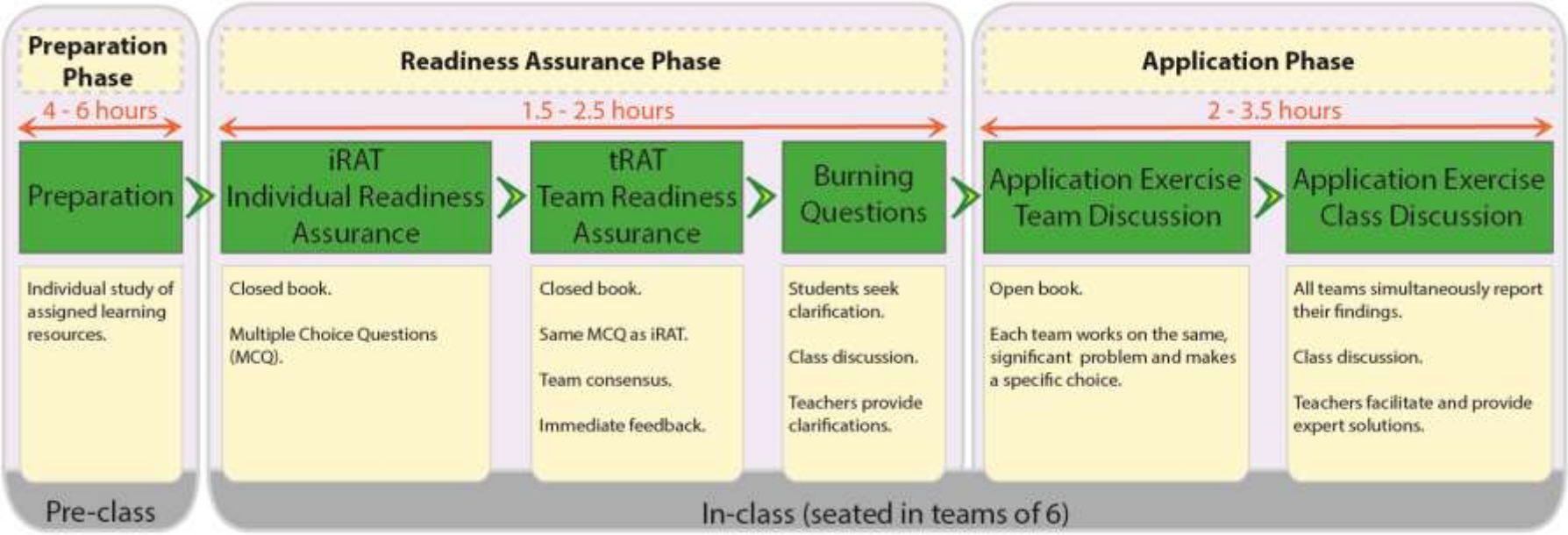


# OVERVIEW OF TBL PROCESS



# SETTING-UP AND SCALING TBL

# MENTI

What is a critical success factor for large scale TBL?

# IMPLEMENTING TBL ON A LARGE SCALE

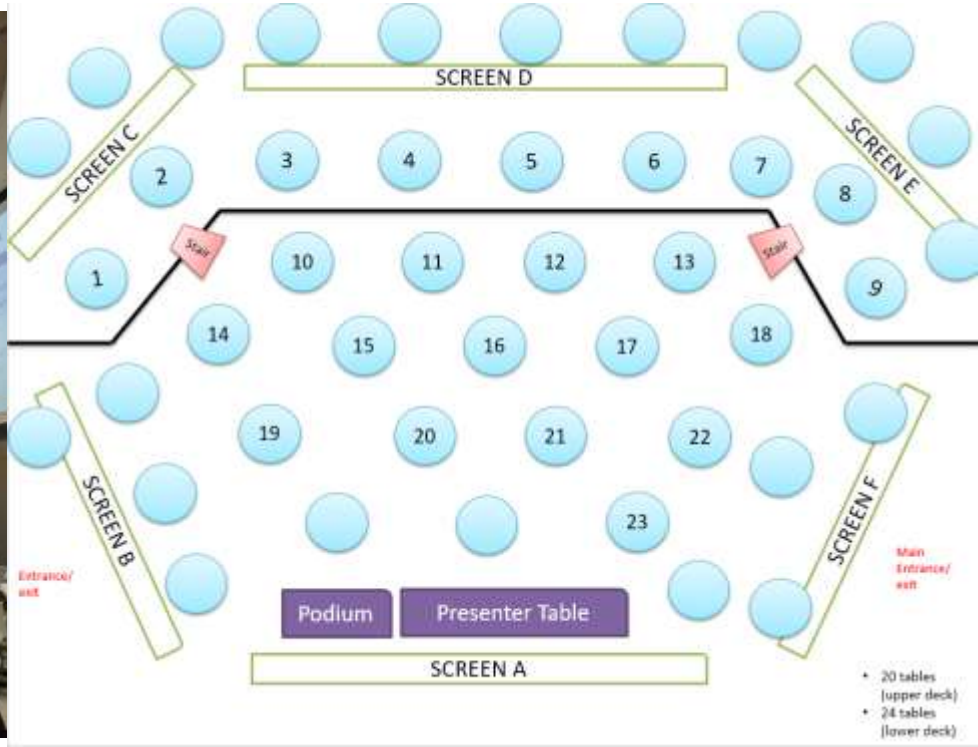
Rajalingam *et al.*, 2018

Team Centric Learning Spaces

Integrated Digital Learning Ecosystem

Team Teaching

# TEAM CENTRIC LEARNING SPACES



# MENTI

Where is the best pace to sit in this classroom?

A. In front near the presenter
B. At the back
C. Closer to either side
D. Anywhere but with front facing presenter

# INTEGRATED DIGITAL LEARNING ECOSYSTEM

# INTEGRATED DIGITAL LEARNING ECOSYSTEM IRAT (STUDENT VIEW)

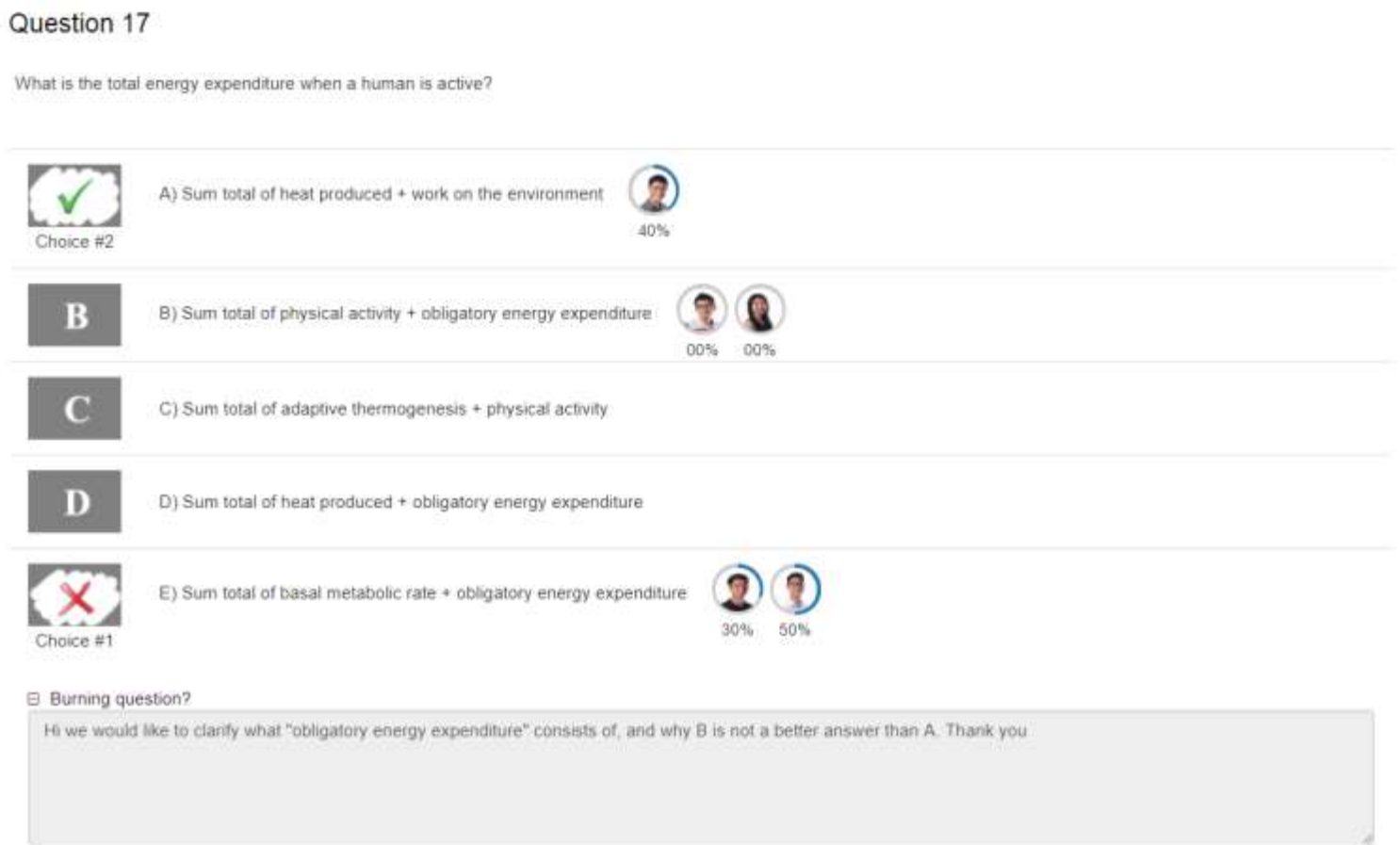
17) What is the total energy expenditure when a human is active?

- A) Sum total of heat produced + work on the environment
- B) Sum total of physical activity + obligatory energy expenditure
- C) Sum total of adaptive thermogenesis + physical activity
- D) Sum total of heat produced + obligatory energy expenditure
- E) Sum total of basal metabolic rate + obligatory energy expenditure

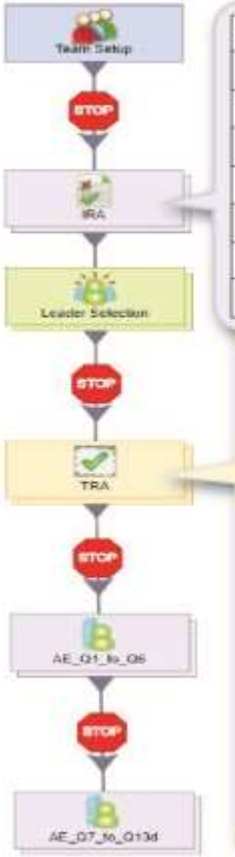
Confidence

0 50 100%

# INTEGRATED DIGITAL LEARNING ECOSYSTEM TRAT (STUDENT VIEW)



# INTEGRATED DIGITAL LEARNING ECOSYSTEM DASHBOARD (FACULTY VIEW)




| Question | A | B | C | D | N/A |
|---|---|---|---|---|---|
| 1 | 0% | 0% | 100% | 0% | 0% |
| 2 | 0% | 5% | 37% | 56% | 2% |
| 3 | 98% | 0% | 0% | 1% | 1% |
| 4 | 9% | 4% | 82% | 2% | 3% |
| 5 | 4% | 93% | 0% | 0% | 3% |
| 6 | 5% | 91% | 2% | 0% | 2% |
| 7 | 9% | 78% | 3% | 9% | 1% |

| | Question 1 | Question 2 | Question 3 | Question 4 | Question 5 |
|---|---|---|---|---|---|
| **Correct answer** | C | C | A | C | B |
| **Teams** | | | | | |
| Team_01 | C | D | A | C | B |
| Team_02 | C | D | A | C | B |
| Team_03 | C | D | A | C | B |
| Team_04 | C | D | A | C | B |
| Team_05 | C | D | A | C | B |
| Team_06 | C | C | A | C | B |
| Team_07 | C | C | A | C | B |
| Team_08 | C | C | A | C | B |
| Team_09 | C | D | A | C | B |

**Burning Questions**

**Application Exercise**

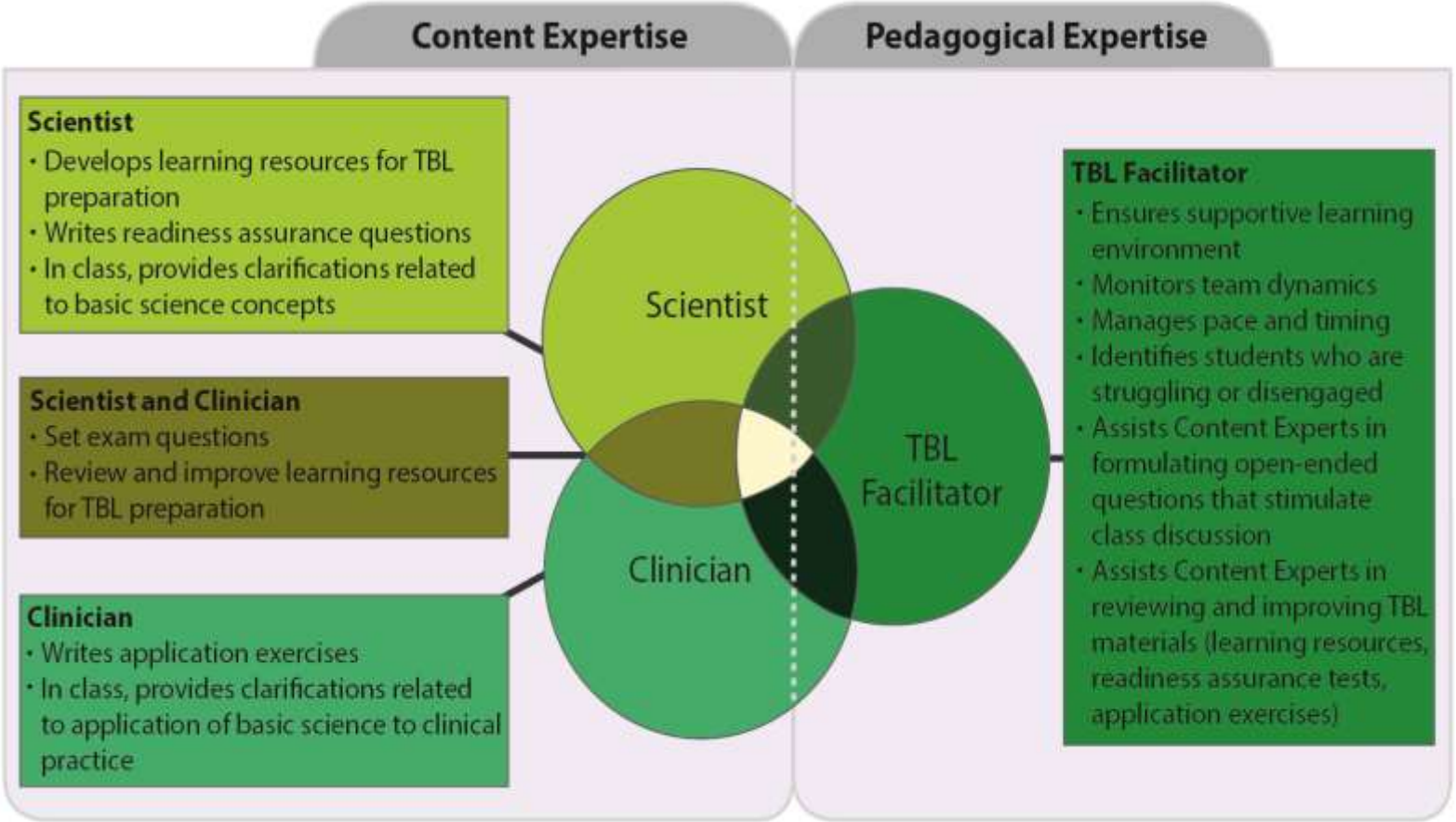
Q1) A histopathology sample is being looked at from a large bowel resection of a 64 year old man. How may apoptosis be distinguished from necrosis? [1]

| | | |
|---|---|---|
| Team 06 | How do you differentiate necrosis and Apoptosis since we have only learned differentiating them by the continuum of ATP present in the cell | 0 |

Q2) A histopathological sample is being examined and features consistent with programmed cell death without cellular oedema, but with cell lysis are seen. What mechanism of cell death BEST describes this? [7]

| | | |
|---|---|---|
| Team 01 | What distinguishes necrosis-like cell death from apoptosis-like cell death? | 0 |
| Team 02 | How do we determine if a PCD is necrosis-like or apoptosis-like? | 0 |
| Team 11 | What differentiates necrosis like cell death from apoptosis like cell death? | 0 |
| Team 12 | What is the difference between necrosis-like and apoptosis-like cell death? | 0 |
| Team 15 | May we get some clarification on the difference between apoptosis-like & necrosis-like PCD? | 0 |

# TEAM TEACHING (Yang and Rajalingam, 2019)

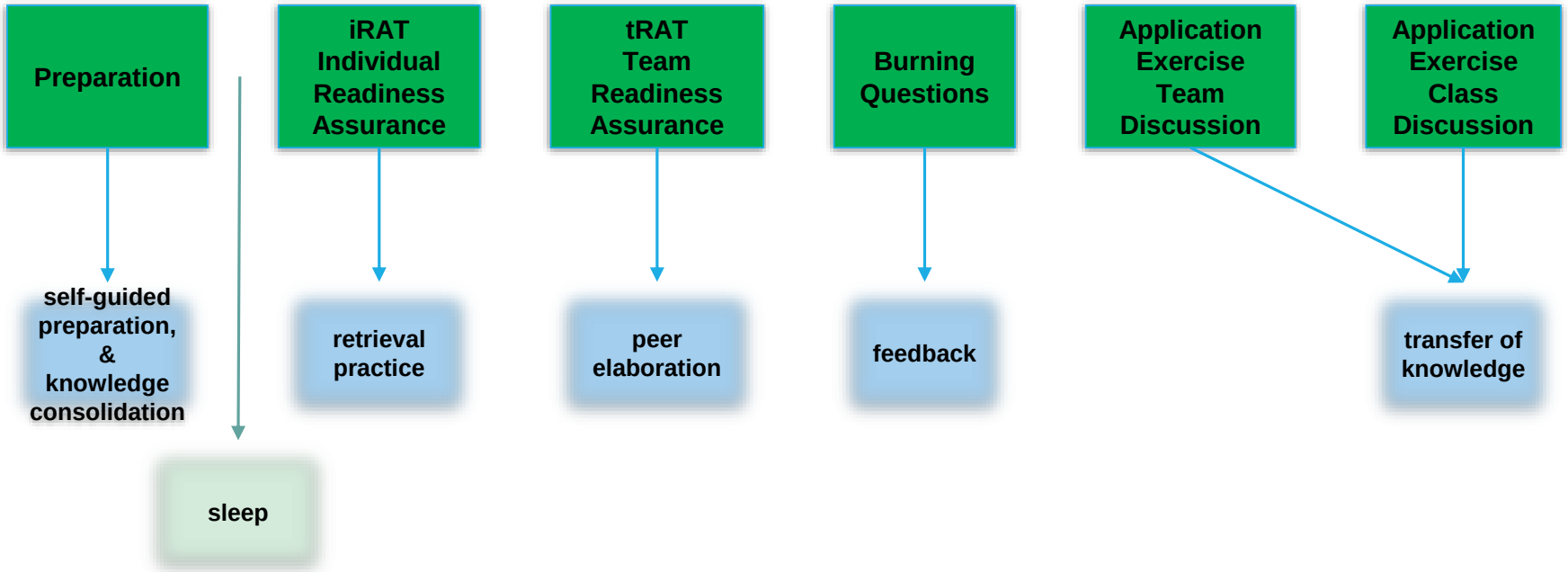


# UNDERSTANDING TBL

# MENTI

What is one educational or psychological process that underpins TBL?

# PSYCHOLOGICAL MODEL

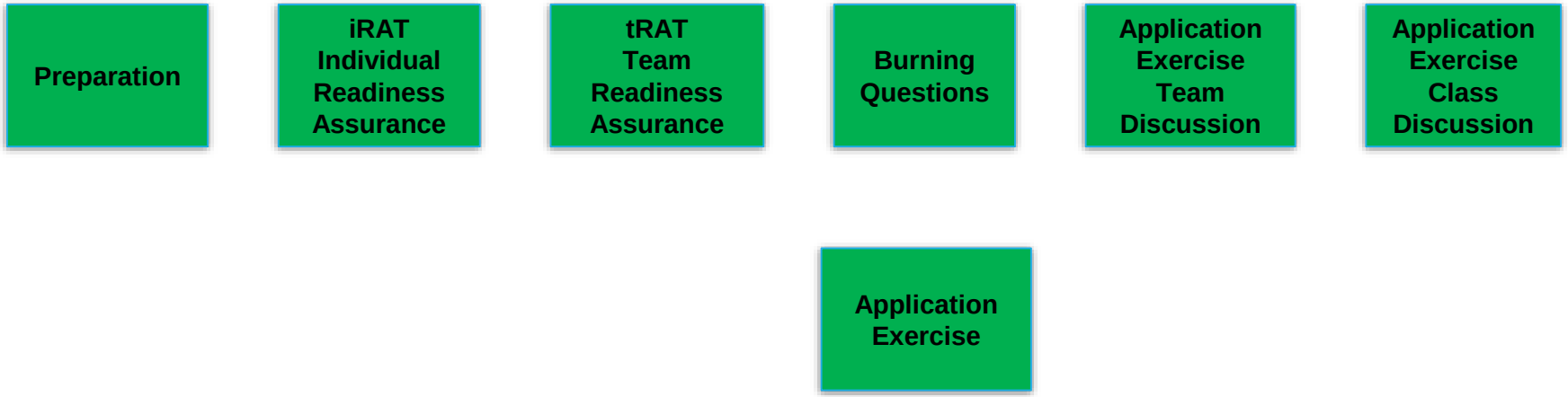



Ahn, H. S., Rotgans, J. I., Rajalingam, P., Lee, J. J. R., Koh, Y. Y. J., & Low-Beer, N. (2017).
Schmidt, H. G., Rotgans, J. I., Rajalingam, P., & Low-Beer, N. (2019)

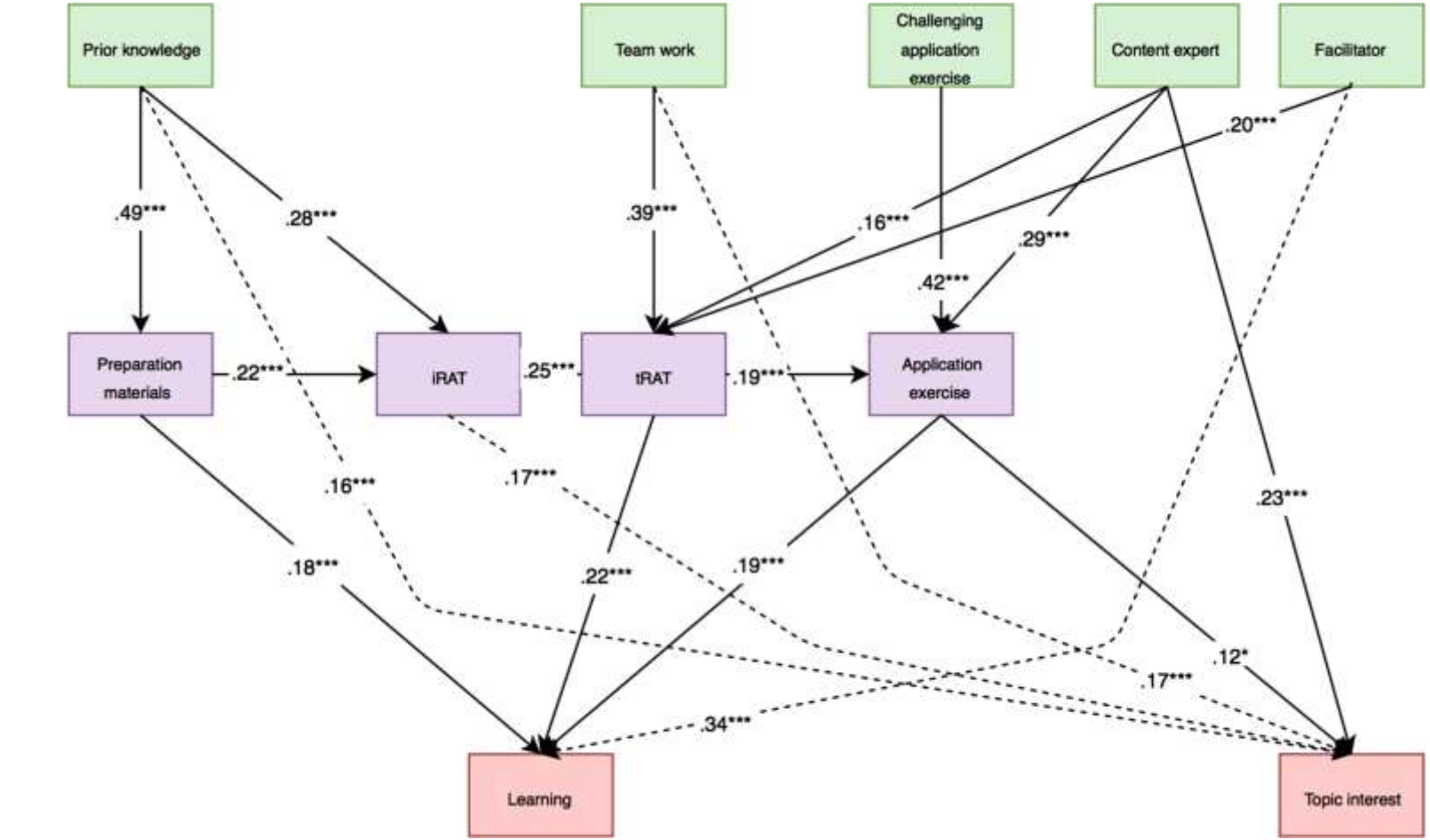
# MENTI

What do student thing is the most important process?

# STUDENT MODEL

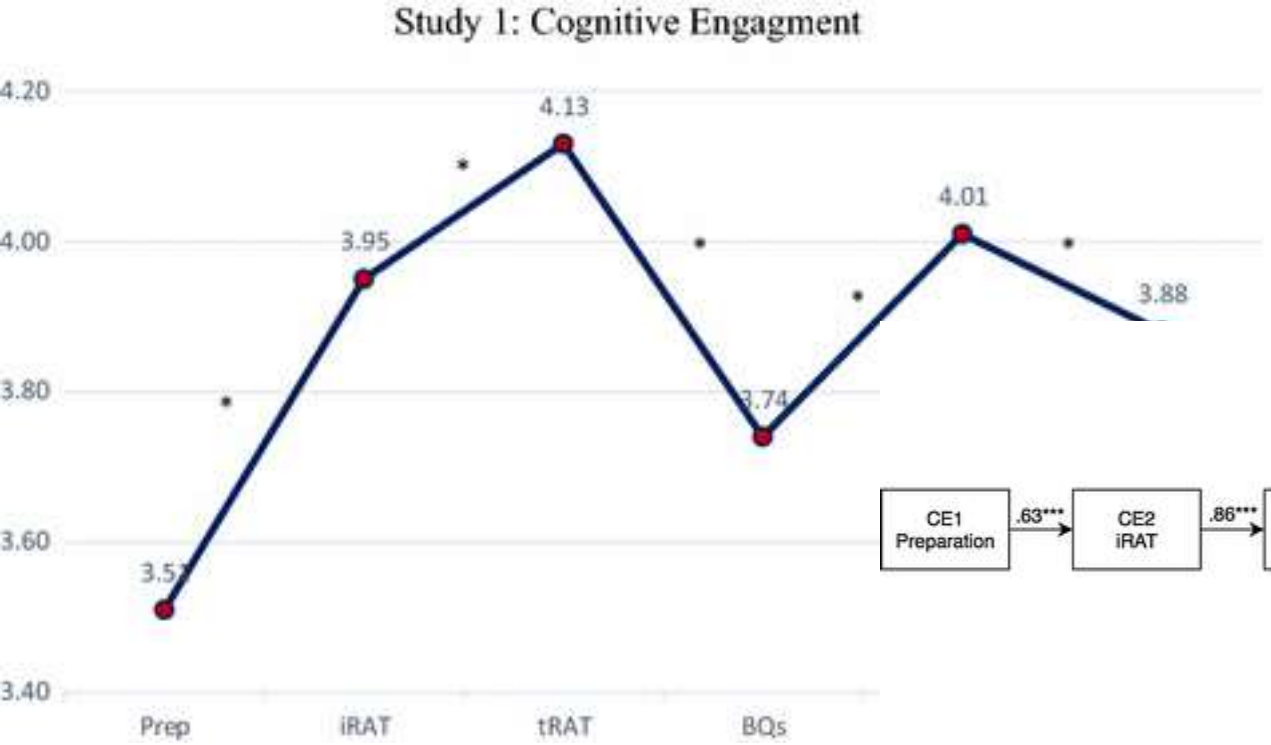


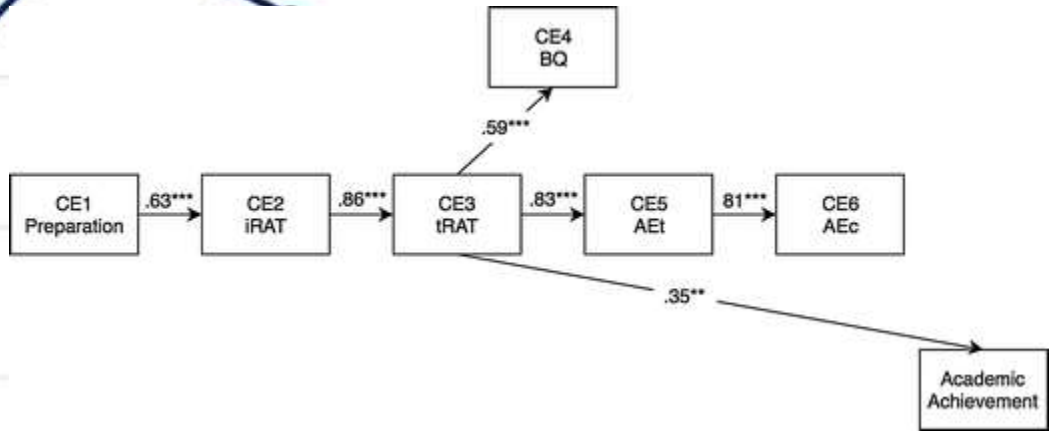

Rotgans, J. I., Rajalingam, P., Ferenczi, M. A., & Low-Beer, N. (2018). **A students' model of team-based learning.** Health Professions Education.




Rotgans, J. I., Rajalingam, P., Ferenczi, M. A., & Low-Beer, N. (2018). **A students' model of team-based learning.** Health Professions Education.

# COGNITIVE ENGAGEMENT



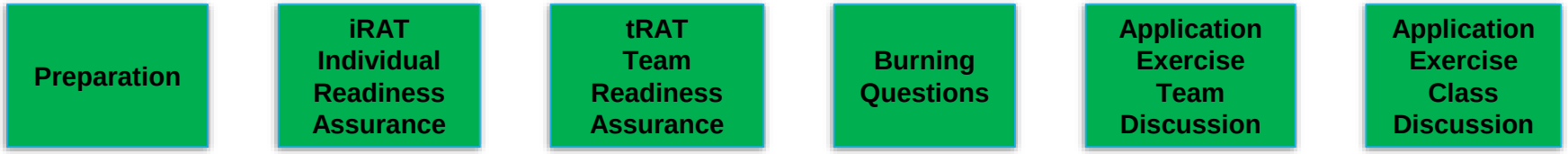

Rotgans, J. I., Schmidt, H. G., Rajalingam, P., Hao, J. W. Y., Canning, C. A., Ferenczi, M. A., & Low-Beer, N. (2017). **How cognitive engagement fluctuates during a team-based learning session and how it predicts academic achievement.** *Advances in Health Sciences Education*, 1-13.

# MENTI

Should students be graded for individual tests in TBL?

Yes / No

# GRADED VS UNGRADED




Koh, Y. Y. J., Rotgans, J. I., Rajalingam, P., Gagnon, P., Low-Beer, N., & Schmidt, H. G. (2019). **Effects of graded versus ungraded individual readiness assurance scores in team-based learning: a quasi-experimental study.** *Advances in Health Sciences Education*, 1-12.

**Table 1** Means and standard deviation of download frequency, iRAT and examination scores for three cohorts across 2 years

| Cohort | N | Year 1 | | | Year 2 | | |
|---|---|---|---|---|---|---|---|
| | | Dl Freq. | iRAT | Exam | Dl Freq. | iRAT | Exam |
| 2013 | 53 | 233.55 (99.96) | 79.59 (4.90) | 75.35 (6.34) | 241.74 (153.81) | 81.17 (3.97) | 71.23 (6.52) |
| 2014 | 78 | 208.65 (117.66) | 79.09 (5.05) | 74.66 (5.71) | 133.58 (116.56) | 76.94 (4.98) | 73.14 (6.56) |
| 2015 | 89 | 153.25 (86.39) | 74.98 (5.91) | 72.93 (6.50) | 102.05 (80.20) | 75.98 (5.74) | 69.99 (10.69) |

Dl Freq. = Download Frequency (i.e. the number of times the materials were downloaded). iRAT and examination scores are percentage scores (%). Standard deviations are in parentheses

Koh, Y. Y. J., Rotgans, J. I., Rajalingam, P., Gagnon, P., Low-Beer, N., & Schmidt, H. G. (2019). **Effects of graded versus ungraded individual readiness assurance scores in team-based learning: a quasi-experimental study.** *Advances in Health Sciences Education*, 1-12.

# BURNING QUESTIONS

Preparation

iRAT
Individual
Readiness
Assurance

tRAT
Team
Readiness
Assurance

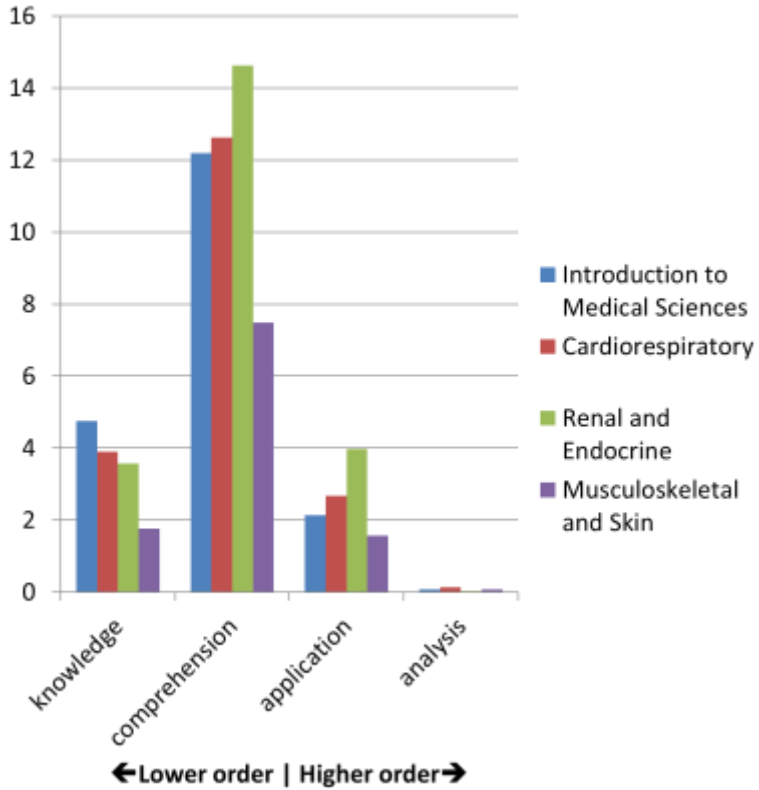
Burning
Questions

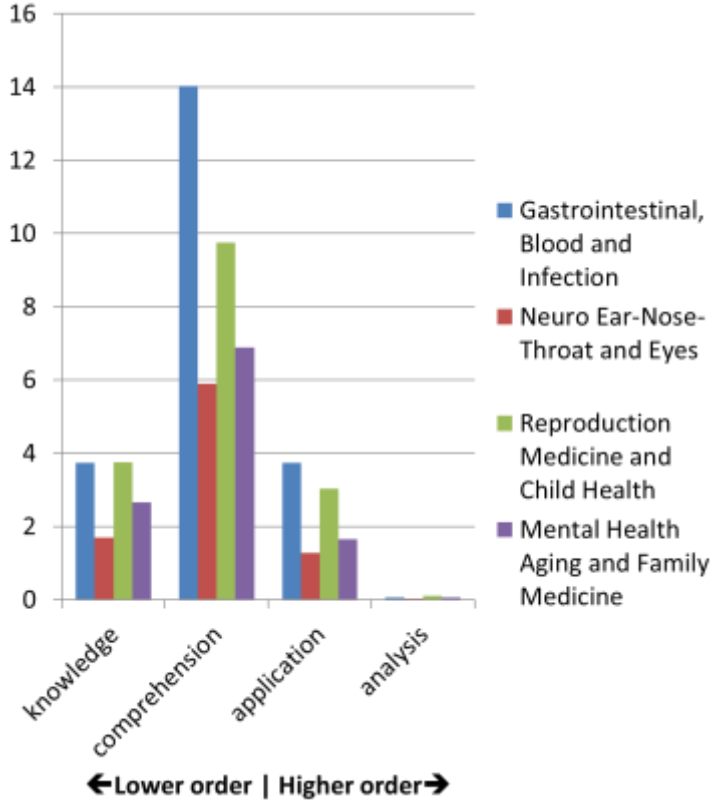
Application
Exercise
Team
Discussion

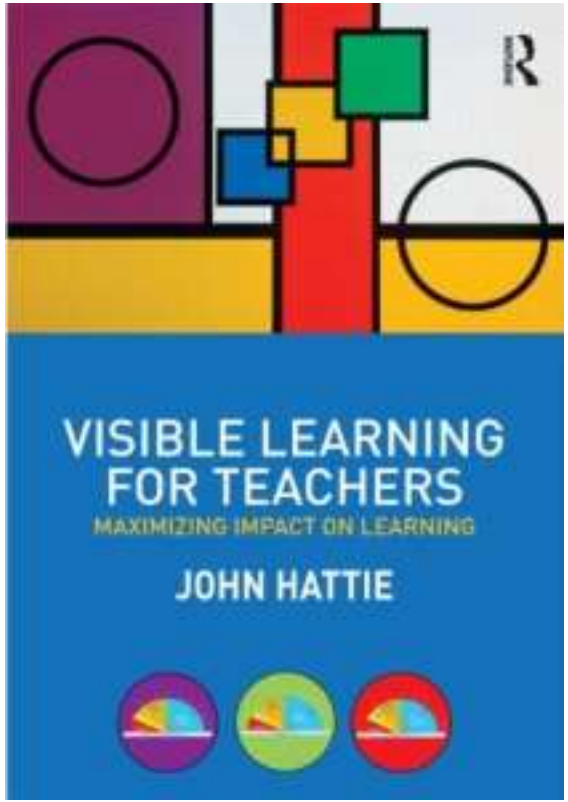
Application
Exercise
Class
Discussion

# MENTI

What percentage of questions asked by medical students are higher order questions?


16
14
12
10
8
6
4
2
0
knowledge
comprehension
application
analysis
Introduction to Medical Sciences
Cardiorespiratory
Renal and Endocrine
Musculoskeletal and Skin
←Lower order | Higher order→


16
14
12
10
8
6
4
2
0
knowledge
comprehension
application
analysis
Gastrointestinal, Blood and Infection
Neuro Ear-Nose-Throat and Eyes
Reproduction Medicine and Child Health
Mental Health Aging and Family Medicine
←Lower order | Higher order→




“The remarkable feature of the evidence is that the greatest effects on student learning occur when teachers become learners of their own teaching, and when students become their own teachers”

over 800 meta-analyses (over 50,000 studies)

# REFERENCES


Ahn, H. S. *et al*. (2017) 'Assessing How Students Learn in Team-Based Learning: Validation of the Knowledge Re-Consolidation Inventory', *Health Professions Education*, 3(2), pp. 118–127. doi: 10.1016/j.hpe.2017.10.001.

Freeman, S. *et al*. (2014) 'Active learning increases student performance in science, engineering, and mathematics', *Proceedings of the National Academy of Sciences*. National Acad Sciences, 111(23), pp. 8410–8415.

Hattie, J. (2015) 'The applicability of Visible Learning to higher education.', *Scholarship of Teaching and Learning in Psychology*. Educational Publishing Foundation, 1(1), p. 79.

Kirkwood, A., & Price, L. (2016). Technology-enabled learning implementation handbook.

Koh, Y. Y. J. *et al*. (2019) 'Effects of graded versus ungraded individual readiness assurance scores in team-based learning: a quasi-experimental study', *Advances in Health Sciences Education*. Springer Netherlands, 24(3), pp. 477–488. doi: 10.1007/s10459-019-09878-5.

Rajalingam, P. *et al*. (2018) 'Implementation of team-based learning on a large scale: Three factors to keep in mind*', *Medical Teacher*, 40(6), pp. 582–588. doi: 10.1080/0142159X.2018.1451630.

Rajalingam, P., Koh, Y. Y. J., Rotgans, J. I., Gagnon, P., Low-Beer, N. (2019). Evaluating the Quality of Student-Generated Questions in an Undergraduate Medical Program That Uses Team-Based Learning. In 2019 Annual Meeting of the American Educational Research Association, Toronto, Canada

Rotgans, J. I. *et al*. (2018) 'How cognitive engagement fluctuates during a team-based learning session and how it predicts academic achievement', *Advances in Health Sciences Education*, 23(2), pp. 339–351. doi: 10.1007/s10459-017-9801-2.

Schmidt, H. G. *et al*. (2019) 'A Psychological Foundation for Team-Based Learning: Knowledge Reconsolidation', *Academic medicine : journal of the Association of American Medical Colleges*. LWW, 94(12), pp. 1878–1883. doi: 10.1097/ACM.0000000000002810.

Yang, L. and Rajalingam, P. (2019) 'Are Two Teachers Better than One? Team Teaching in TBL', *Medical Science Educator*. Springer US, pp. 1–5. doi: 10.1007/s40670-019-00828-9.