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# TEACHING DEVELOPMENT PROJECT: ENHANCING STUDENTS' LEARNING THROUGH TEAM-BASED LEARNING (TBL)

## PROJECT TEAM:

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# ACKNOWLEDGEMENT

- Teaching Development Grant awarded to the speakers (T0174).
- Research Assistant: Ms Maggie Qiao
- Advisor: Dr. Fraide Ganotice
- Students who participated in the project

# OUTLINE

- TBL as an innovative pedagogy
- Findings of the TDG project
- Application of TBL in Psychology course

# WHAT IS TEAM-BASED LEARNING?

- Team-based learning (TBL) was developed in the 1970's by Prof. Larry K. Michaelsen, a Professor of Management at the University of Oklahoma
- His goal: to change the passive learning in his lectures into *active learning* by testing and assigning students to teams.



# PEDAGOGICAL MERITS OF TBL AS SUGGESTED BY EMPIRICAL LITERATURE

To date, the empirical findings about TBL effectiveness can be summarized as:

- lower failure rate (Anwar et al, 2012)
- enhanced emotional intelligence (Borges et al, 2012)
- interactive behaviors in teamwork (Chung et al, 2009)
- increased engagement (Drummond, 2012).

# TBL INSTRUCTIONAL ACTIVITY SEQUENCE

Phase 1: Preparation (pre-class)	Phase 2: Readiness Assurance Process (in-class)	Phase 3: Application of Course Content
<p>Individual study:</p> <ul style="list-style-type: none"><li>• Textbook</li><li>• Journal articles</li><li>• PPT</li><li>• Video clips</li></ul>	<p>Individual Test (iRAT)</p> <p>Team Test (tRAT)</p> <p>Appeal</p> <p>Mini-lecture</p>	<p>4-S</p> <ul style="list-style-type: none"><li>• Same problem</li><li>• Significant problem</li><li>• Specific choice</li><li>• Simultaneous reporting</li></ul>

## TBL

Gain basic  
facts and  
concepts

Reading and  
readiness  
Assessment

Apply  
concepts

Application activities

## Traditional classroom

Gain basic  
facts and  
concepts

Lectures

Apply  
concepts

Application exercise  
/assessment

## FORMING GROUPS

TBL practitioners can refer to the following four principles to strategically form groups (Michaelson, 2002).

- Transparent
- Heterogeneous
- Even
- Permanent

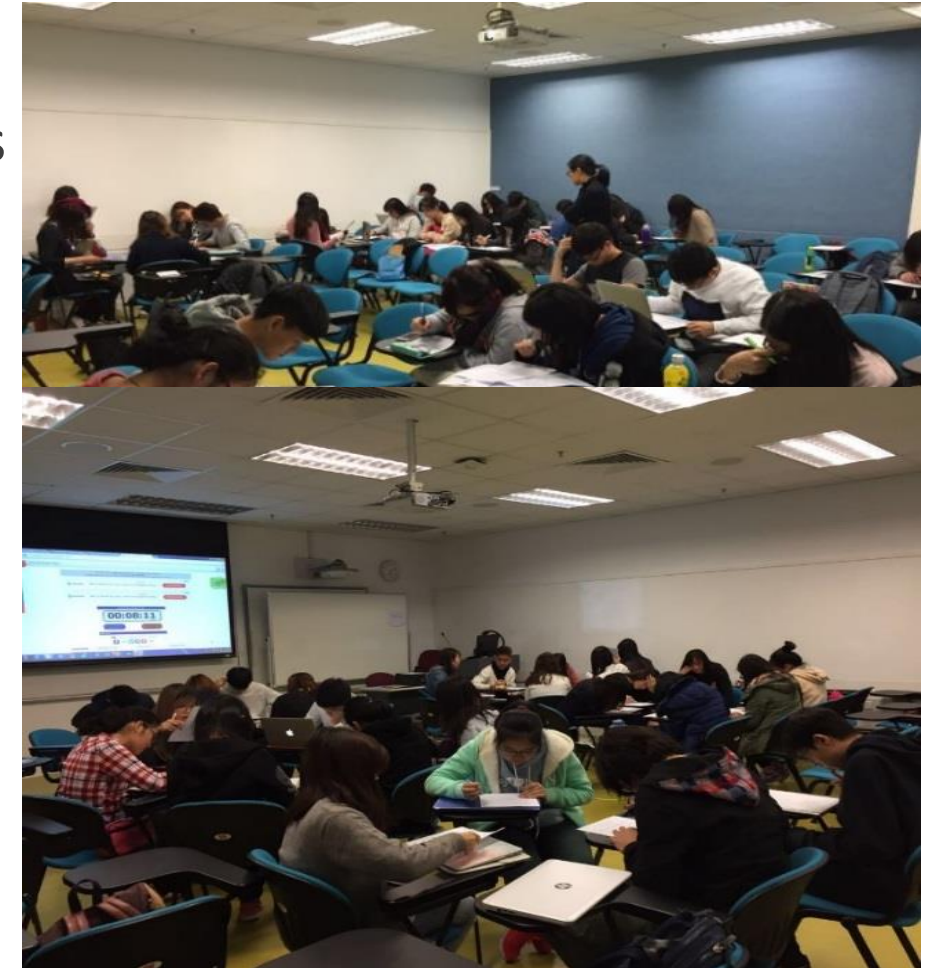


## PHASE 1 – PREPARATION (PRE-CLASS)

- Assigned pre-class reading
- Matched with learning objectives
- Supported by a study guide (one-page)

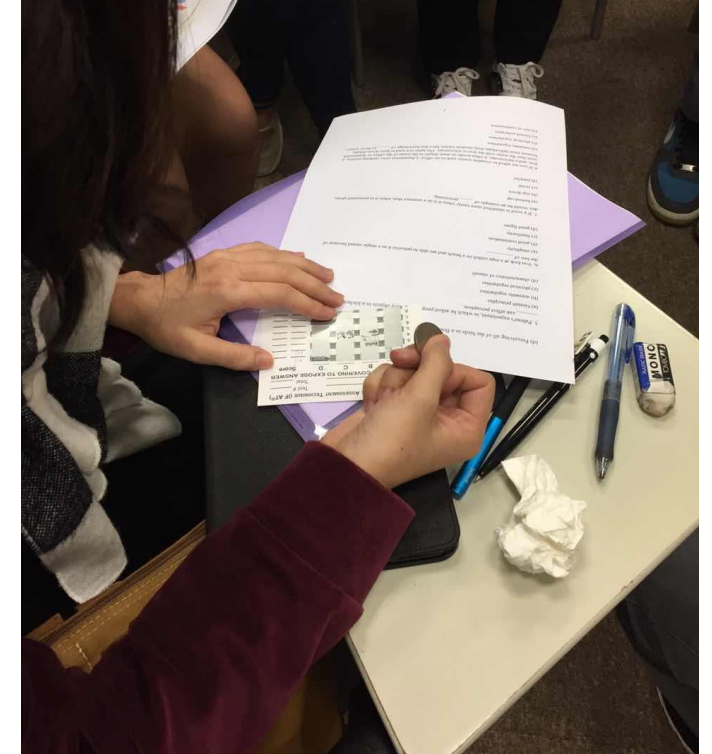
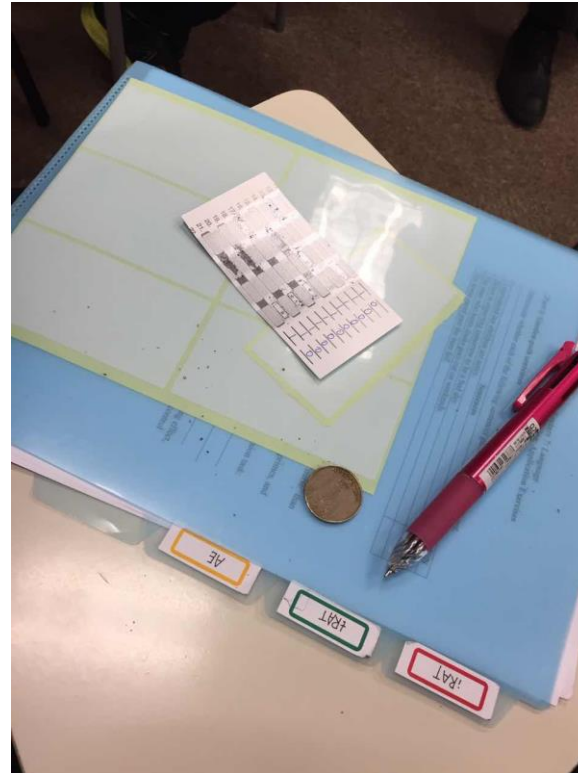
## PHASE 2 – READINESS ASSURANCE PROCESS: IRAT

- At the beginning of each instructional unit, students first take a short test in multiple-choice format (around 10 questions) on their understanding of pre-readings.
- Focus on fundamental key knowledge/concepts
- 65-80% questions correct on average (Sweet & Michaelsen, 2012)
- Closed-book exercise



## PHASE 2 – READINESS ASSURANCE PROCESS: TRAT

- Right after iRAT, students retake the exact identical test as a team, which is entitled as team readiness assurance test (tRAT).







tRAT

## MORE ABOUT TRAT

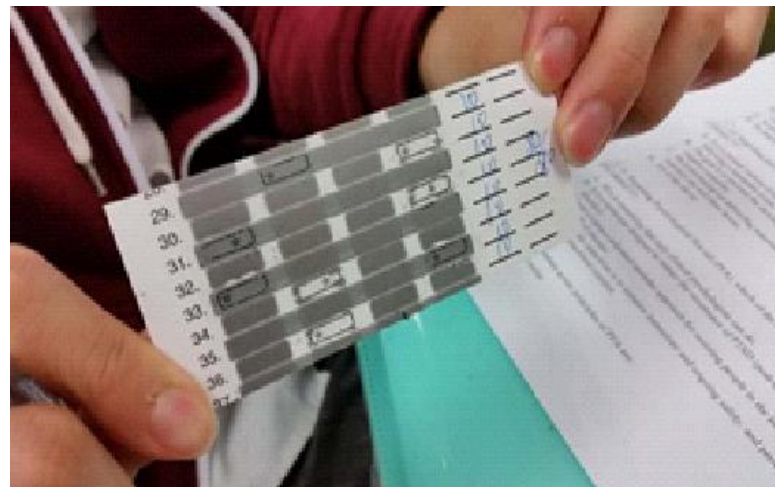
- tRAT scores are immediately open so that students can monitor their group performance.
- Partial credit is given for each attempt.
- Use of IF-AT

**First attempt: 10 points;**

**Second attempt: 5 points;**

**Third attempt: 2.5 points;**

**Fourth attempt: 0 point.**



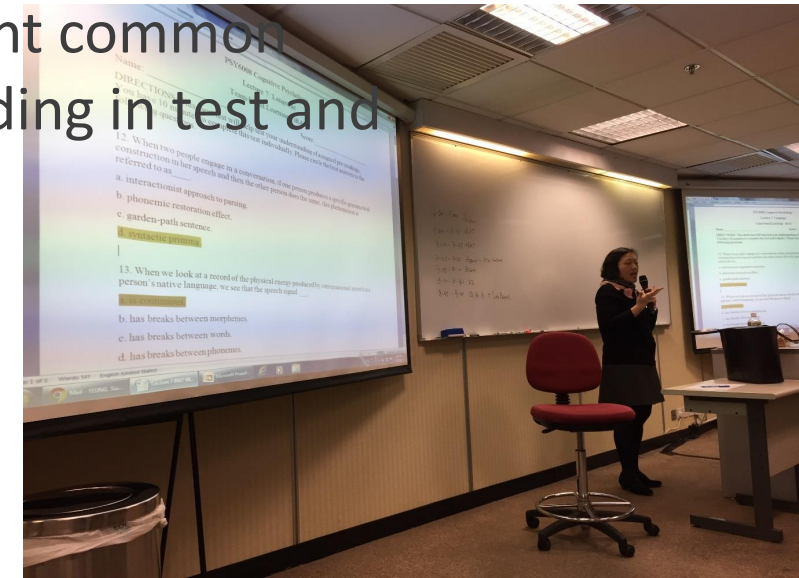
# APPEAL AND MINI LECTURE

## APPEAL

- If students find that they disagree with teacher's selection of best answer, or pose challenge to the validity of question, they can make a case for their argument supported by relevant evidence. This is an open book process, which asks for another round of review of pre-readings.

## MINI-LECTURE

- Following RAT, the instructor is expected to give a highly-targeted corrective lecture to address student common misunderstanding in test and pre-readings.

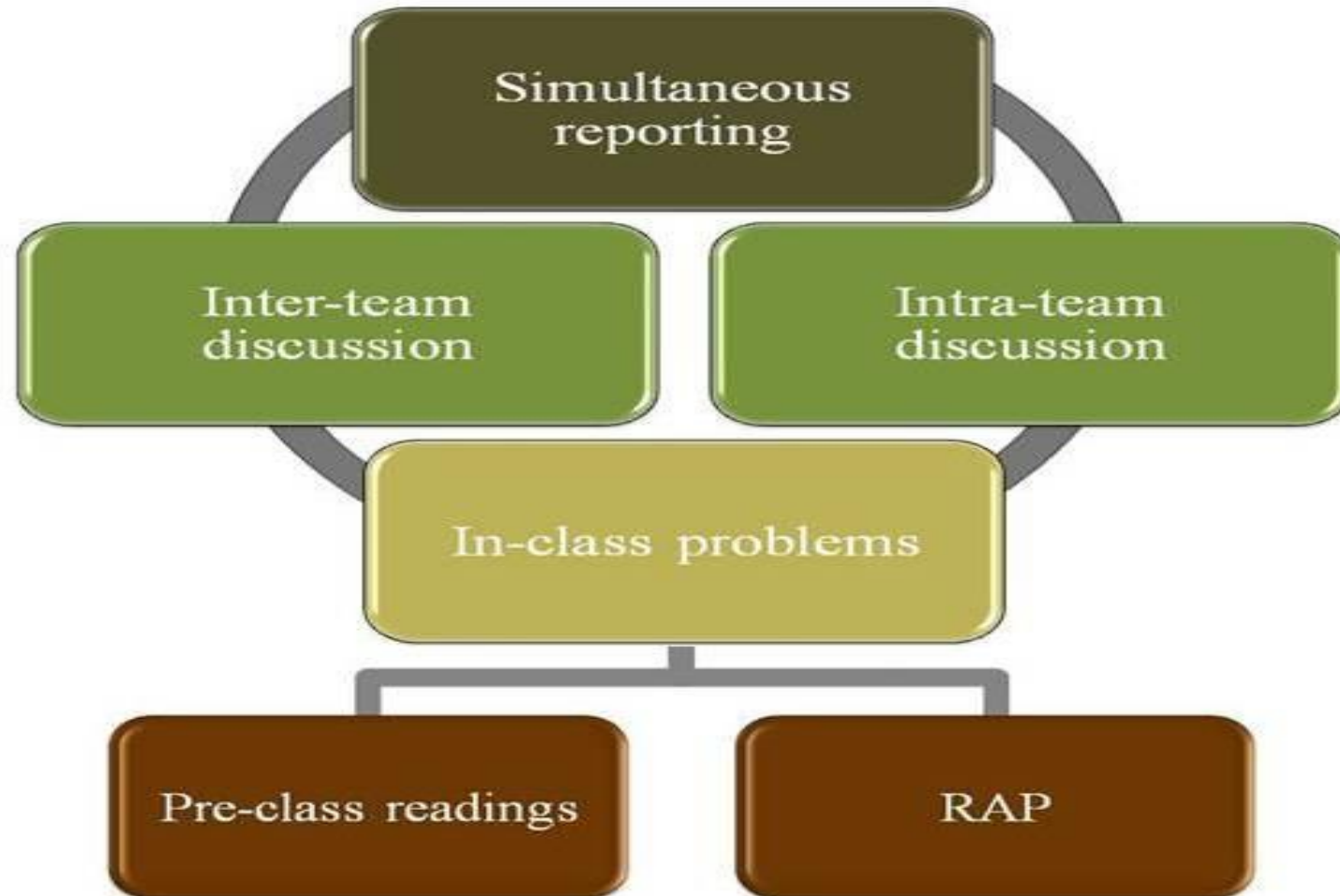


## PHASE 3: APPLICATION OF COURSE CONTENT

- Application exercise (AE) is the cornerstone to the success of Team-Based Learning (TBL). Its design must build upon core concepts that students have grasped during pre-class preparations and Readiness Assurance Process (RAP; Sibley, 2012).



# APPLICATION EXERCISE





## FOUR CHARACTERISTICS OF GOOD AE

- 1. Significant problem
- 2. Same question
- 3. Specific choice
- 4. Simultaneous response



# BEST PRACTICES IN AE

- Teachers' scaffolding is crucial
- Well-defined AE asks for intensive collaboration and content-based discussion
- Presentation or producing a lengthy writing work may lead to division of labor.
- Time management. AE can be time consuming.

# SIMULTANEOUS REPORTING

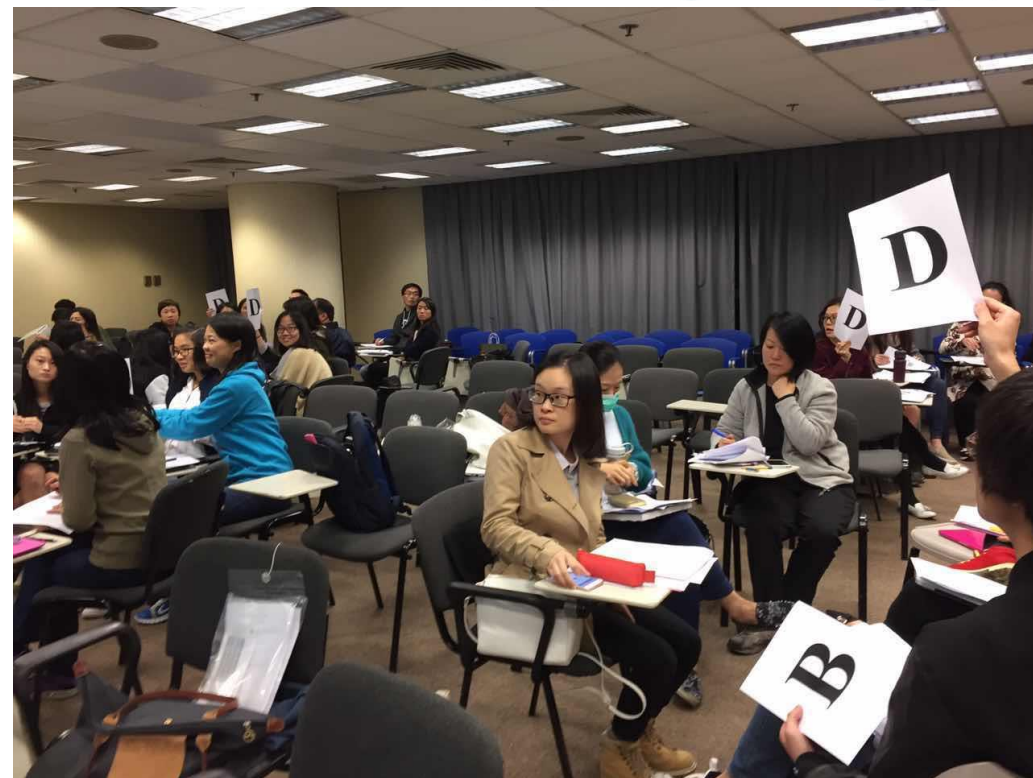
- To explore in-depth the differences of opinions among teams: how team decisions are different and why they came to different standpoints.
- When comparing inter-team answers, TBL practitioners should ‘focus classroom conversation through thoughtful questions, help students appropriately summarise their key points, support critical reflection, and provide positive feedback for participation.’ (Whitley et al, 2015, p.7).



## SIMULTANEOUS REPORTING

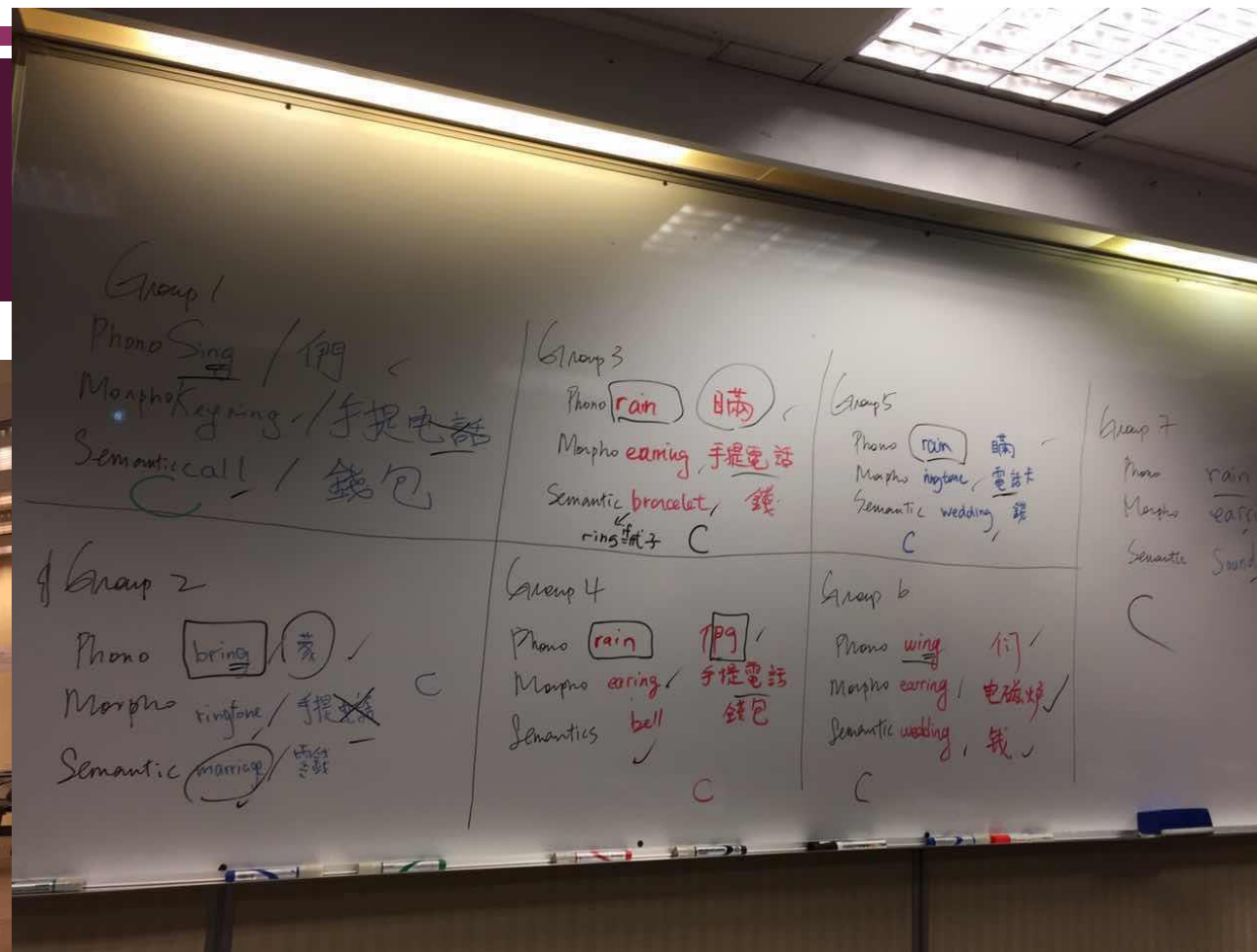
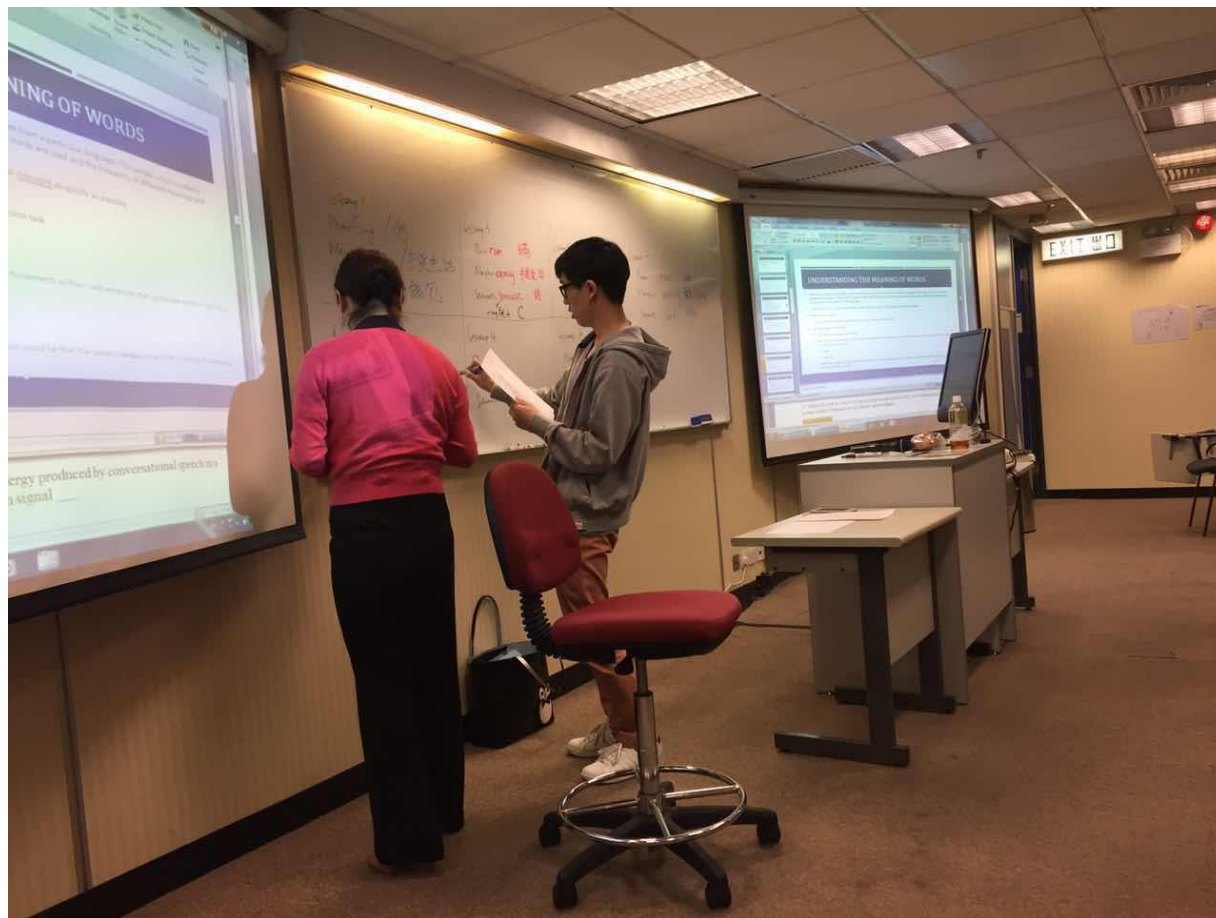


## ABCD card



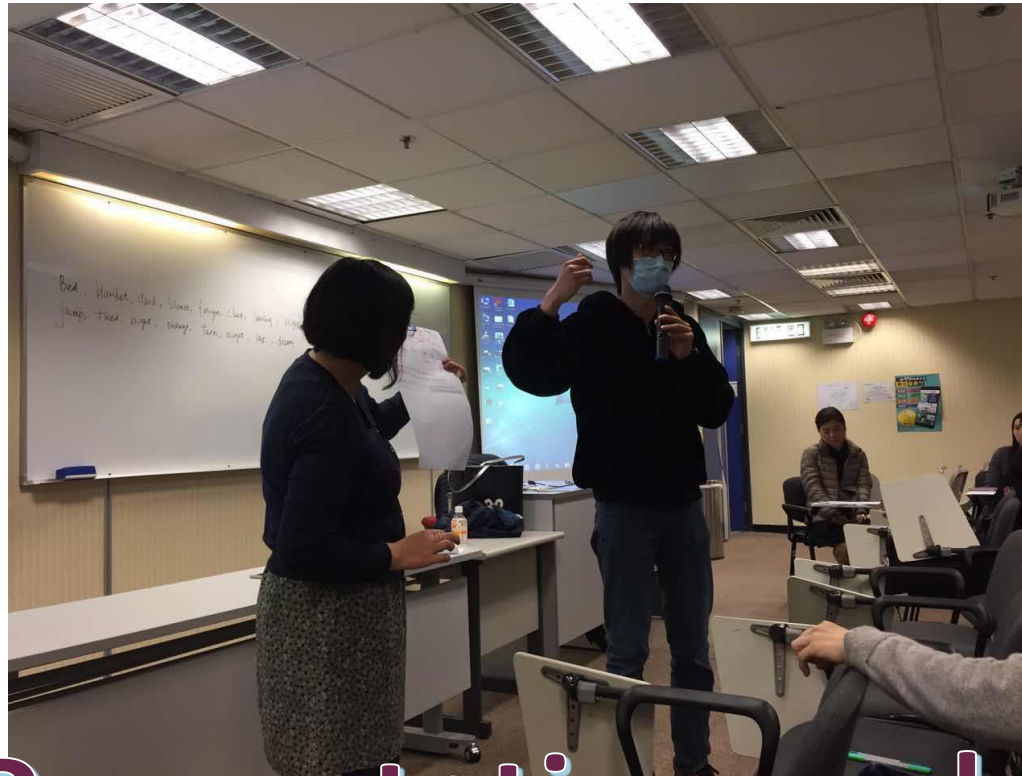


# SIMULTANEOUS REPORTING



## Whiteboard

## SIMULTANEOUS REPORTING



**Verbal Presentation and A3 Paper**

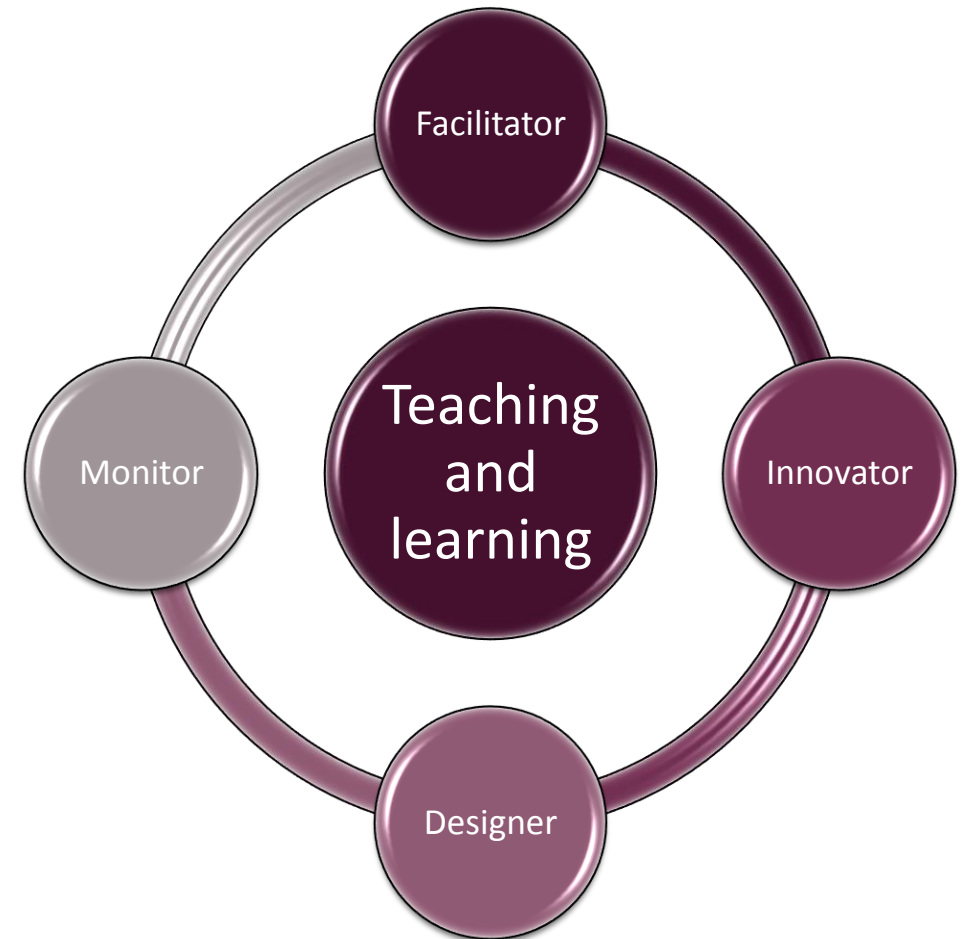
# PEER EVALUATION

1. Contribute a lot in discussion.
2. Willing to listen to disagreements
3. Prepare pretty well
4. She is so clever and can put forward some easy-to-understand examples in the discussions.
5. His answer is always right.
6. I think you help me a lot. You are always cheerful.
7. Brainstorm, ask questions and facilitate discussion.

1. Talk more, please
2. Go too fast. Please wait other groupmates.
3. Please try to be more confident.

# TBL AS A MEANS TO TRANSFORM YOUR CLASSROOM

- A change in the role of educators: From 'the sage on the stage' to 'guide on the side'; from source of information to relying on students to agent of learning'.
- TBL practitioners should not focus on what and how to teach; instead, they should focus on how to facilitate student self-regulated learning, inspire their higher-order thinking, monitor their performance, provide highly-targeted scaffolding, encourage team discussion, give immediate and constant feedback and create a learning climate.







## EVALUATION OF TBL

### Objective:

To evaluate the effects of TBL as innovative pedagogy on students' learning among EdUHK students using both quantitative and qualitative methods.

## PARTICIPANTS

- TBL was implemented in three courses under different programs, namely Psychology- related, GE Breadth and Early Childhood Education course for one semester (2016/2017).

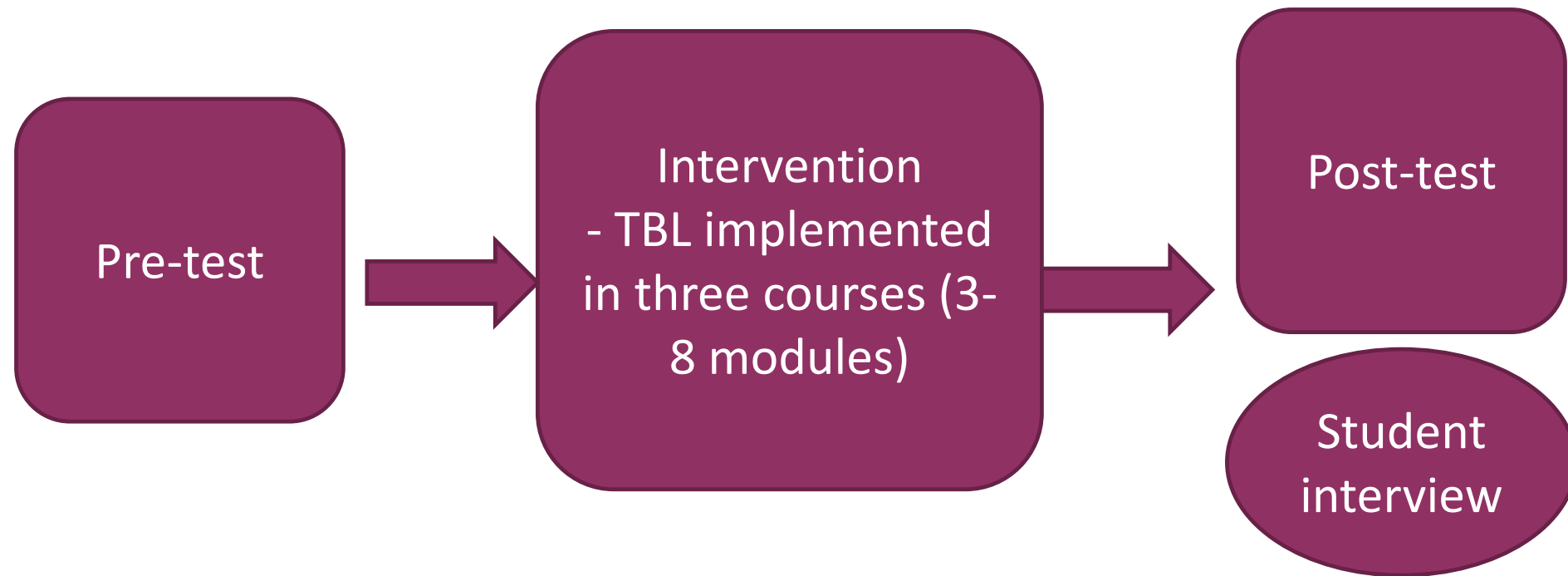
- Experimental group:

130 students in three courses implemented TBL

- Control group:

Students who enrolled in the same course but in different section/class/semester (n = 135)

## RESEARCH DESIGN



### **Pre-test & post-test:**

Self-reported measures (47 items): Achievement emotions, peer feedback, school engagement and team experience.

## QUANTITATIVE EVALUATION

- Quasi-experimental design
- Two classes taught by the same teacher were randomly assigned to either experimental group or control group.

## RESULTS-EVALUATION

- At pretest: no significant differences were found on the outcome measures.
- Intervention effects: to examine TBL effects, ANCOVAs were conducted to examine the differences in posttest scores between two groups with pretest scored statistically controlled.

### Outcomes

### Definition

Team Experience (TEQ; Curry et al., 2015)

Satisfaction with team learning; team impact on learning; satisfaction with peer evaluation; team impact on critical thinking and teamwork

School Engagement (Fredrick et al., 2005)

Cognitive and behavior school engagement

Learning related achievement emotion – positive (Yang & Sin, 2013)

Positive emotions that directly tied to achievement activities – enjoyment and hope

Learning related achievement emotion - negative (Yang & Sin, 2013)

Negative emotions that directly tied to achievement activities – boredom and anxiety

Perceived Usefulness of Peer Feedback(Gan, 2011)

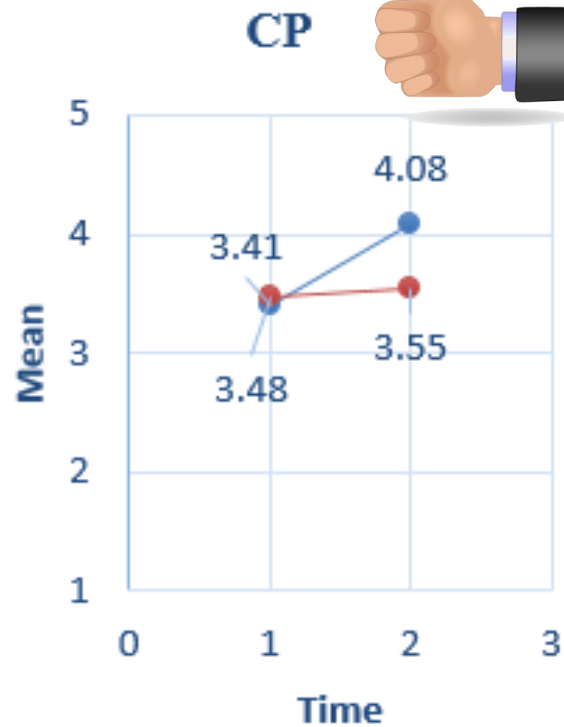
The perception of peer feedback in learning

## TBL IN THE THREE COURSES

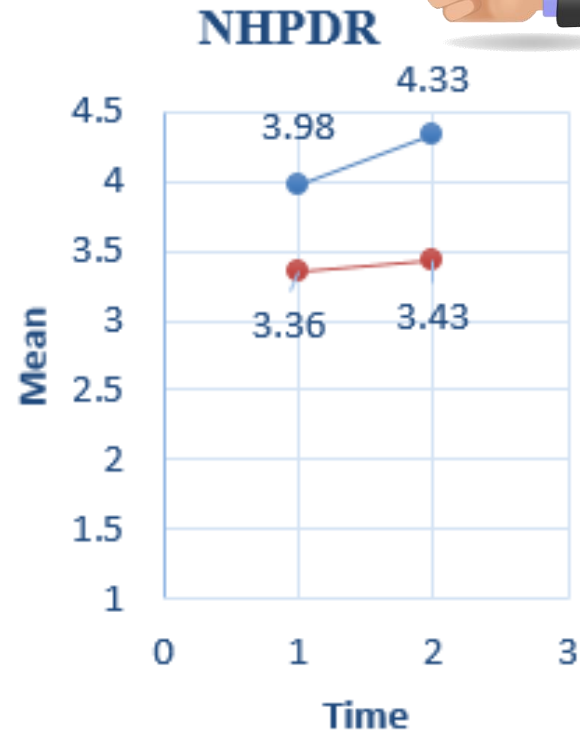
Courses	Level	Number of TBL cycles	Comparison Class
PSY 6008: Cognitive Psychology	Postgraduate (Master)	8	Cognitive Psychology in BSocSci (Mass lecture and tutorial)
GEH 1021: Natural Hazards and Post-Disaster Recovery	Undergraduate	4	Same course in Sem 1 2016/17
ECE0189: Developing a Play-based Curriculum	Higher Diploma	3 (in 5 lessons)	Same course in Sem 2 2016/17

## RESULTS – TEAM EXPERIENCE

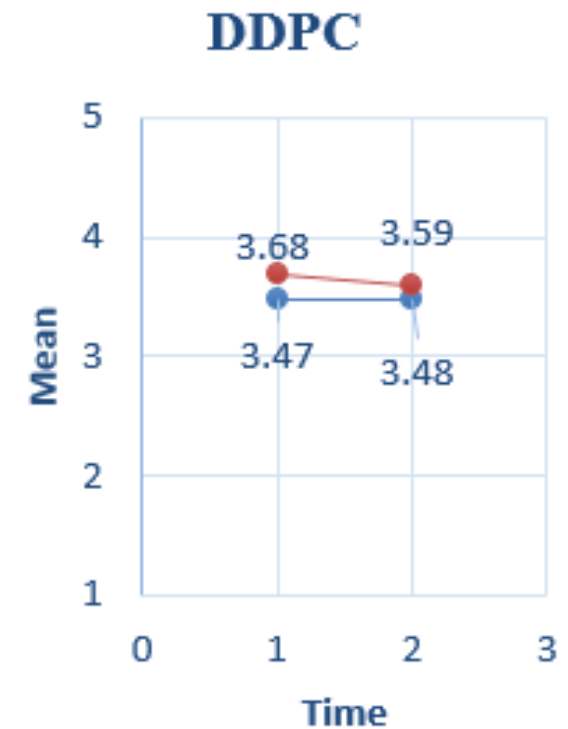
significant  
difference



—●— Experimental group  
—●— Control group

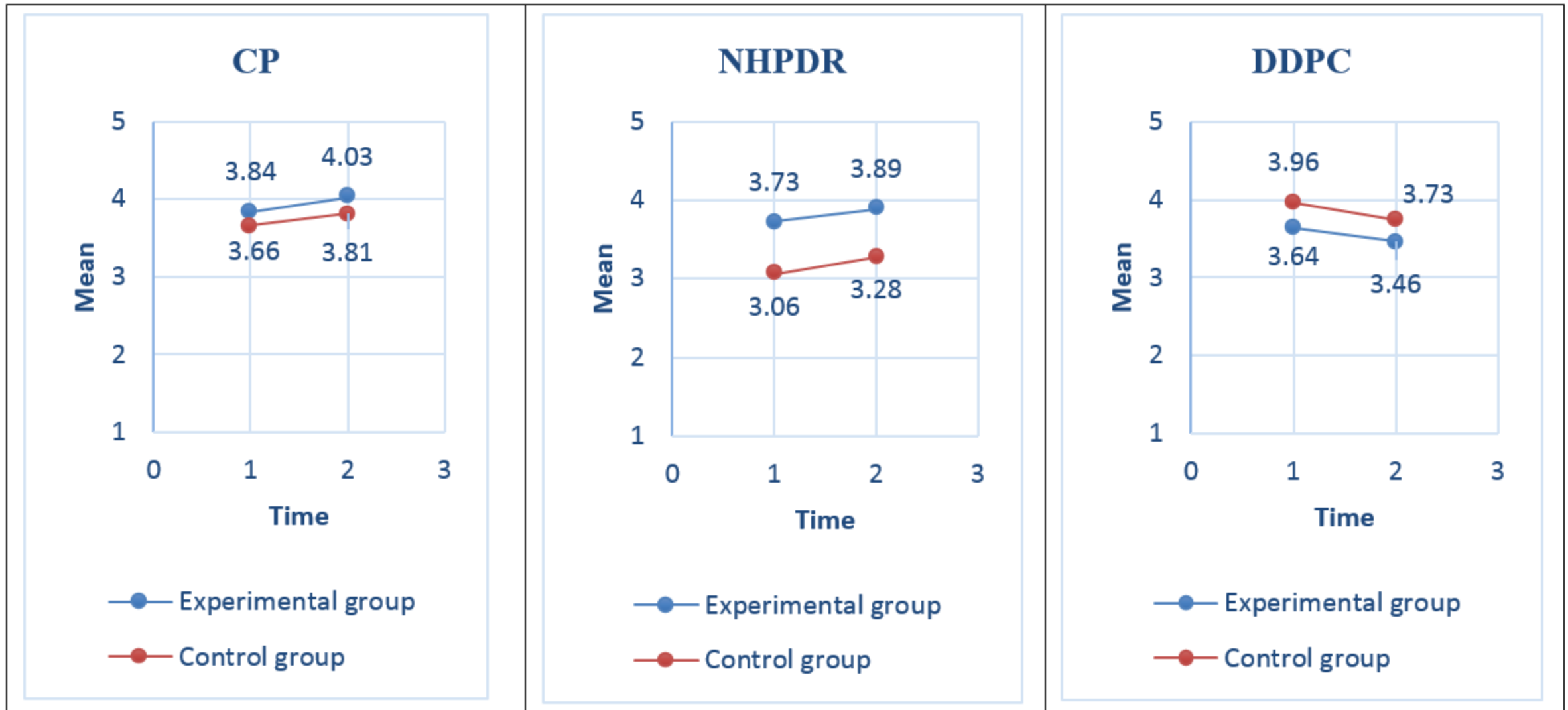


—●— Experimental group  
—●— Control group



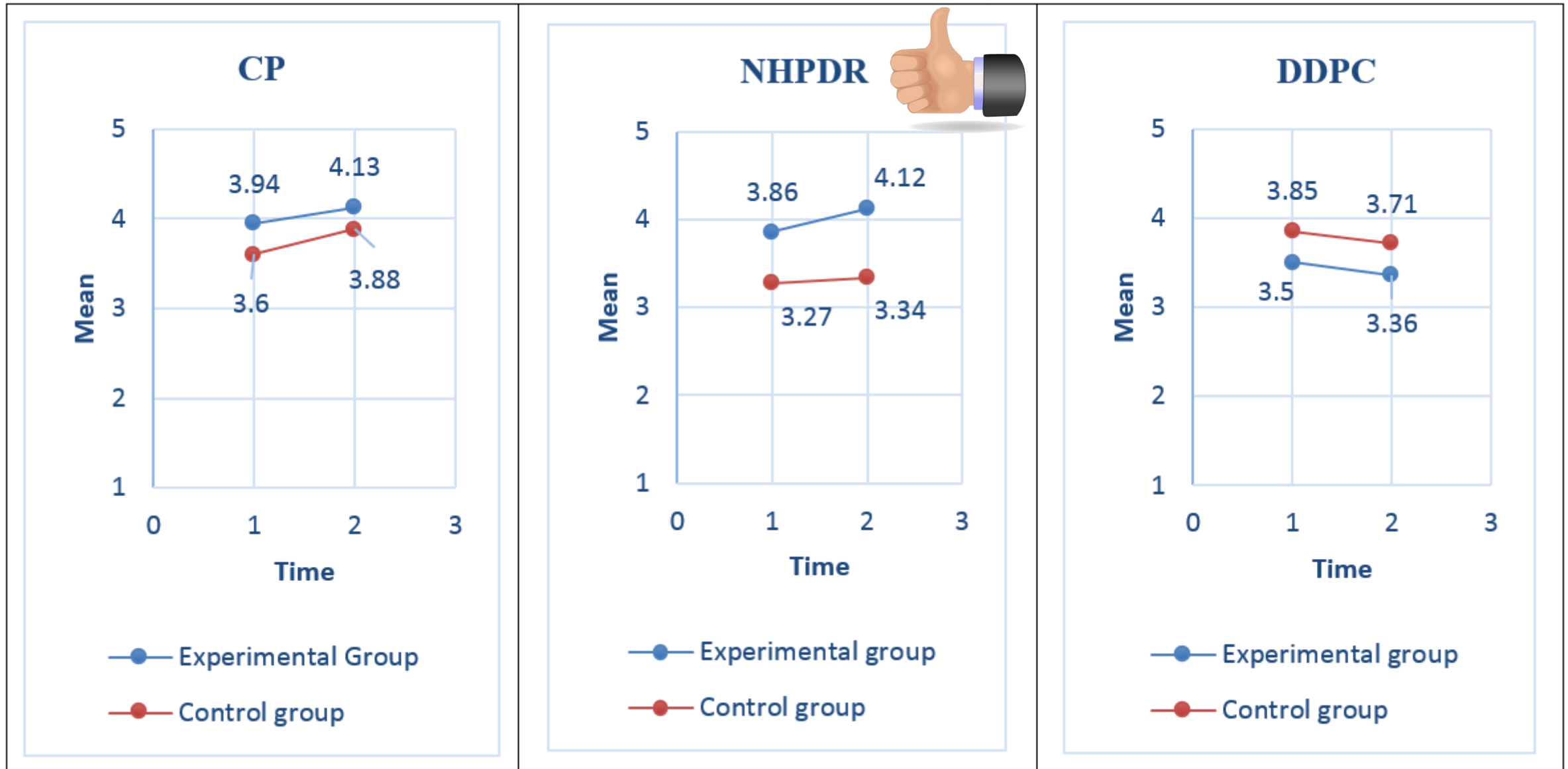
—●— Experimental group  
—●— Control group

## RESULTS – SCHOOL ENGAGEMENT

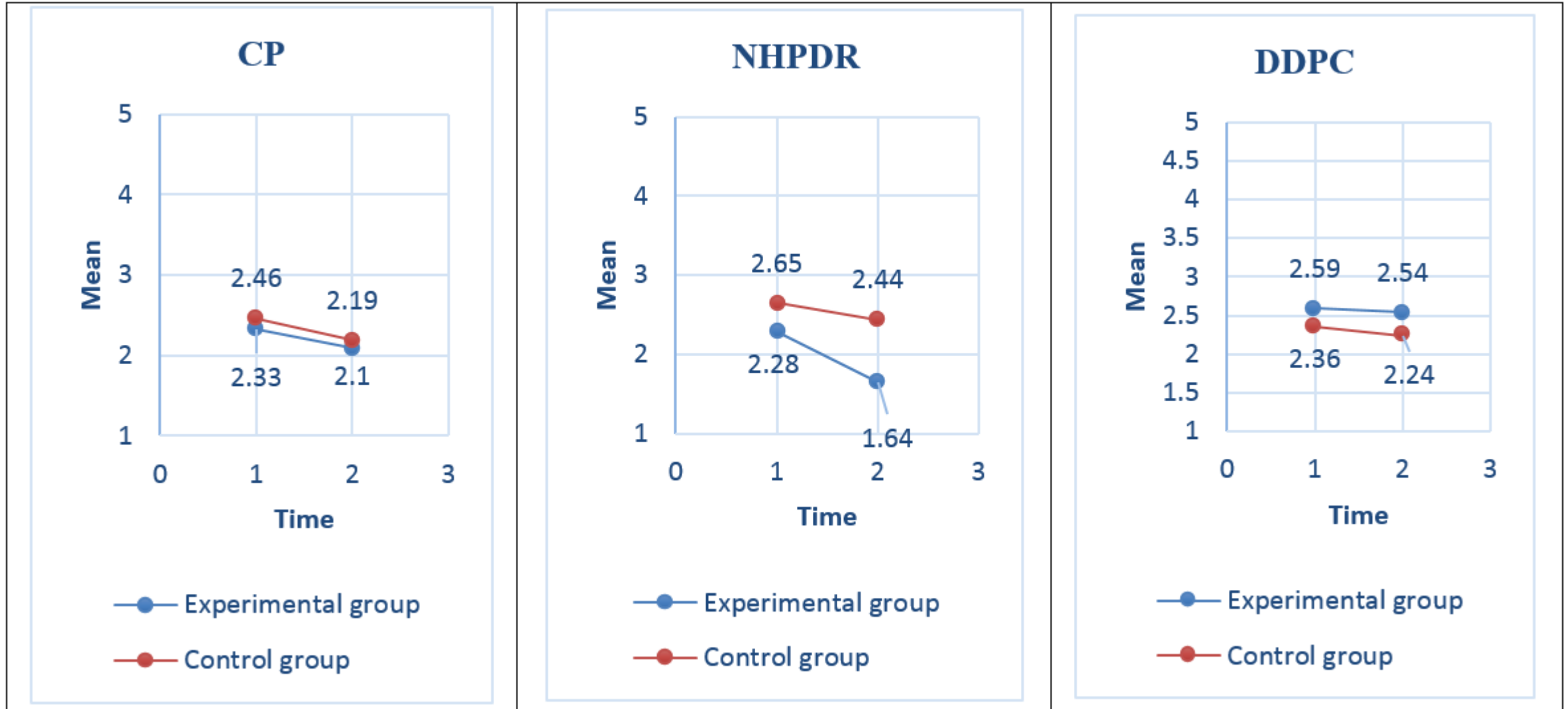




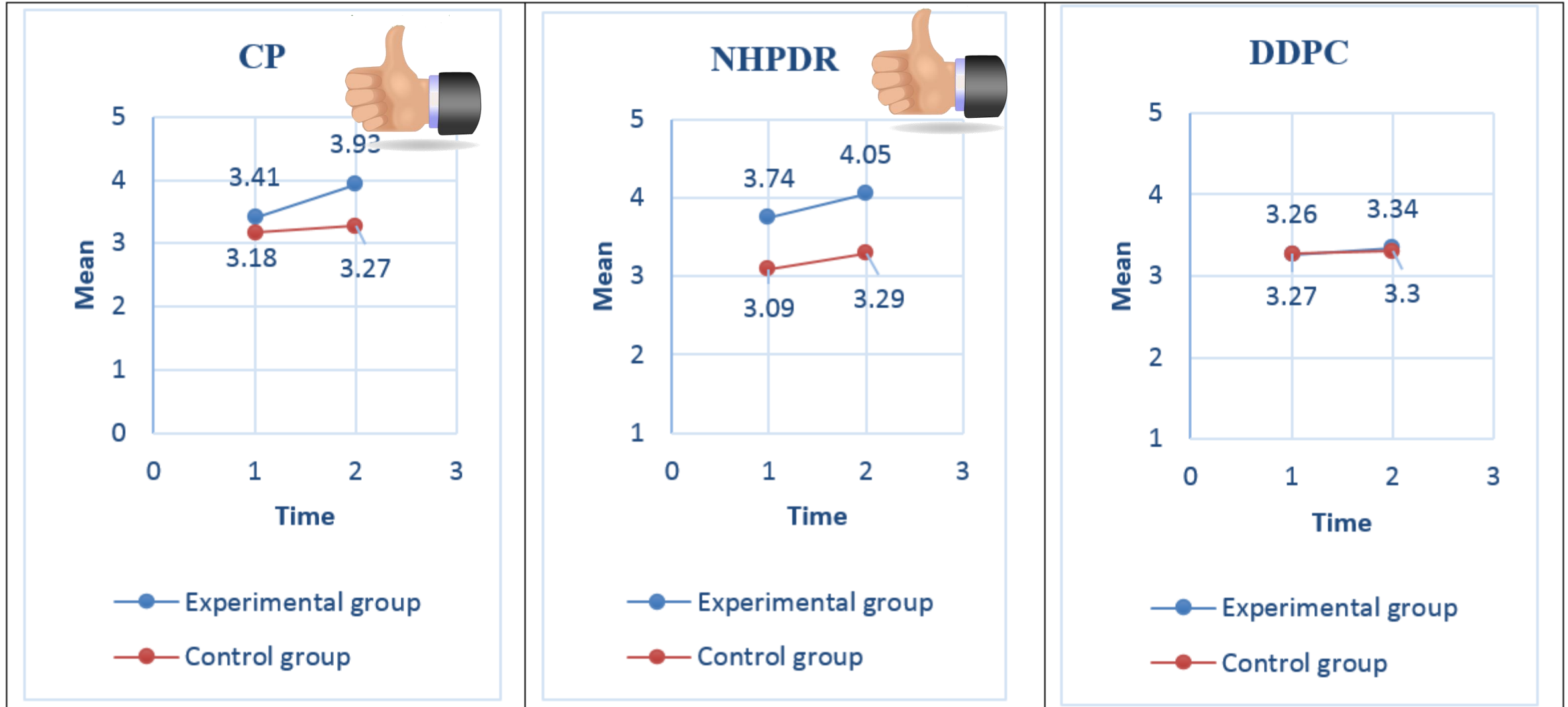
## RESULTS – POSITIVE EMOTION



## RESULTS – NEGATIVE EMOTION



## RESULTS – PERCEIVED USEFULNESS OF PEER FEEDBACK IN LEARNING



## INTERPRETATION

- TBL has significant positive effects on team experience and perceived usefulness of peer feedback in undergraduate and postgraduate courses but no significant effect on school engagement and negative emotion.
- TBL has a positive effect on positive emotion in GE Breadth course.
- TBL has no effect on sub-degree classes – maybe due to small number of TBL cycles and students' characteristics.

## QUALITATIVE EVALUATION

- TBL我是欣賞的，因為小組討論有多角度，自己一個人只有一個角度，透過討論對理論，看法，實驗有更多的理解。
- 我們的小組合作很順利，很開心，因為我們的背景不同，有full time 有part time，我們讀書背景不一樣，正因如此，我們有多角度思考，所以在過程中多元化學習，我們很樂意思考分享。
- 因為我們讀好concept的東西，有這些exercise會比較容易visualise和apply到我們真實的環境，如果不是这样，只是普通的學和上lecture不會太了解到的，特別是那些人生經歷少的同學。
- TBL不同的地方在上課之前會逼你做預習先，這和傳統老師講完之後你再做discussion是不同的，因為你上課前已經開始記得很多理論。這樣老師講完對理論有更深的了解。



# TEAM-BASED LEARNING IN COGNITIVE PSYCHOLOGY (PSY6008)



## COGNITIVE PSYCHOLOGY IN MSOCSC(PSY)

- A conversion degree in psychology
- 46 students with very diverse background
- Full time and part time
- Learning Outcomes of the course:

CILO<sub>1</sub> Describe the major concepts, findings, and theories in cognitive psychology;

CILO<sub>2</sub> **Critically compare and contrast** different theories in cognitive psychology;

CILO<sub>3</sub> Acquire relevant techniques and experiences in conducting research in cognitive psychology;

CILO<sub>4</sub> Develop **critical thinking skills** to evaluate empirical evidence in cognitive psychology;

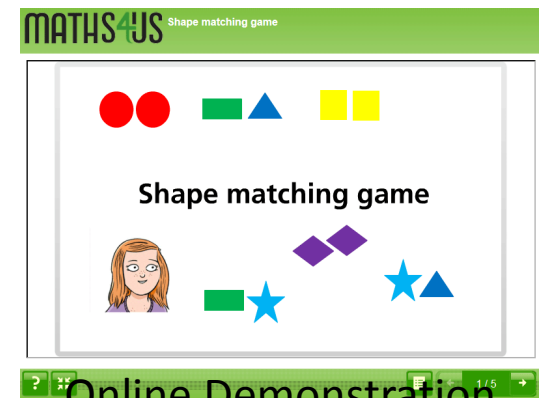
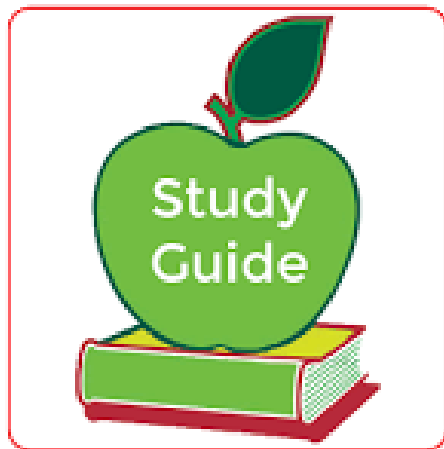
CILO<sub>5</sub> **Apply** the knowledge of cognitive psychology to daily life and teaching practices.

## TBL BASICS IN CP

- 8 instructional cycles on 8 topics: Perception, Attention, Memory, Language, Thinking
- 20% of final grade
- 12% iRAT, 4% tRAT and 4% peer evaluation
- All iRAT in MCQs format, some AE in mcqs and some are open ended questions
- Use of IF-AT cards



## PRE-READINGS BEFORE CLASS



# INDIVIDUAL READINESS ASSURANCE TEST (iRAT)

- MCQs
- Foundational knowledge
- No feedback, no marks until later
- 62% of accuracy over the 8 modules of all students
- From item bank; selection of MCQs – factual or applicatio

## APPENDIX 3: A Sample of Individual Readiness Assurance Test (iRAT)

PSY6008 Cognitive Psychology

Lecture 2 Perception

Team-based Learning - iRAT

Name: \_\_\_\_\_

Score: \_\_\_\_\_

DIRECTIONS: This short test will help test your understanding of assigned pre-readings. You have 10 minutes to complete this test individually. Please circle the best answers to the following questions.

1. A bottom-up process is involved in fixating on an area of a scene that \_\_\_\_\_.

- A. carries meaning for the observer.
- B. fits with the observer's interests.
- C. is familiar.
- D. has high stimulus salience.

2. According to the likelihood principle, we tend to perceive objects that are \_\_\_\_\_ likely to have caused the pattern of stimuli we have received and this is typically the result of \_\_\_\_\_ inferences.

- A. most; unconscious
- B. most; conscious
- C. least; unconscious
- D. least; conscious

3. Which statement best summarizes the focus of the Gestalt psychologists?

- A. We must understand the basic components of perception.
- B. We want to understand how the sum of parts adds up to create perception.
- C. We need to identify the number of basic features needed for object recognition.
- D. All of the above.

4. Which of the following is a better example of an effect of top-down processing?

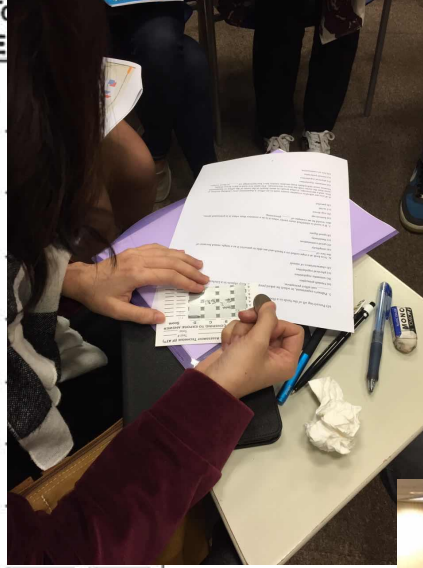
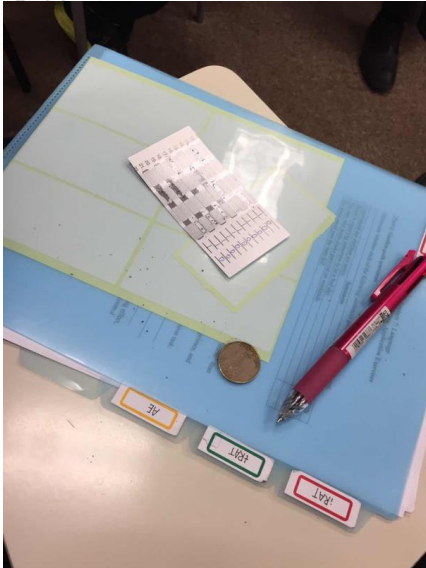
- A. Seeing a flash of lighting in a thunderstorm
- B. Speech segmentation
- C. The response of a feature detector
- D. Perceiving all of the birds in a flock as belonging together

# TEAM READINESS ASSURANCE TEST (TRAT)

IMMEDIATE FEEDBACK ASSESSMENT TECHNIQUE (IF AT®)

Name Team #3

Test # 2



**First attempt: 10 points;**

**Second attempt: 5 points;**

**Third attempt: 2.5 points;**

**Fourth attempt: 0 point.**



## Immediate feedback

Marks count for grades

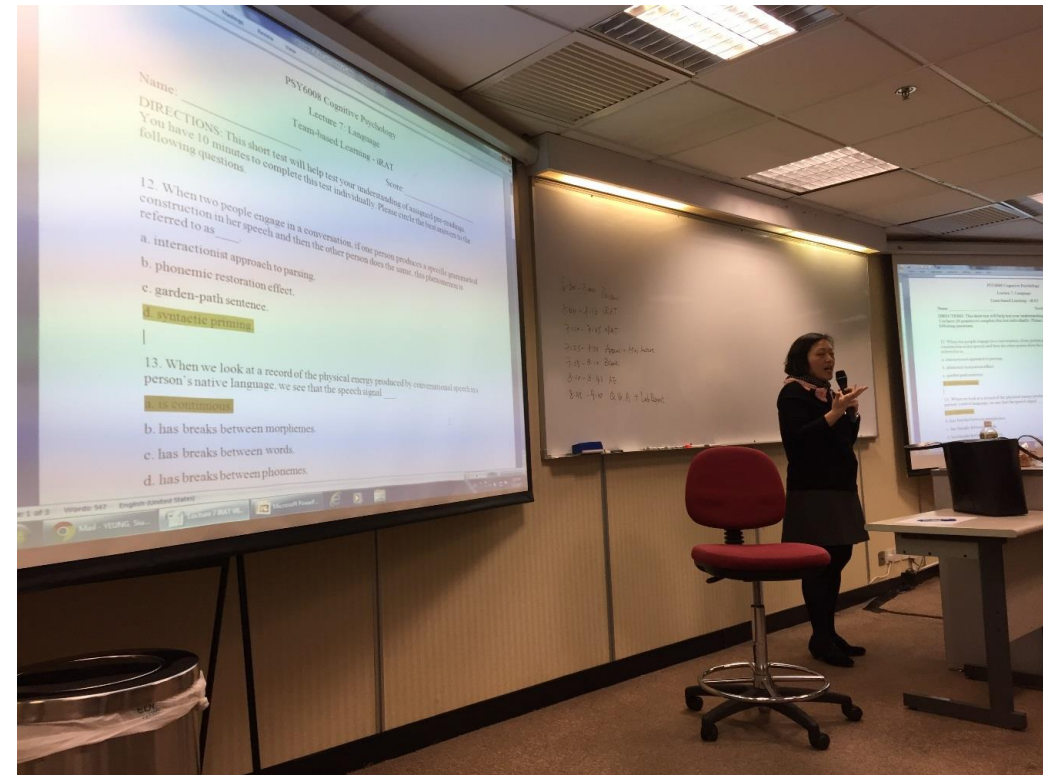
Ability to answer again if incorrect: Partial credit

# APPEAL

- Rarely happened
- Stimulated deep thinking of the course content

# MINI-LECTURE

- Clarify common misunderstandings in test
- Ensure course content coverage



## APPLICATION EXERCISE

- Difficult to design
- Exercises need to engage students in real collaboration and discussion (how to involve everyone)
- Time management
- Tried out different format in the course, but the best format is not yet known.
- Specific choices are important; focusing students on specific concepts.



## APPLICATION EXERCISE EXAMPLE

## Specific choice



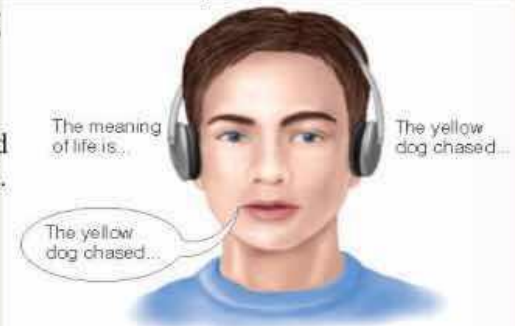
- Cognitive Psychology: Attention (Lecture 3)
- AE: Students carry out dichotic listening procedures and pool which model of selective attention supports their findings. Ju



## Significant problem

### Experimental Procedures of studying selective attention : Dichotic listening task (Cherry 195

- Focus your attention on the words in one ear, which we will call the *attended ear*, and as you hear the words, repeat them out loud.



**Figure 4.2** In the shadowing procedure; a person repeats out loud the words that have just been heard. This ensures that subjects are focusing their attention on the attended message. © Cengage Learning

# Same problem & Simultaneously reporting

qiaoshen0623 • 1m

## Application exercise: Dichotic listening task

Lecture 3: Attention

### Group 1:

1. Distress, stress, school, achievement, pressure
2. Female
3. Cantonese
4. Mother language (Cantonese), high pitch.
5. Modern Psychology

Treisman's attenuation theory

### Group 2:

1. Broadbent
2. Chinese, meaning
3. female
4. Treisman
5. Jung, 書店
6. 英文, educational issue

### Group 3:

Treisman's model of attenuation theory  
It is very hard to ignore the language and meaning

### Group 6:

1. Increase accountability in school provide more incentives for principal and teachers. provide more flexibility.
2. Female
3. Cantonese
4. High Pitch, intonation 有抑揚頓挫, higher fluency
5. 當代著名心理學家 Freud, Carl Yung, Erickson, 在哪裡可以找到他們的著作?

書局主要有三類關於心理學的書：  
第一類：真正的心理學著作，佛洛伊德，榮格等這些當代著名心理學家的著作

第二類：偽心理學，心靈雞湯類，教人做人

第三類：非科學類，如輪迴轉世

three types of psychology related books can be found in bookstore: Freud, Yung, Erikson. Where can we find 231?

### Group 4:

1. how to improve student academic achievement

2. female

3. Cantonese

4. It is Susanna's voice.

5. 到書店去買心理學的書

### Group 5:

Majority-Treisman's theory (intermediate).

Due to the familiarisation of physical characteristic (Susanna's voice).  
Language (Cantonese).

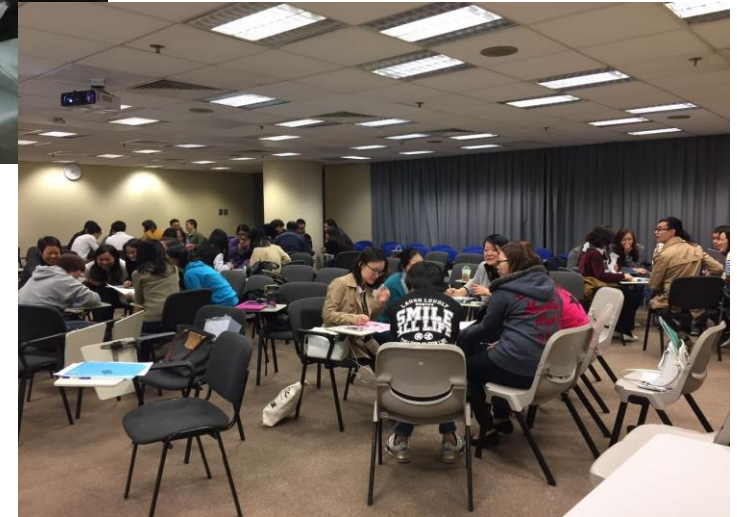
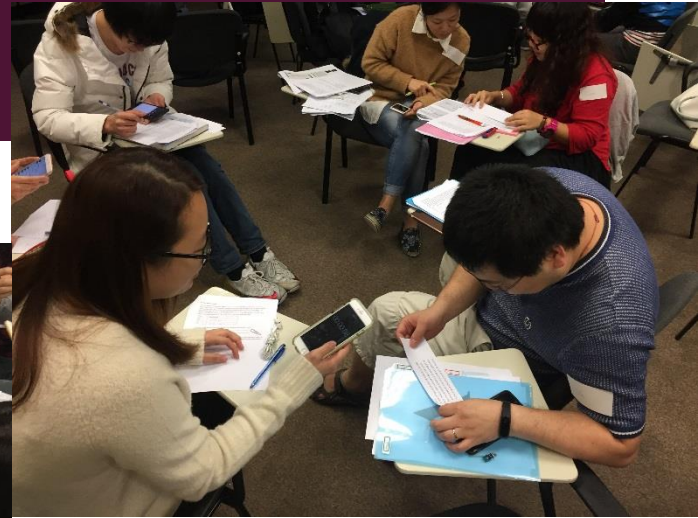
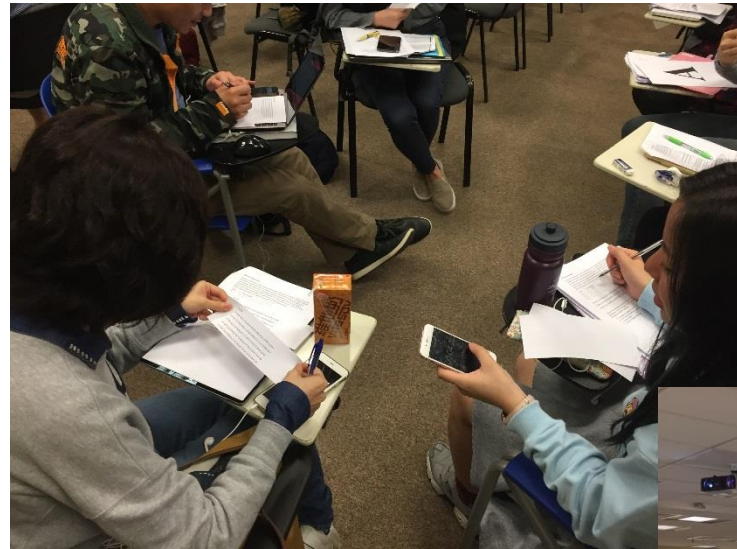
### Group 7:

1. some sort of complete prose in English, Structure of schools
2. female
3. Cantonese
4. Mother language and utterance of higher pitch, familiar voice, higher voice level, clarity in the utterance are more dominant.
5. Fraud





- Differentiating course concepts
- Real-life problem solving
- Cognitive experiment
- Scenario-based learning
- Journal reading on experimentation



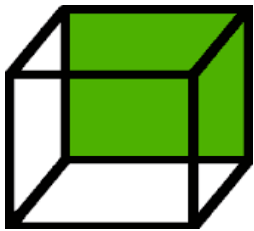
# Cognitive Psychology in TBL

## Formats: AE examples

# DIFFERENTIATING COURSE CONCEPTS



- E.g. bottom-up or top-down processing



Please determine whether each of the following cases is an example of bottom-up or top-down processing:

1. *Glancing over to see a spider crawling across his shoulder, Andrew screamed.*

*Bottom-up / Top-down*

2. *The following figure (The Necker Cube) results in two perceptions.*

*Bottom-up / Top-down*

# APPLYING COURSE CONTENT INTO EXPLAINING REAL-WORLD PROBLEMS

## Lecture 4: Short term and working memory

### *Part I: Applying concepts and ideas to explain real world behavior*

Imagine you are driving to a friend's new house. In your mind, you say the address repeatedly until you arrive. Once you arrive, you stop thinking about the address and start to think about buying a housewarming gift for your friend. To remember the address, you used a(n)\_\_\_\_\_ process in STM.

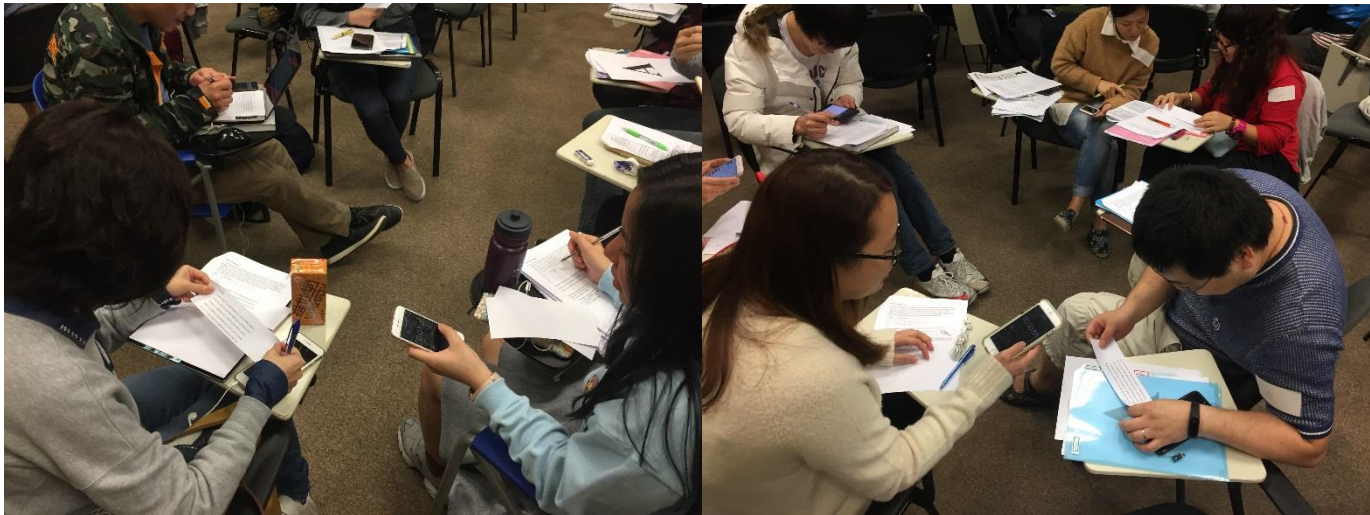
- a. control
- b. automatic
- c. retrieval
- d. registration



# COGNITIVE EXPERIMENT

- Carry out cognitive psychology procedures:  
one student serve as experimenter and one as  
participant

e.g. Lecture 4: Short term and working memory



## Part II: Memory Demonstrations

Work in pairs in this exercise, one as experimenter and one as participant. Complete the activities listed in the left column and answer the questions in the right column of the table below.

Swap your role when one completes all the activities. You have 10 mins for the activities and 10 mins for discussing the questions in the right column in your group.

Activity and Response	Questions
<b>Activity 1</b>  Please read these instructions to your participant... It may help you to close your eyes for this task. How many windows do you have in your house?  Response: _____	Which component in memory was this testing?  <i>Visual Spatial Sketchpad</i>  Which model is it included in?  <i>Baddeley's revised working memory model</i>
<b>Activity 2</b>  Please ask your participant to do the following two tasks at the same time... <ul style="list-style-type: none"><li>• Study a list of words for 20 seconds (shown on p.4)</li><li>• Repeat their name and address to themselves</li></ul>	Which component in memory was this testing? What processes are involved in this activity?  <i>Phonological loop/ articulatory suppression or articulatory processes.</i>  Which model is it included in? <i>Working memory</i>
<b>Activity 3</b>  Please read these instructions to your participant... 'On the desk in front of you is a piece of paper which is turned down so that you cannot see the picture on it (see p.5). In a moment I am going to ask you to look at the picture for 20 seconds and then place it back on the desk so you cannot see it. You should then try to draw the picture from memory. This will happen 4 times. I will tell you when your 20 seconds is up! Time them for 20 seconds with each trial.	Which component in memory was this testing?  <i>Visual STM</i>  Which model is it included in?  <i>Modal model</i>

# EXTRACTION FROM JOURNAL ARTICLES ON EXPERIMENTATION

- Read journal articles on the topic of

e.g. Lecture 2: a

Brady and



## Part II

One of the cognitive experiments conducted by Brady and Oliva (2008) is described in the following paragraphs. Please read the information about the experiment carefully and answer the question based on what you have learnt in preclass materials by choosing the best answer.

*Some previous studies have asked participants to observe a sequence of shapes and are not told that the sequence consists of arrangements of four temporal triplets (e.g., groups of three shapes that always appear in the same order, as in the sequence ABCGHIDEFABCJKLDEF), and after a brief exposure to this stream, participants are able to reliably identify the triplet (e.g., ABC) as more familiar than foil sequences (e.g. AEI), despite the fact that they have seen all the individual shapes as equal number of times.*

*Today, experiments like these have used novel shapes to investigate this learning phenomenon. In the real world, however, the units over which learning must operate are considerably more information rich. Therefore, the present study investigates the learning of complex stimuli with which the participants have prior association.*

*In the study, 12 scene categories were used: bathroom, bedroom, bridge, building, coast, field, forest, kitchen, living room, mountain, street and waterfall. Each category consists of 120 different full color images. A stream of 1000 images was made in which triplet (e.g. ABC) were presented together with randomly chosen images. Repeat images were inserted into the stream such that sometimes either the first or the third image in a triplet repeated immediately (e.g. ABCCGHI or ABCGGHI). Participants watch a 20 mins sequence of 1000 images, presented one at a time for 300 ms each with a 700 ms interstimulus interval. During this sequence, the task was detect back-to-back repeats of the same image and to indicate repeats as quickly as possible by hitting the space bar. This cover task was intended to help prevent participants from becoming explicitly aware of the structure in the stream and also avoided having participants simply view the stream passively. Note that they never informed that there was any structure in the stream of images.*

*Following this study period, observers were asked if they had recognized any structure in the stream and then were given a surprise forced-choice familiarity test.*

*Results indicated that participants on average detected 91% of the repetitions (SD=5%) and committing between 1-5 false alarms. No participants reported explicitly noticing that study stream had any structure. Performance on the familiarity test indicated that triplets were successfully discriminated from foils (86.6% of the test sequence chosen were triplets and 13.4 were foils, statistically significant).*

## OVERALL REFLECTION

- Appreciated students' effort in preparation before coming to class! Self-regulated learning!
- tRAT – favorite component as perceived by students
- Certain mark given to each activity is crucial. AE should carry some weight in final grade.
- Minimize time in lecturing; more enjoyable lesson for both teacher and students.
- TBL in CP was welcome by high achieving students; weaker students wanted more support/lecture/explanation. How to support weaker students in the future?

