

Cooperative Problem-Based Learning (CPBL): Example of Strategic Integration of Active Learning Techniques

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Outline

- Background – future & current needs of future graduates
- Active Learning (AL) & Student-Centered Learning (SCL) – the AL Continuum
- Integrating Cooperative Learning (CL) activities to support students in attaining outcomes
- Cooperative Problem Based Learning

The Grand Challenges in the 21st Century

Global Sustainability	Destruction of forests, wetlands, and other natural habitats Global warming Ballooning global population
Energy	Unsustainable fossil fuel Sustainable energy technologies Alternative energy technologies Energy infrastructure
Global Poverty and Health	Green revolution 1/6 population - extreme poverty Globalization
Infrastructure	Aging infrastructure Urbanization Manufacturing to knowledge services Systems integration

Malaysia's New Economic Model

Source: New Economic Model for Malaysia: Part 1



Target
USD 15,000
GNI per capita
by 2020



Enables all community benefits from the wealth of the country

Meets present needs without compromising future generations



The Challenge....

Will this work for the
21st Century?

Lila M. Smith

From K. Smith 2007

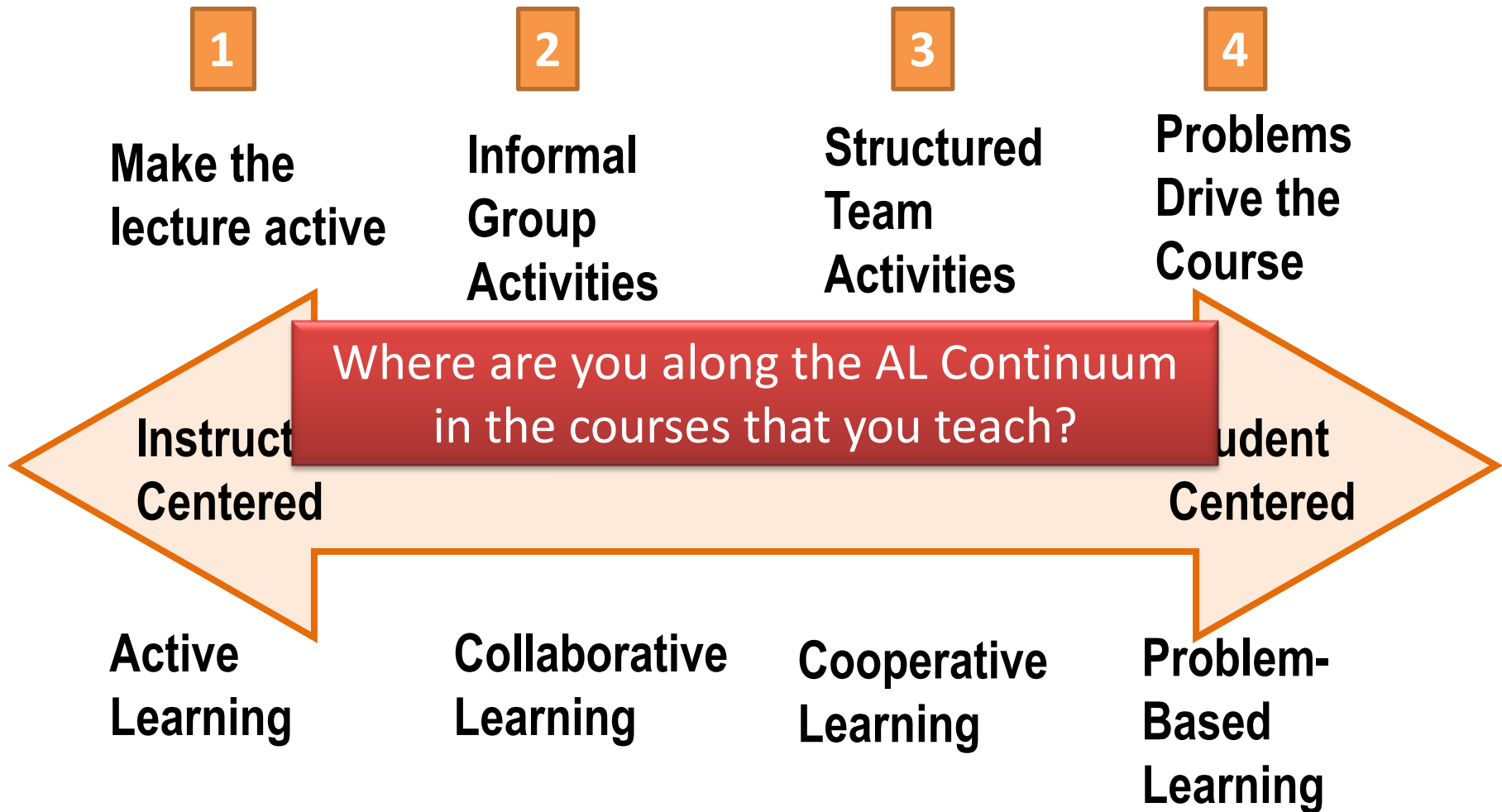
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Definition

- Active learning
 - Any focused learning activity that has students engaged in doing something else to learn other than listening to lectures and taking notes
- SCL
 - Places students at the centre of the learning process
 - Takes into account who the students are, and their prior knowledge
 - Active participants in their learning
 - Teaches students to learn how to learn

The Active Learning Continuum



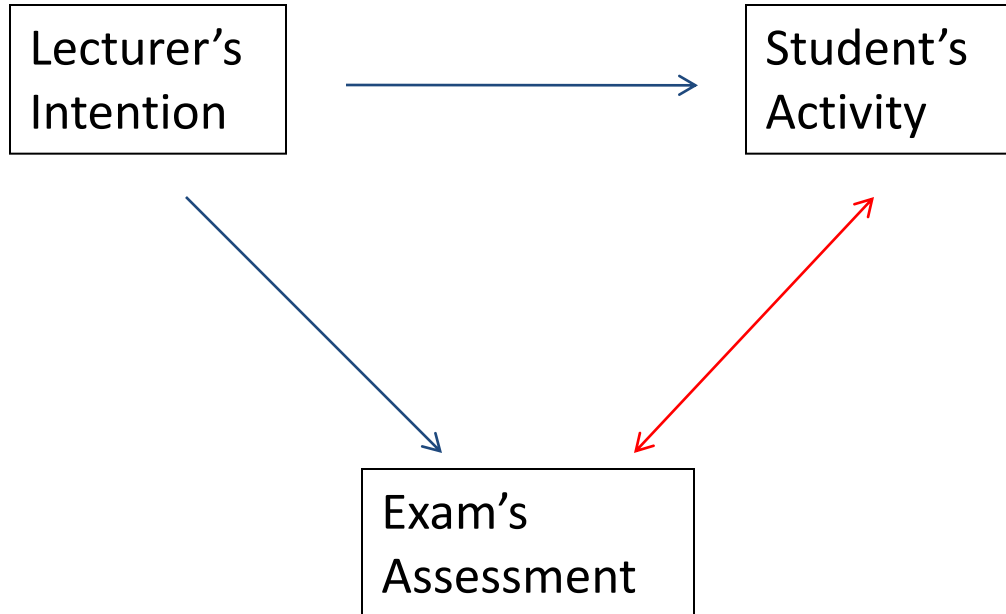


How do we choose which activity to use?

Constructive Alignment

Intended outcomes must clearly
be indicated

Activity will match
outcomes



Assess intended outcomes

What outcomes do I want to
achieve?

Where should I be along the AL
continuum?

Overt Learning Activities Model

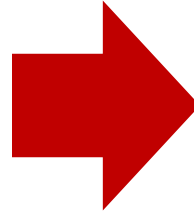
(Chi, 2008)

- Passive: students receive information
- Active: students manipulate the learning materials
- Constructive: students generate new ideas
- Interactive: students work together to generate ideas



$I > C > A > P$

If we want to
engage and
enhance students'
learning of a
concept ...



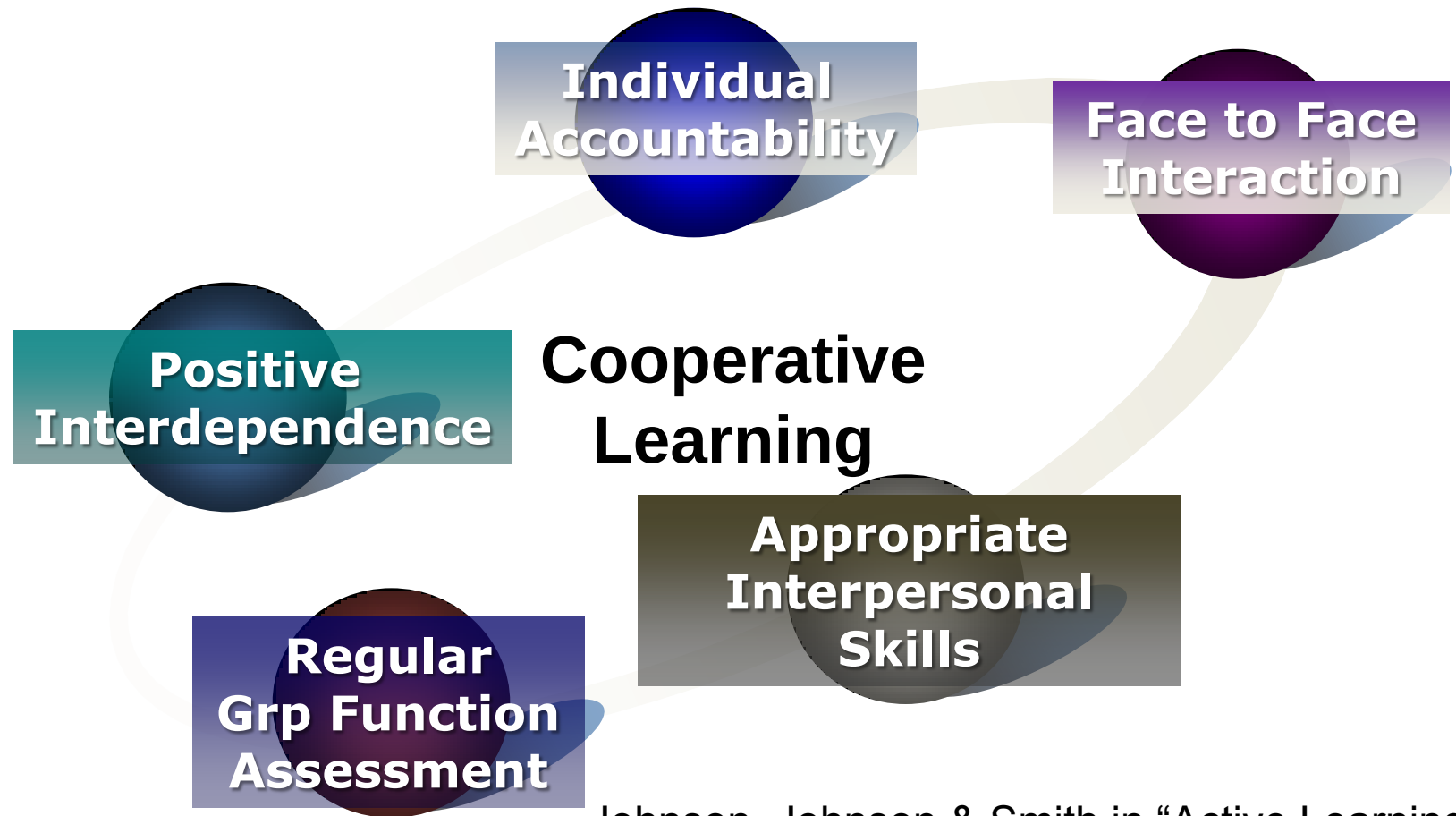
Since we know that
 $I > C > A > P$,
what type of
activity should we
choose?

Informal Cooperative Learning Activity
Eg: Think-Pair-Share

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Principles of Cooperative Learning



Johnson, Johnson & Smith in "Active Learning: Cooperation in the College Classroom", 2006

Cooperative Learning Structures

1

Informal

Ad-hoc groups
perform structured
active learning
activities

2

Formal

Formal long-term
groups ranging from
one class to one
semester– may
perform longer
structured activities

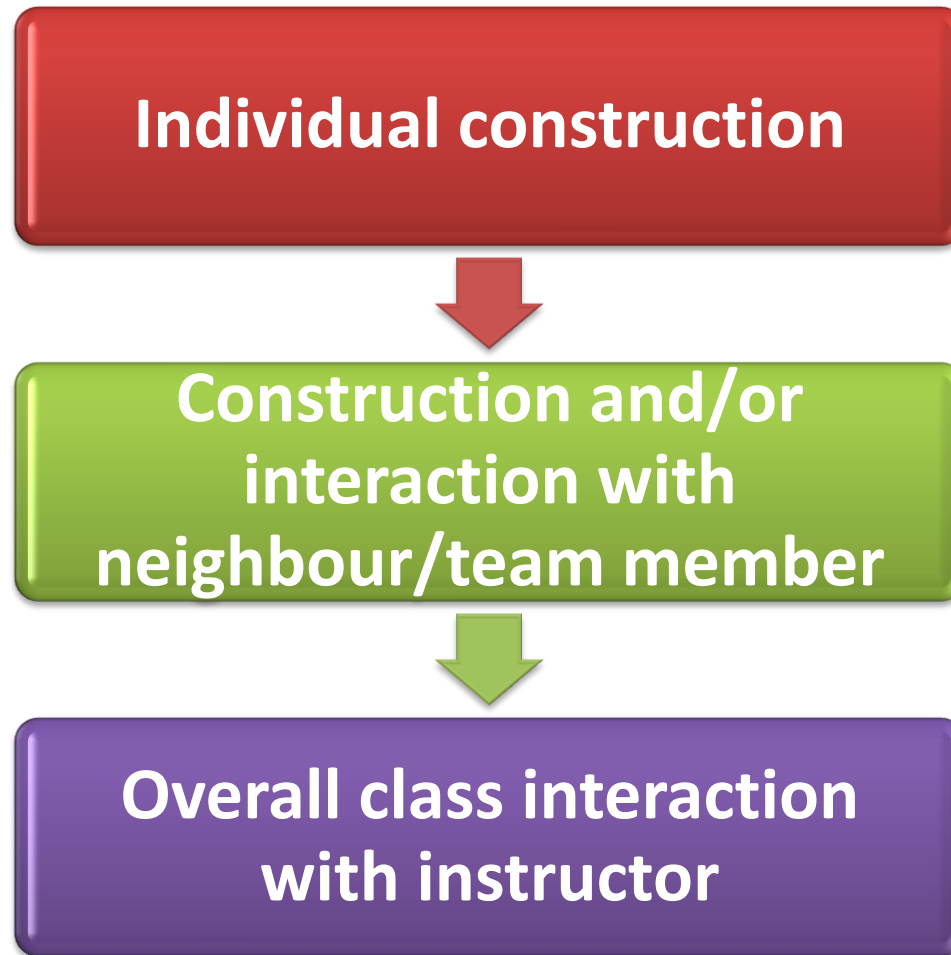
3

Cooperative base groups

- Formal
support groups
– from one
semester until
students
graduate

Pattern in Informal CL Activities

Involves everyone in the
class!

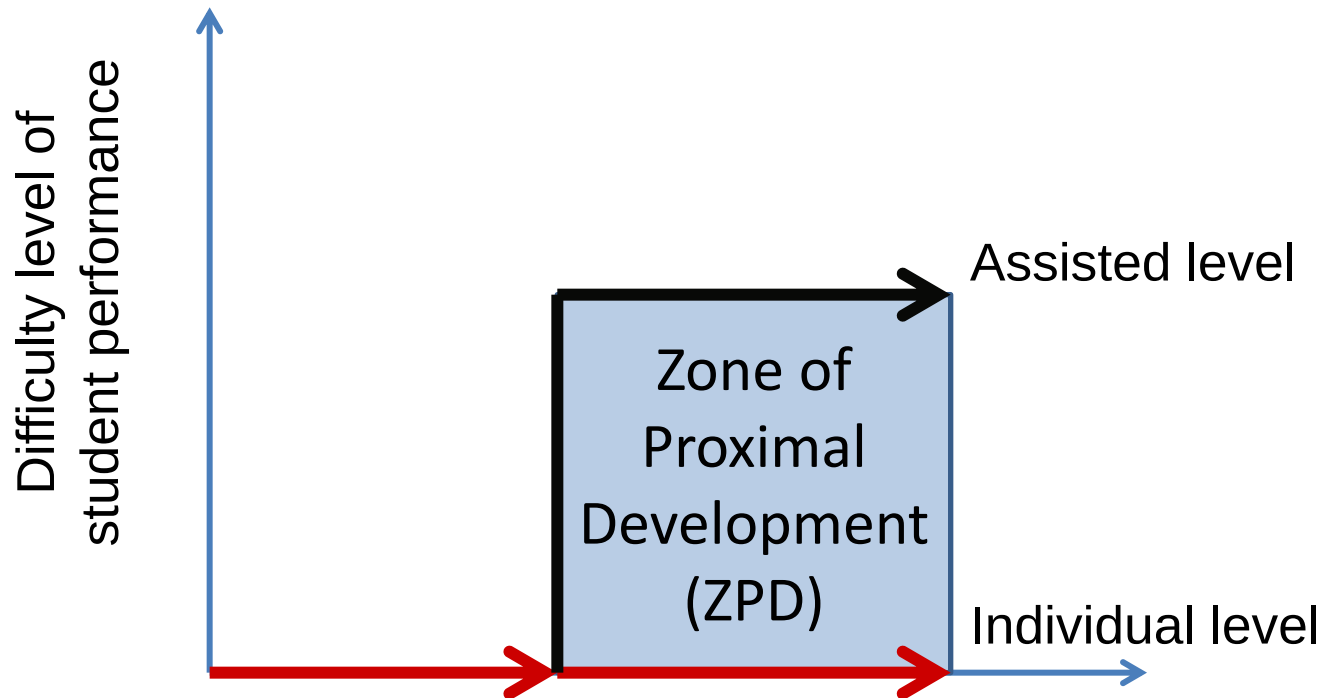


If life-long learning skill is desired...

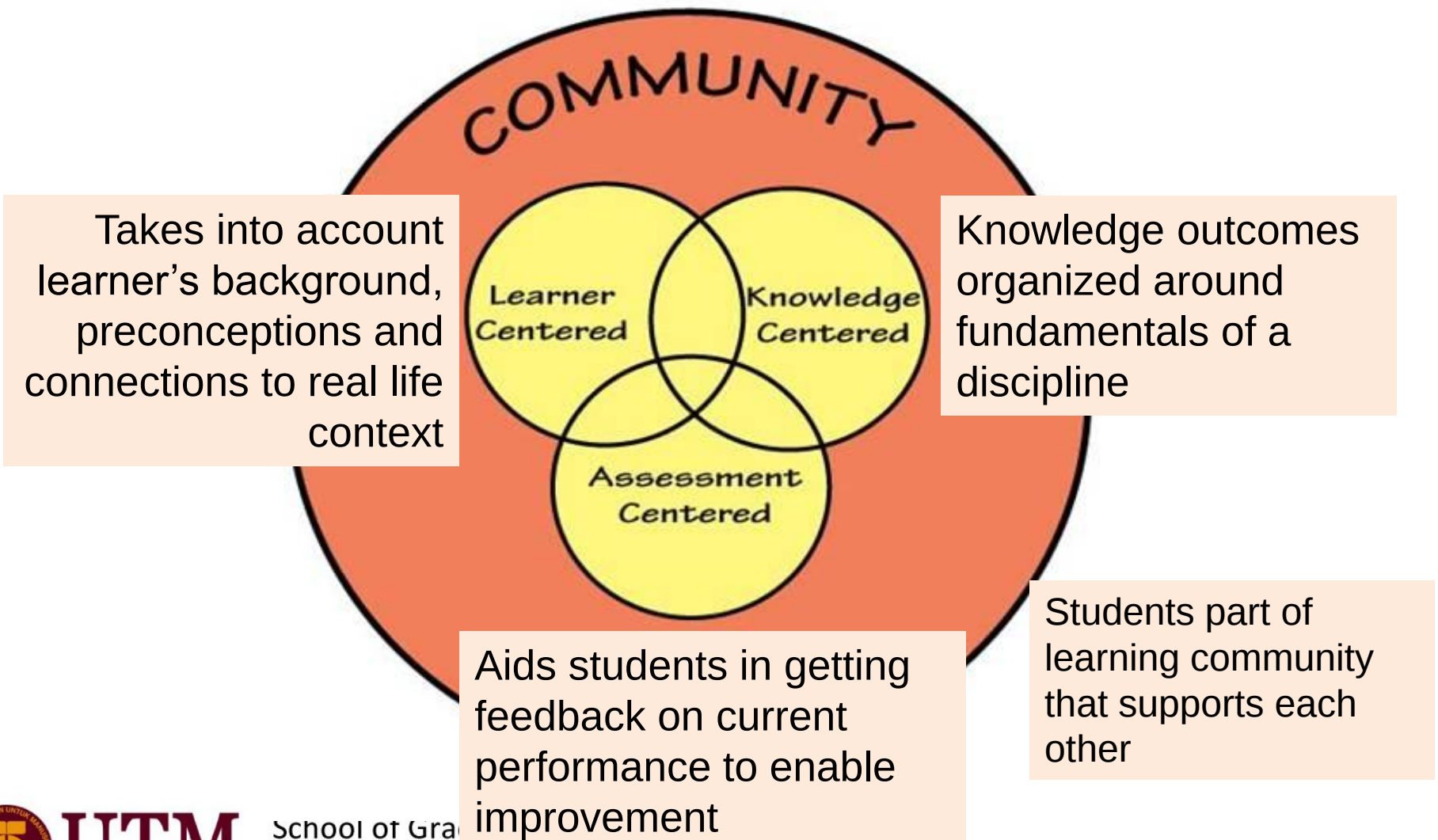
- Option 1: ask students to read certain topics on their own, and write a report / give a presentation / ask question during examination

Is this effective?

Add scaffolding to support student learning



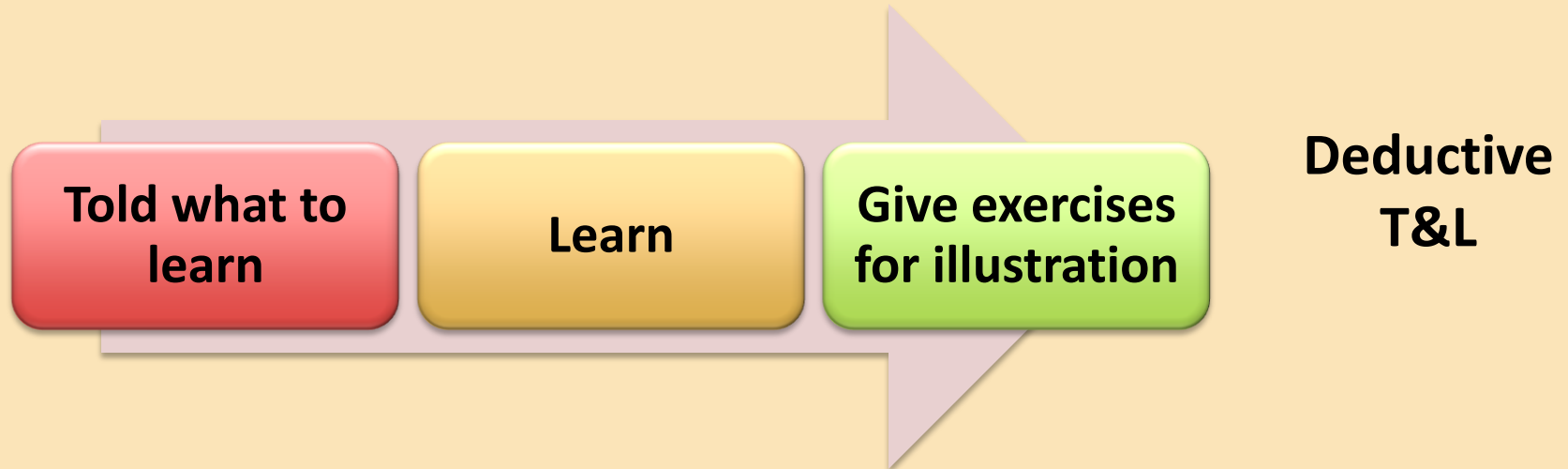
How People Learn (HPL) Framework



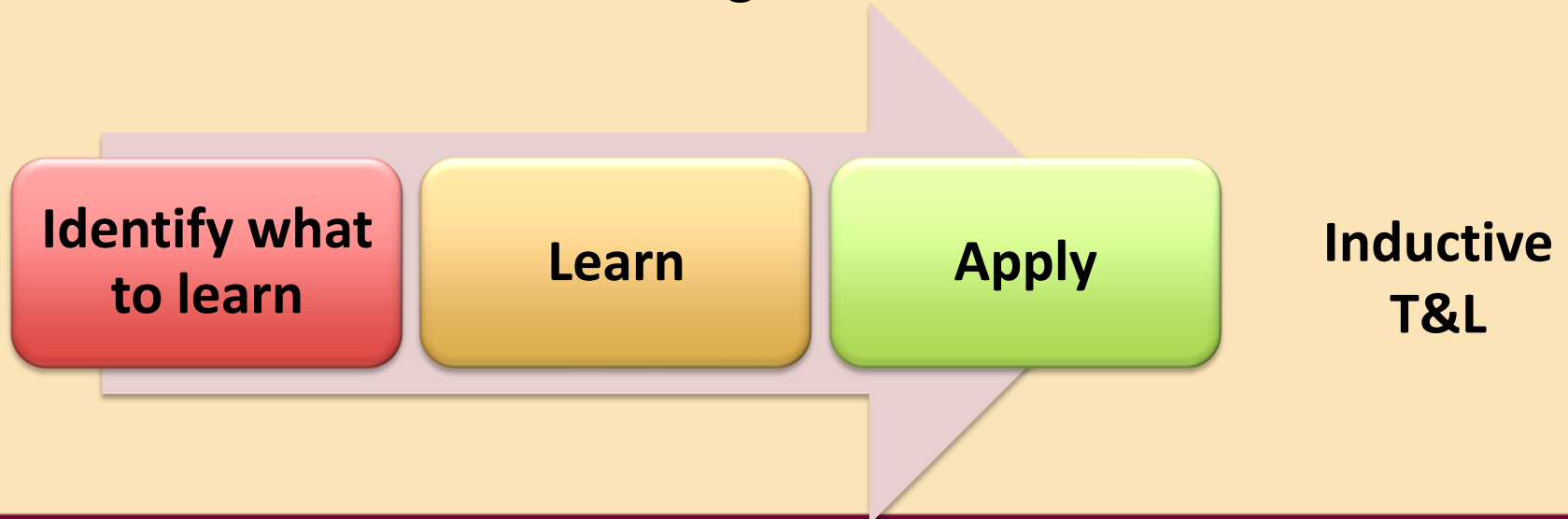
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Traditional Teaching and Learning (T&L) Model



Problem-Based Learning Model



What type of PBL?

- Many models in PBL (M-PBL, PoPBL, RP-PBL) (Barrows, 1996; Woods, 1996; Graaff and Kolmos, 2003; O'Grady, Hong and Ng, 2004)
 - Require intensive manpower, infrastructure and institutional support.
 - Small group (3 – 10 students), small-size classroom (below 25 students).
- PBL purist said PBL not effective in a small groups, in a medium to large class setting
 - PBL does not develop team working skills, leading to breakdown in learning teams (Singaram, Dolmans, Lachman & Vleuten, 2008; Wee, 2005; Peterson, 2004)
- Detractors of PBL tend to assert that PBL does not work at all (Kirschner, Sweller and Clark, 2005).
- Focus shift from comparing PBL vs traditional methods, to effective models of PBL in typical classroom settings, and how it happens (Strobel and Barneveld, 2009)

Coping with change – need to explain and rationalize => MOTIVATE!!

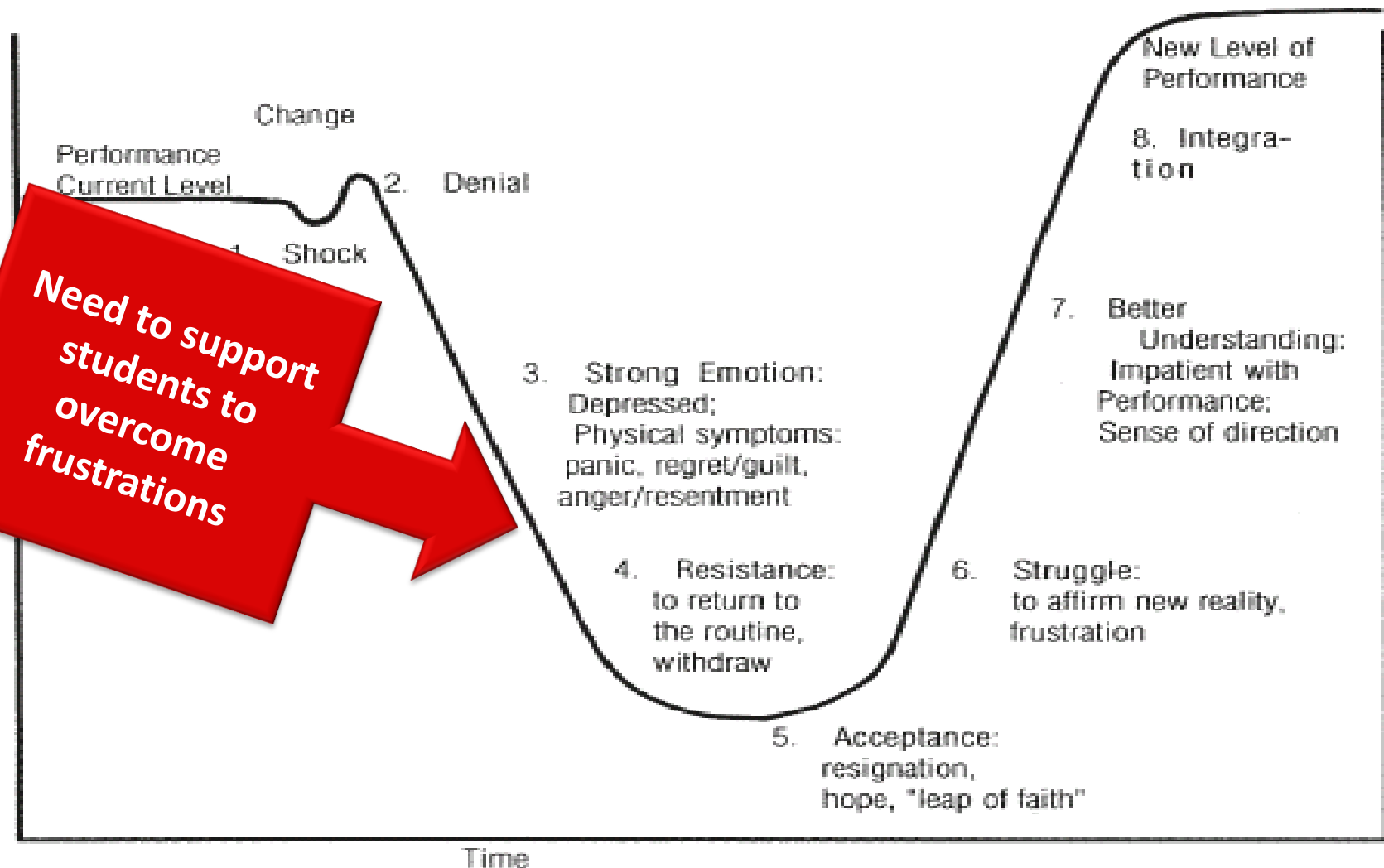
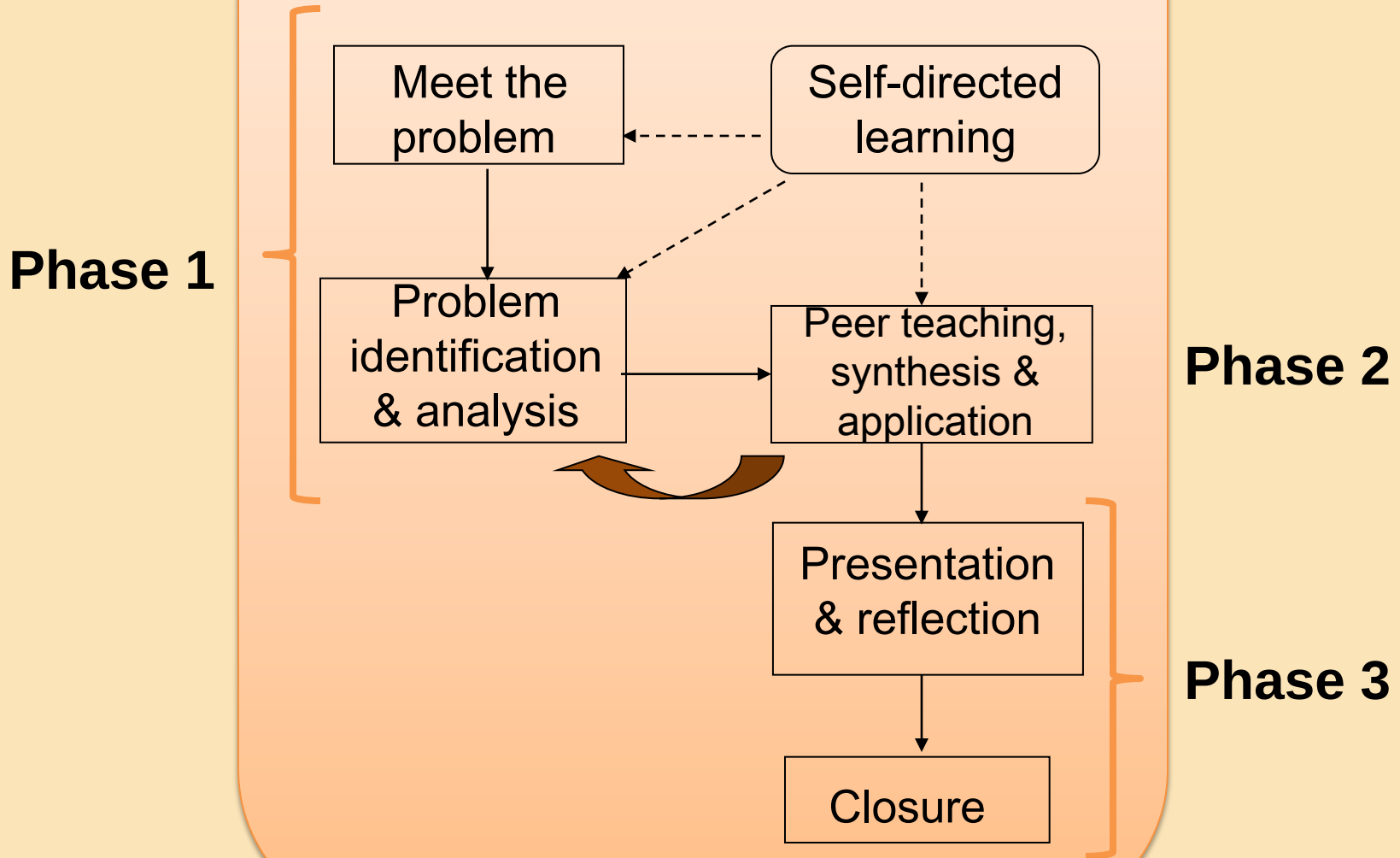


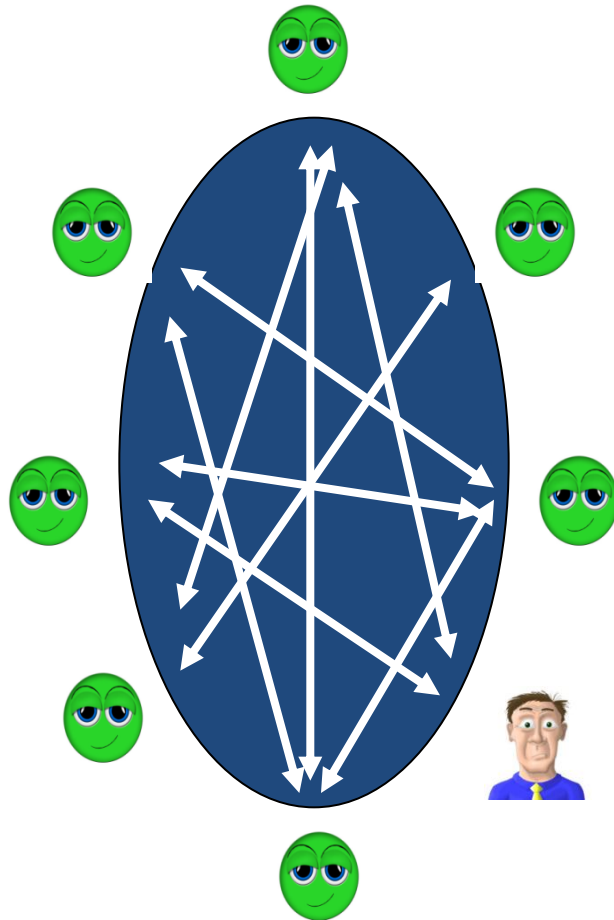
Figure 1-1 The grieving process as a model of how we cope with change

The PBL Process



Medical School Model

Typical course implementation

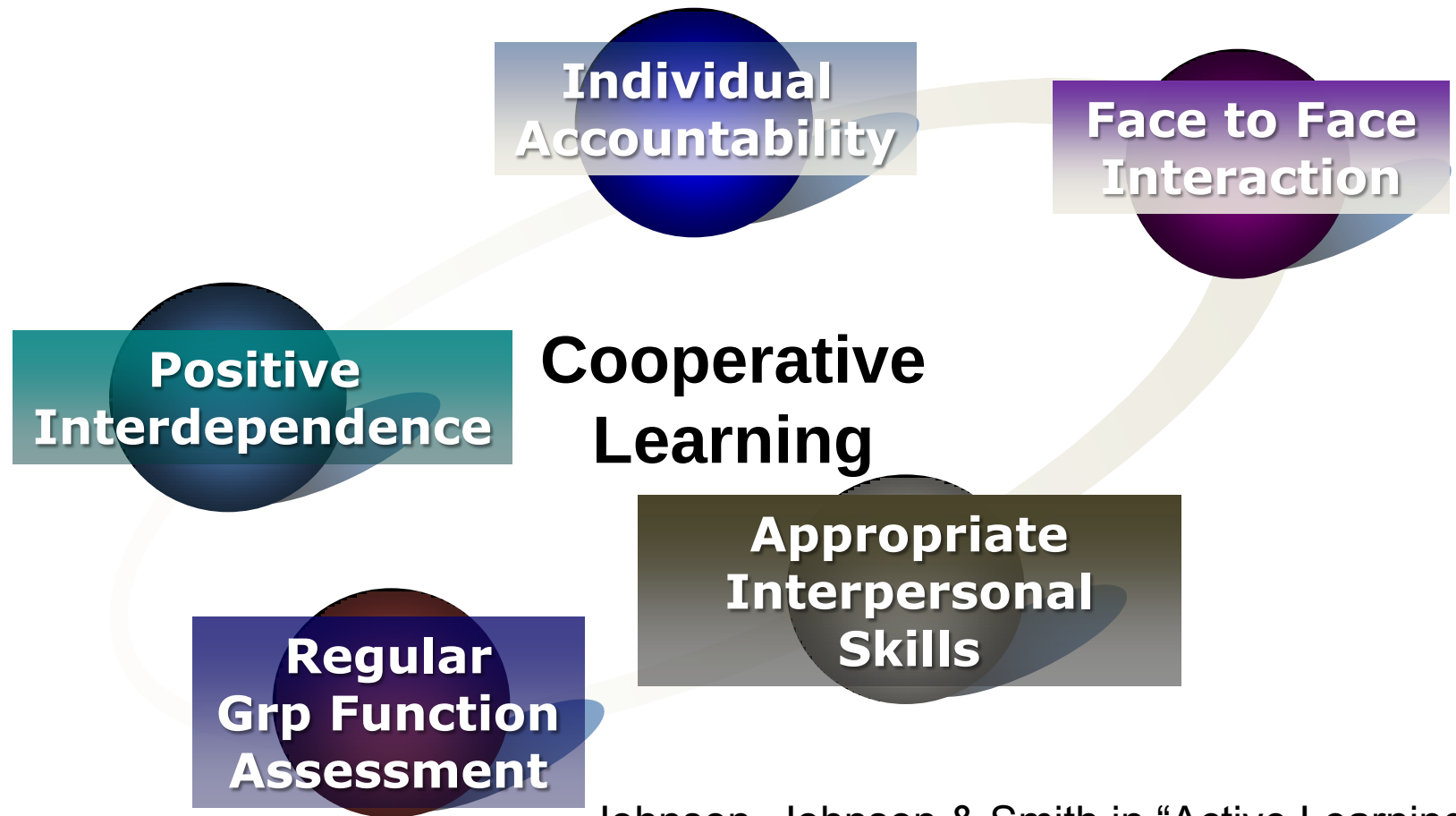


Small groups in a
medium/large class
using a floating facilitator

What normally happens when we assign students into groups to learn?

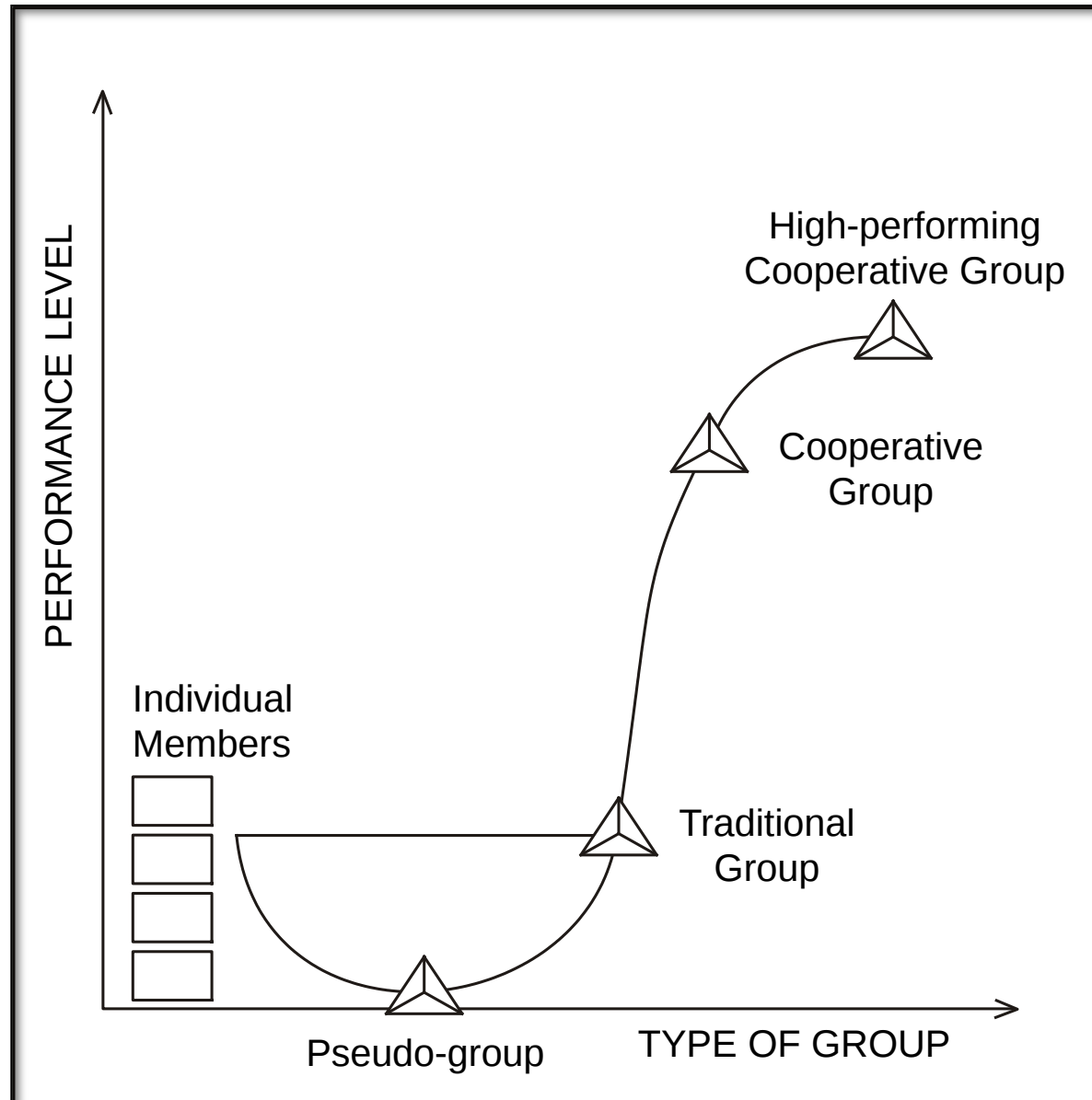
Can we provide support using
Cooperative Learning?

Principles of Cooperative Learning



Johnson, Johnson & Smith in "Active Learning: Cooperation in the College Classroom", 2006

Performance Level of a Group (K. Smith, 2007)

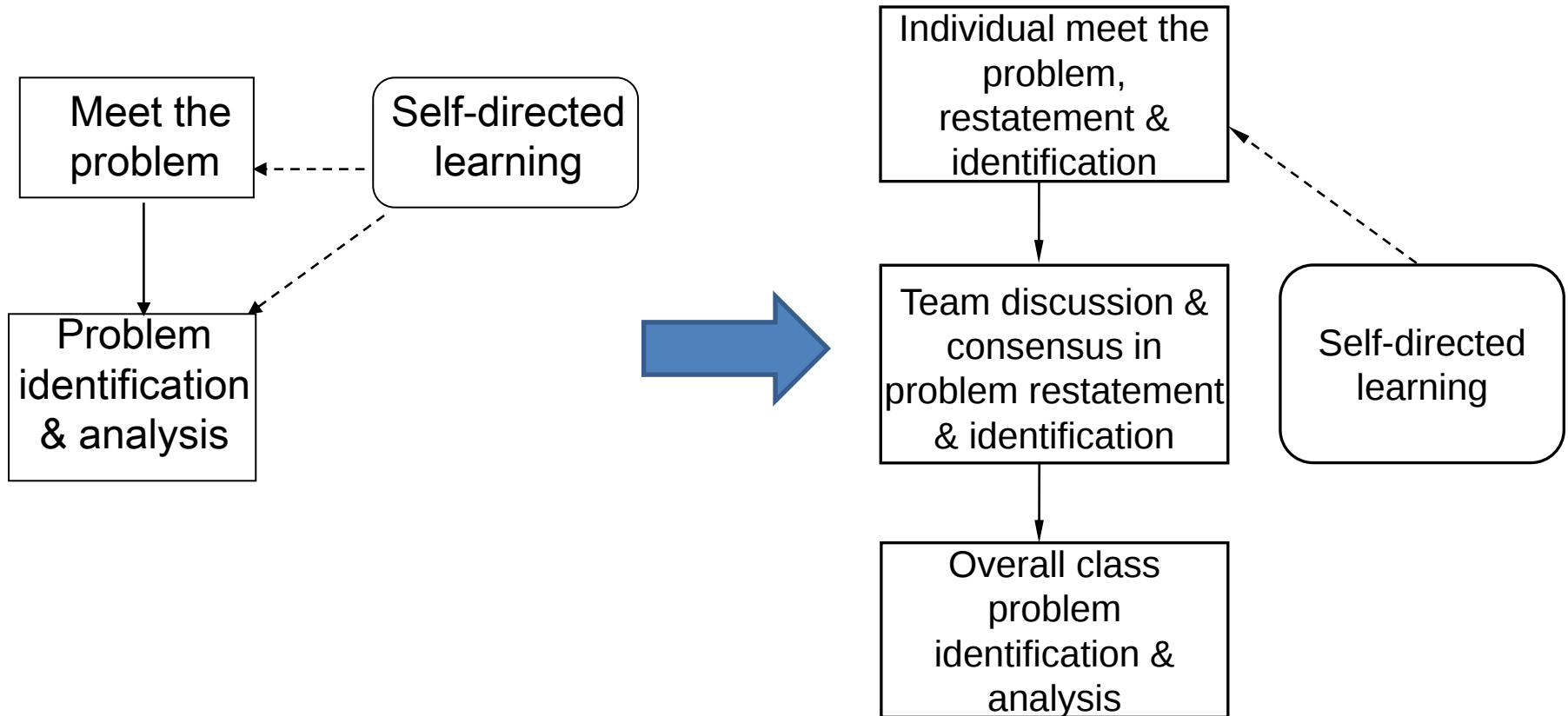


My best experience in team working was in this PC class. I can feel the strength of team work by working with my team. But, one thing I'm confused on: can cooperation in a team be achieved if just one member did the best? Here, I want to make a comparison with my * team and ** class team this semester that have a big project.

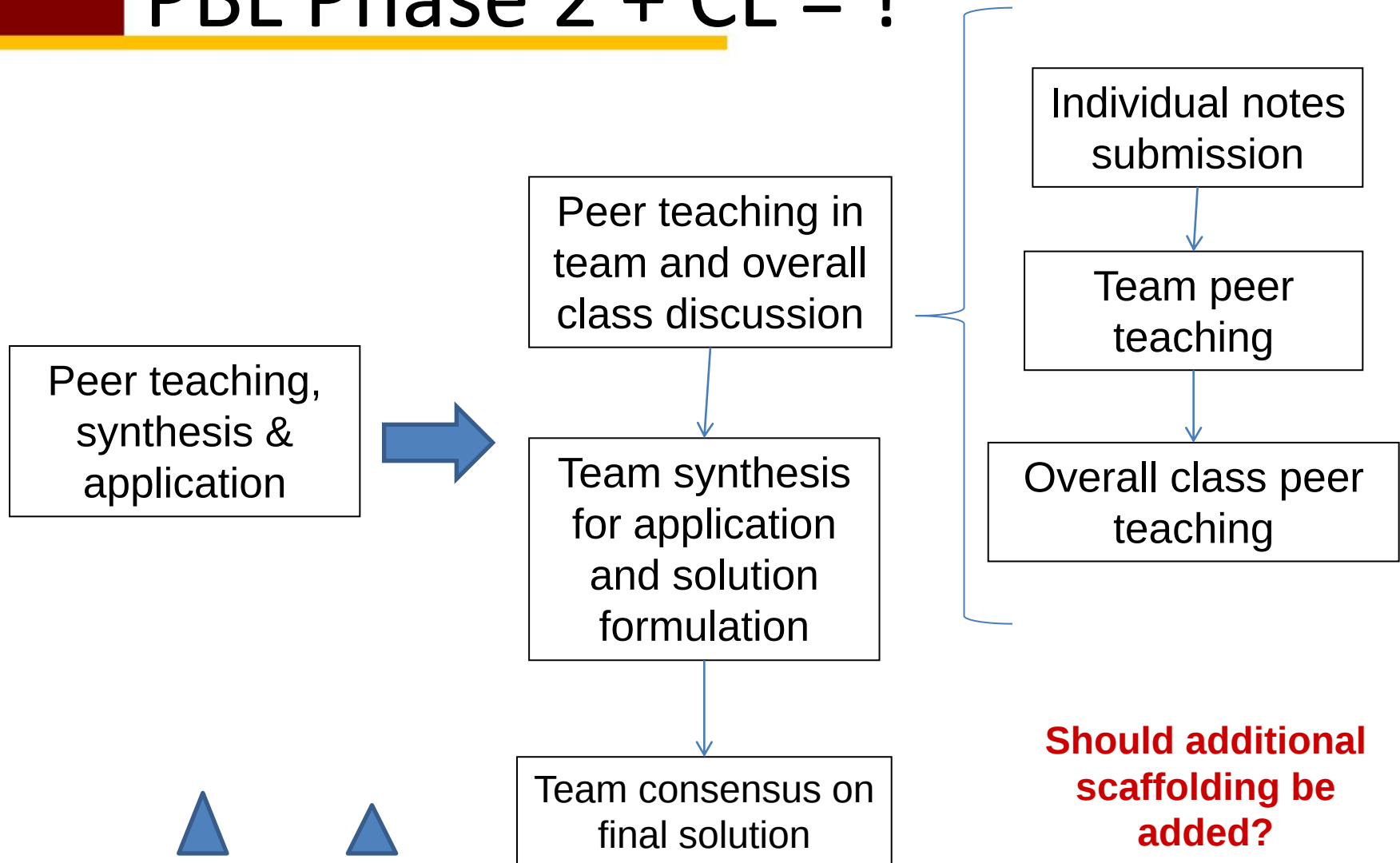
* Team	** Team
know her/his task well and also help others	doesn't know what to do (because doesn't want to know) and doesn't help others
finish task on time	always delay work for individual task
everyone play their role well	everyone doesn't want to lead (or be project manager)

In *Team and **team, I gave the same effort that I could give to achieve the very best work at the end. But, the outputs that I got at the end were not the same. Here, a conclusion that I can make is a good team need to have all team members' effort, not just one person. The performance of a team member does not depend on how great he/she is, but by how much effort put in to help himself/herself and others. If left up to only one member, the one person is lastly very exhausted because of tiredness and frustration.

PBL Phase 1 + CL = ?

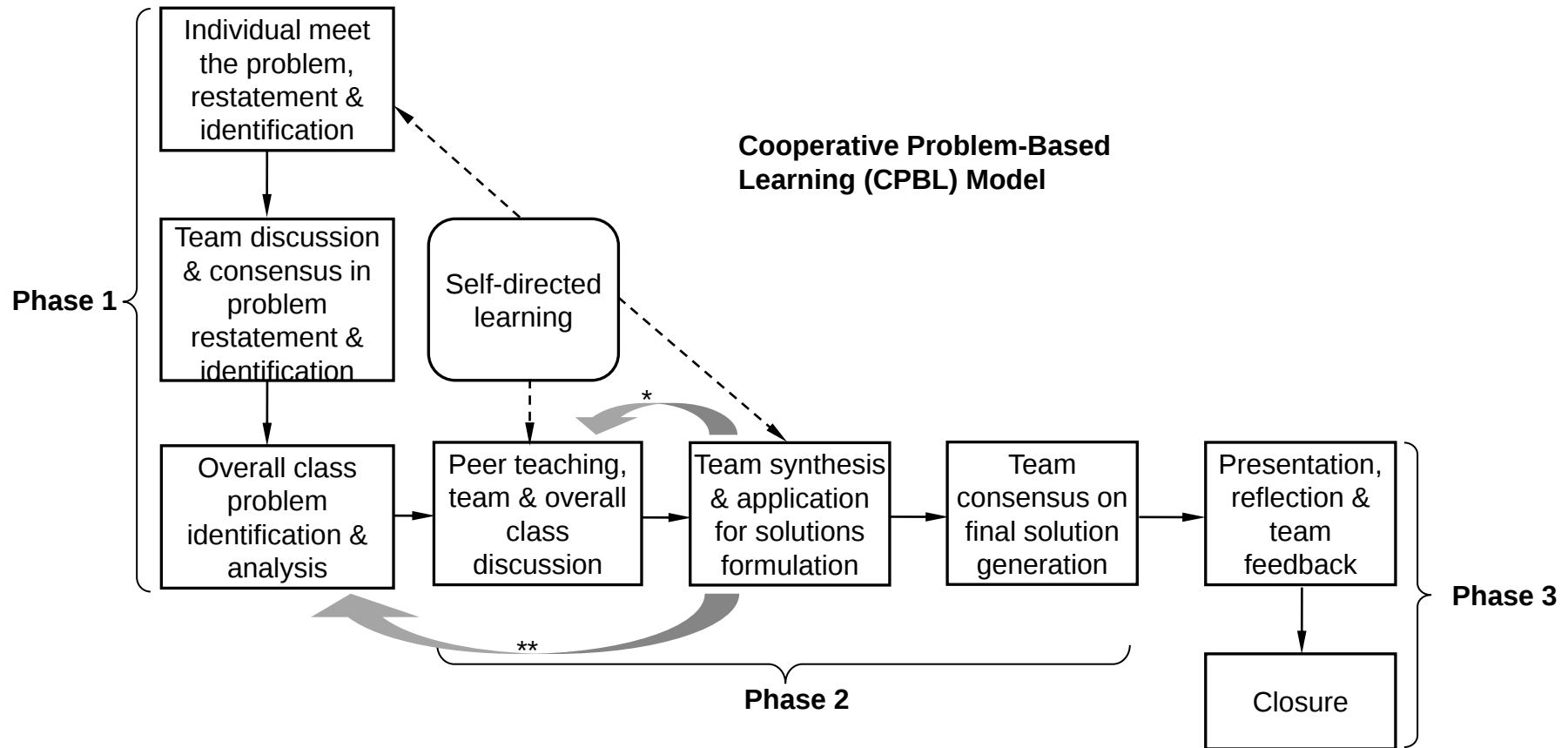


PBL Phase 2 + CL = ?



Should additional scaffolding be added?

Cooperative Problem-based Learning (CPBL)



* Insufficient understanding of learning issues to solve problem

**Incomplete or misunderstanding of problem requirements

** Incomplete or misunderstanding of problem requirements

Forum Post from a Student:

“Going through the CPBL cycle has helped me a lot in completing the case study. With this cycle, I'm able to settle the problem step by step and at the same time reducing the stress on thinking how to settle this complicated problem myself. The discussions with team mates and during classes reduce my burden on this problem and it became easier for me to solve the problem.”

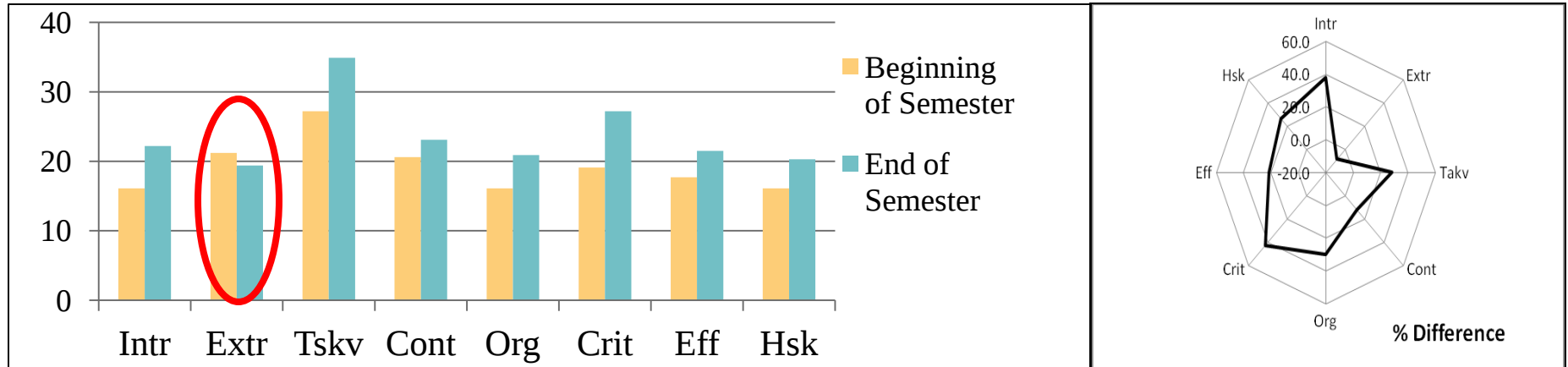
Cooperative Problem-based Learning (CPBL)

- An inductive learning method that incorporates the five principles of Cooperative Learning (CL) into the Problem-Based Learning (PBL) cycle (Khairiyah et al., 2011)
- Suitable for small groups in a medium size class (40-60) with one floating facilitator



Syed Ahmad Helmi et al. (2011) found that CPBL enhances students' motivation and learning strategies, problem solving abilities, and team working skills

Motivation and Learning Strategies



Paired Sample t-test	Paired Differences			t	p< .05	Effect Size (d)
	Mean	Std. Deviation	Std. Error Mean			
Intrinsic	-6.300	4.793	.875	-7.199	0.000	1.49
Extrinsic	1.667	3.623	.661	2.520	0.018	0.41
Task Value	-7.467	6.431	1.174	-6.359	0.000	1.41
Control Belief	-3.367	3.792	.692	-4.863	0.000	0.99
Organization	-5.300	3.949	.721	-7.351	0.000	1.38
Critical Thinking	-8.433	5.673	1.036	-8.142	0.000	1.95
Effort Regulation	-3.533	4.075	.744	-4.750	0.000	0.89
Help Seeking	-4.167	3.797	.693	-6.010	0.000	1.30

The virtuous cycle of research & practice



**Educational
Practice**

When it comes to educating our future engineers, we can no longer afford “an enterprise of methodical guessing” (Bertrand Russell).

which help
improve

**Answers
Insights**

that results in

**Educational
Research**



**Questions
Ideas**

which lead to

(David Radcliffe, 2010)

Students' Responses in Mid Sem during Students' Perception of CPBL Study

Self-directed and
group work
engagement

Improvement of their
reading and learning
skills

Optimizing their
efforts in learning

Offering better
understanding of their
mistakes through open
class discussions

Learning new
approached in
problem solving for
future career

Improvement of
interpersonal skills
and communication
among friends

Students' Responses in Mid Sem

a. Self-independent and group work engagement

Q6-A1.3. *"...I love this class! I love the self-making notes, group activities and open-minded class discussions. All these hardworking efforts make me appreciate myself more..."*

b. Improvement of reading and learning skills

Q6-A2.1. *"...the presented notes are results from reviews on peer-teaching notes from friends. I have reviewed others' models several times and study the differences and similarities in textbooks. It causes me do lots of reading, rewriting and rereading, something that I have never done before..."*

c. Optimizing own efforts in learning

Q6-A3.1. *"It very different! This learning style is not dependent on lecture and lecture notes, requires students to talk and discuss among each other. It mostly about self-learning..."*

Students' Responses in Mid Sem

d. Better understanding of own mistakes

Q6-A4.1. *"It is truly different! If we have misconceptions, these concepts will be thoroughly discussed together again and again in the classroom. It differs from previous learning method, where it's only on the paper, nobody care to ask and most students just pretend to understand..."*

e. Approach towards future industry problems and applications

Q6-A5.2. *"Since study using CPBL approach, my understandings on specific problems are better. Compared to previous classes, students only describe the theoretical situations and concepts in industry. But, through CPBL the problems are more practical, based on what may happen and how to solve the problems."*

f. Improve self-interpersonal skills and interactions

Q6-A6.1. *"Before this, I am passive, shy to interact with friends and to come forward. But now, I feel relaxed, better communications and close to my friends. Now I can even freely tell my jokes!"*

Conclusion

- Meaningful learning environment can be created through Active Learning
- Different methods can be integrated to harness the strength of each technique in supporting student learning
- Strategic placement can create powerful learning environment