Cooperative Problem Based Learning (CPBL) Process: Phase 1 & Phase 2

Khairiyah Mohd. Yusof, PhD  
(khairiyah@cheme.utm.my)  
&  
Syed Ahmad Helmi Syed Hassan, PhD  
(helmi@fkm.utm.my)

Centre of Engineering Education  
Universiti Teknologi Malaysia

Universiti Teknologi Malaysia  
3-4 September 2014
COOPERATIVE PROBLEM-BASED LEARNING (CPBL)
Medical School Model

Typical course implementation

Small groups in a medium/large class using a floating facilitator
Performance Level of a Group (K. Smith, 2007)

TYPE OF GROUP

- Individual Members
- Pseudo-group
- Traditional Group
- Cooperative Group
- High-performing Cooperative Group
Principles of Cooperative Learning

Positive Interdependence

Individual Accountability

Face to Face Interaction

Cooperative Learning

Appropriate Interpersonal Skills

Regular Grp Function Assessment

Johnson, Johnson & Smith in “Active Learning: Cooperation in the College Classroom”, 2006
Pattern in CL Activities

- Individual construction
- Construction and/or interaction with neighbor/team member
- Overall class interaction with instructor

Involves everyone in the class!
The PBL Process

Phase 1

Meet the problem

Problem identification & analysis

Phase 2

Self-directed learning

Peer teaching, synthesis & application

Phase 3

Presentation & reflection

Closure
PBL Phase 1 + CL = ?

- Meet the problem
- Self-directed learning
- Problem identification & analysis
PBL Phase 2 + CL = ?

Peer teaching

Team synthesis for application and solution formulation

Team consensus on final solution

Peer teaching, synthesis & application

Should additional scaffolding be added?
Cooperative Problem-Based Learning (CPBL) Model

Phase 1
- Individual meeting the problem, restatement & identification
- Team discussion & consensus in problem restatement & identification
- Overall class problem identification & analysis

Phase 2
- Individual notes, Peer teaching in team & overall class discussion
- Team synthesis & application for solutions formulation

Phase 3
- Team consensus on final solution generation
- Presentation, reflection & team feedback

* Insufficient understanding of learning issues to solve problem
** Incomplete or misunderstanding of problem requirements

IEEE & IJET paper 2011
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.”
UTM CPBL Model

• PBL + CL = CPBL
• Small groups (3 to 5 students per team) in a medium to large class (30-60 per class) – floating facilitator
• Used to cover content – in the form of learning issues (knowledge gap) – which must be learned to solve problem
• Designed based on Constructive Alignment and HPL Framework
• Duration: 1 to 4 weeks
On-going Work:
Researching the Effectiveness of Cooperative Problem Based Learning (CPBL)
Research on CPBL

• Does CPBL enhance:
  – Motivation and Learning Strategies
    • Motivated Strategy for Learning Questionnaire (MSLQ), $\alpha = 0.97$
  – Problem-solving
    • Engineering Problem-solving Instrument (EPSI), $\alpha = 0.94$
  – Team-working
    • Team-working Effectiveness Score (TES), $\alpha = 0.98$
• Pre and post test given to measure the difference at the end of the semester compared to the beginning of the semester
## Motivated Strategy for Learning Questionnaire (MSLQ)

<table>
<thead>
<tr>
<th>Section</th>
<th>Component</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>Value</td>
<td>1. Intrinsic Goal Orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Extrinsic Goal Orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Task Value</td>
</tr>
<tr>
<td></td>
<td>Expectancy</td>
<td>4. Control of Learning Beliefs</td>
</tr>
<tr>
<td>Learning Strategies</td>
<td>Cognitive/ Meta-cognitive Strategies</td>
<td>5. Organization</td>
</tr>
<tr>
<td></td>
<td>Resource Management Strategies</td>
<td>6. Critical Thinking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Effort Regulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Help Seeking</td>
</tr>
</tbody>
</table>

Overall reliability, $\alpha = 0.97$
Result of pair t-test

<table>
<thead>
<tr>
<th>Scale</th>
<th>p&lt;0.05</th>
<th>Effect Size (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic</td>
<td>0.000</td>
<td>1.49</td>
</tr>
<tr>
<td>Extrinsic</td>
<td>0.018</td>
<td>0.41</td>
</tr>
<tr>
<td>Task Value</td>
<td>0.000</td>
<td>1.41</td>
</tr>
<tr>
<td>Control Belief</td>
<td>0.000</td>
<td>0.99</td>
</tr>
<tr>
<td>Organization</td>
<td>0.000</td>
<td>1.38</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>0.000</td>
<td>1.95</td>
</tr>
<tr>
<td>Effort Regulation</td>
<td>0.000</td>
<td>0.89</td>
</tr>
<tr>
<td>Help Seeking</td>
<td>0.000</td>
<td>1.30</td>
</tr>
</tbody>
</table>
Motivation
Intr = intrinsic goal orientation
Extr = extrinsic goal orientation
Tskv = task value
Cont = Control of learning beliefs

Learning Strategies
Org = organization
Crit = critical thinking
Eff = effort regulation
Hsk = help seeking

Value
Expectancy

Cognitive/ Meta-cognitive
Resource Management
Problem Solving Ability - Deep Thinking

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>p &lt; .05</th>
<th>Effect Size (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Identification</td>
<td>8.86</td>
<td>Sig</td>
<td>1.80</td>
</tr>
<tr>
<td>Analysis and Synthesis</td>
<td>8.89</td>
<td>Sig</td>
<td>2.09</td>
</tr>
<tr>
<td>Solution Generation</td>
<td>9.68</td>
<td>Sig</td>
<td>1.84</td>
</tr>
<tr>
<td>Reflection</td>
<td>10.02</td>
<td>Sig</td>
<td>1.59</td>
</tr>
<tr>
<td>Self-directed Learning</td>
<td>7.42</td>
<td>Sig</td>
<td>1.74</td>
</tr>
</tbody>
</table>
Problem Solving Assets

<table>
<thead>
<tr>
<th>Component</th>
<th>t</th>
<th>p&lt; .05</th>
<th>Effect Size (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>11.402</td>
<td>Sig</td>
<td>1.92</td>
</tr>
<tr>
<td>Expectation</td>
<td>8.615</td>
<td>Sig</td>
<td>1.76</td>
</tr>
<tr>
<td>Process</td>
<td>9.898</td>
<td>Sig</td>
<td>2.08</td>
</tr>
</tbody>
</table>
## Team-Working

<table>
<thead>
<tr>
<th></th>
<th>Sig. (2-tailed)</th>
<th>p&lt; .05</th>
<th>Effect Size (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdependence</td>
<td>.040</td>
<td>Sig</td>
<td>-0.265</td>
</tr>
<tr>
<td>Potency</td>
<td>.023</td>
<td>Sig</td>
<td>-0.293</td>
</tr>
<tr>
<td>Goal Seeking</td>
<td>.018</td>
<td>Sig</td>
<td>-0.306</td>
</tr>
</tbody>
</table>
WHAT IS THE BEST WAY FOR YOU TO START LEARNING ABOUT CPBL?

What better way than to ...

Go through it yourselves!!!

• Will allow full understanding of CPBL cycle
  • Visualize how CPBL is conducted
• Understand how students feel when undergoing the cycle for the first time
PHASE 1 OF CPBL
LET’S FORM TEAMS AND START PHASE 1 OF CPBL
TLA in Phase 1

- Individual Problem Restatement & Prob Identification (PR&PI)
- Team discussion & consensus on PR&PI
- Overall class discussion
Problem Restatement & Identification (PR & PI)

• Identify:
  – What is known
  – What data or information needed
  – New knowledge needed to solve problem → learning issues
## CPBL Process

<table>
<thead>
<tr>
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<th>Purpose</th>
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</thead>
<tbody>
<tr>
<td><strong>1. Meet the problem.</strong>&lt;br&gt;Students read and address problem. Come-up with a problem statement agreed by the team</td>
<td>Teaches students to encode and organize information in useful ways. Allows students to find what they know and what they don’t know. Misconceptions can be corrected in discussion of the problem. Ensure sweeping assumptions and biases are avoided</td>
</tr>
</tbody>
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## CPBL Process

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<tr>
<td><strong>2. Problem identification.</strong> Students discuss and analyze problem using prior knowledge and resources available. May use KNL or FILA table to analyze problem</td>
<td>Development of cognitive skills for problem-solving process</td>
</tr>
<tr>
<td>Facilitator poses questions: ie. •Do you need more information?</td>
<td>Development of self-monitoring skills to identify the learning needs</td>
</tr>
<tr>
<td>•Are you sure of the facts or will a review be helpful?</td>
<td>Development of habitual student-initiated questioning</td>
</tr>
<tr>
<td>•Do you think more information on this area would be helpful?</td>
<td></td>
</tr>
<tr>
<td>What we know</td>
<td>What we need to know</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------</td>
</tr>
</tbody>
</table>

Let’s try to look at a problem...
The Mosquito Problem

There is an explosion of mosquitoes in a suburban region of Kampala, Uganda. Local news report that several villages and towns there have been under siege from disease-carrying mosquitoes. According to a report from a nearby medical centre, a number of people have been hospitalized. The usual method of mosquito control do not seem to be effective.

You are with a group of humanitarian volunteers & workers. The group has been approached to help with the problem. You have access to further support, resources and funding, which will be given based on your recommendations. What recommendations will you make to help solve the problem?
How to tackle the problem?
Now let’s look at YOUR problem....
Individual Problem Restatement & Problem Identification (PR & PI)

• Restate the problem IN YOUR OWN WORDS
  – The restatement should be concise, in complete sentences

• Identify:
  – What is known
  – What data or information needed
  – New knowledge needed to solve problem → learning issues
Going back to YOUR problem...

Complete Phase 1
Starting Phase 2
of the CPBL cycle...
Cooperative Problem Based Learning (CPBL) Model

Phase 1
- Indiv. meet the problem & identification
- Team discussion & consensus in problem restatement & identification
- Overall class problem identification & analysis
- Self-directed learning

Phase 2
- Peer teaching, team & overall class discussion
- Team synthesis & application for solutions formulation
- Team consensus on final solution generation

Phase 3
- Presentation, reflection & team feedback
- Closure

*Insufficient understanding of learning issues to solve problem
** Incomplete or misunderstanding of problem requirement
TLA in Phase 1

- Individual Problem Restatement & Prob Identification (PR&PI)
- Team discussion & consensus on PR&PI
- Overall class discussion
Team PR & PI (20 minutes)

• Share your PR & PI with your team mates
• Come up with one PR & PI that the team has come to a consensus on
• Write the PR & PI on mahjong paper and paste it on the wall for the rest to see
<table>
<thead>
<tr>
<th>What we know</th>
<th>What we need to know</th>
<th>Learning issues</th>
</tr>
</thead>
</table>
Restatement

2. Implementation of OBE and PBL application to IPT MARA

1. We are the teachers’ that are selected by MARA to implement the CPBL in microteaching and has attend an introductory w’shop

5. As a PBL champion of MARA, we have to craft a CPBL problem for a micro-level implementation of the course we are teaching next semester.
KNL Table
Infusing PBL into the Curriculum

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mega</td>
<td>Major revamp of course curricula. Need commitment at all levels.</td>
</tr>
<tr>
<td>Macro</td>
<td>Need department approval, and commitment by lecturers teaching the subject.</td>
</tr>
<tr>
<td>Micro</td>
<td>Recommended for new starters. Can be unnerving for isolated implementation among multi-sections</td>
</tr>
</tbody>
</table>

Eg: applied to entire third year of a certain programme

Eg: applied to two subjects in the second year of a programme

Eg: applied to specific topics in a subject
TLA in Phase 2

- Indiv. peer T&L notes, team peer T&L and overall class discussion
- Team synthesis & strategies for solution formulation
- Team consensus on final solution
## CPBL Process

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<tr>
<td><strong>2. Problem analysis (cont’d). Students decide what they need to know and where they might best find the information. They decide which resources to use (people, published papers, etc.) and divide tasks.</strong></td>
<td><strong>Self-directed learning, peer teaching</strong></td>
</tr>
<tr>
<td><strong>Team synthesize new knowledge to solve problem. Apply and perform required tasks</strong></td>
<td></td>
</tr>
</tbody>
</table>
“Reading is one method to gain knowledge and discussing is a one way to gain better understanding. To make discussion more effective, we must at least have a little knowledge about what we're going to discuss. These little knowledge we can get by reading by our own first before starting discuss it to others. This is essential because if we don't have any idea or knowledge at all about the discussion topic, then during the session, we will become a passive learner and listener…Even though we listen carefully about what others are discussing or talking about, we know nothing about it. Then, we will find the discussion is not interesting and boring. And more worst, sometimes it will lows down our self-esteem because we feel ashamed because others have better understanding and knows about everything, but we know nothing. But actually it is our fault because we're not well-prepared especially in knowledge before joining the discussion session.”
e-learning Forum Post by Student 2 on Phase 2

long time ago:
read + read = happy
i used to just read and felt happy i already read...still in dream thinking i understand now. Thinking i'm safe now. Well, i already read. How bad things can be?? Better than not reading anything.

Now:
read + discussion = confuse + more reading
but when we continue our reading with discussion, it's a painful process. Where we have to be able to come out what we understand what we already read and ask question what we did not understand.
First time reading, we felt "yei..i read!!". Then someone ask a question, this is the time where the happiness vanished. haha..if i can't think any answer. I know i don't understand what i actually read.

well, yes ... I vote for reading where it will later lead us to discussion and next to understanding
Preparing for Peer Teaching

1. Read assigned articles individually
2. Summarize the points understood in own words
3. Summarize points to be clarified/verified
4. List questions to be asked
5. Write the main points on the sticky notes – these sticky notes will be pasted on a mahjong
6. Explain to team mates what was learned, along with questions for points that was not understood