FAS Learning and Teaching Forum

Department of Science and Environmental Studies

Sharing of Good Practices of Teaching

Experience sharing in OBL implementation –
Children's Science Learning and Science for Global and Environmental Studies

Tsoi Kwok Ho Samuel

Contents

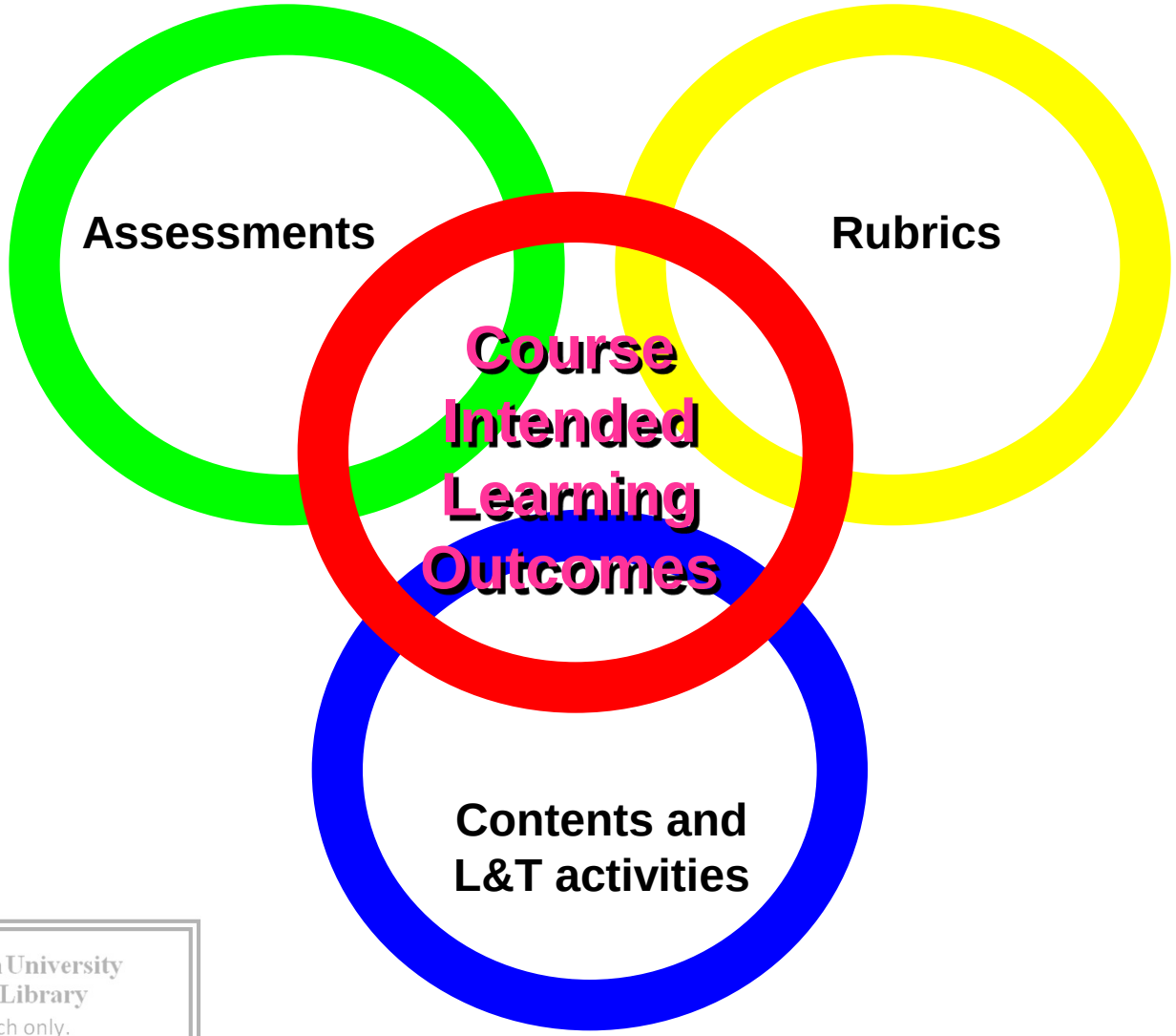
- Introduction of OBL approach
- How to develop the OBL approach in the course Children's Science Learning?
- Evaluation of OBL approach
  - Self evaluation
  - Departmental discussion
  - Students' feedbacks
- Conclusion

Introduction of OBL approach

- What is OBL?
  - Towards a Student Focused Approach to Teaching and Learning
  - The approach emphasizes the learning processes that would lead to planned and specified learning outcomes
  - 4 essential principles
    - Clarity of focus
    - Designing back
    - High expectation of students
    - Diverse learning opportunities

http://www.ied.edu.hk/obl/Introducing_OBL/What.html

OBL course structure



Children's Science Learning

- Development of OBL approach
  - Pilot study (Formal)
  - Course structure
  - Course outlines
  - Course intended learning outcomes
    - Contents and L&T activities
    - Assessments
    - rubrics

Traditional approach

THE HONG KONG INSTITUTE OF EDUCATION

Module Outline **Structure**

Programme Title : Four-year full-time Bachelor of Education (Honours) (Primary)

Module Title : Children's Science Learning
[Maximum length including space: English – 60 characters ; Chinese – 30 characters.]

Department : Mathematics, Science, Social Sciences and Technology

Credit Points : Three

Contact Hours : 30

Pre-requisite(s) : Nil
[If applicable.]

Level : 1
[If applicable. For example, for Discipline Studies under the BEd Core Curriculum, there are three levels of modules to reflect the progression of study or the extent of in-depth knowledge.]

Synopsis

This module provides students with opportunities to develop an understanding of children's science learning and develop strategies to facilitate children's science learning based on researches about children's science conceptions. Students will also learn about how to enhance children's science learning by being sensitised to gender issues, social issues and scientific concepts implied in common language.

Objectives → **Learning outcomes**

To enable students to

a. demonstrate a basic understanding of children's science thinking through their own and established research findings;
b. based on findings about children's science learning, implement a range of strategies that promote children's science learning; and
c. develop strategies that facilitate children's science learning as by being sensitive to gender differences, the use of language and social issues.

Content → **Contents and T&L activities**

a. Finding out children's science understanding of light, growth, natural phenomena and selected topics with various methods e.g. interview-about-instances, predict-observe-explain, drawings, word association, viewfinders;
b. Implications of research studies on children's science thinking in different science topics:
   - Materials;
   - Living organisms;
   - Natural phenomena;
c. Strategies to stimulate children thinking about science (as illustrated in selected topics in General Studies):
   - Concept mapping;
   - Post-box activity;
   - Card sorting;
   - Handling children's questions;
d. Gender sensitivity in science teaching and learning:
   - Discussions about gender difference in science learning;
   - Feminism in science;
e. Facilitating children's science learning:
   - Science in the home;
   - Science inventions and scientists' stories;
f. Designing and assessing investigative activities in daily life:
   - Planning and designing;
   - Focusing and identifying variables;
   - Comparing and contrasting;
   - Presenting and communicating;
g. Being a science literate and responsible citizen:
   - Chinese culture and science;
   - Science knowledge related to current issues, e.g. Genetically Modified food, cloning;
   - Making an informed decision.

Assessment

A project to facilitate children's learning of science: Students are required to interview a few children and find out their preconceptions about a science topic. The alternative concepts are compared with the scientist's scientific understanding. Based on the comparison, the student is to design learning activities that help the children further develop their science concepts and to write up a self-evaluation report analysing the effectiveness of the learning activities.

Required Text

Nil

Recommended Reading

Bell, B. (1993). *Children's science, constructivism and learning in science*. Geelong, Vic.: Deakin University.

Carin, A.A. (1993). *Teaching modern science* (6th ed.). New York: Macmillan Publishing Company.

Driver, R., Guesne, E., & Tiberghien, A. (1985). *Children's ideas in science*. UK: Open University Press, Milton Keynes.

Ebenezer, J.V., & Connor, S. (1998). *Learning to teach science: A model for the 21st century*. Prentice Hall: United States.

Fleer, M., & Hardy, T. (1996). *Science for children*. USA: Prentice Hall.

Glynn, S.M., Yeany, R.H., & Britton, B.K. (1991). *The psychology of learning science* Hillsdale, New Jersey: Lawrence Eribaum Associates, Publishers.

Osborne, R.J., & Freyberg, R. (1985). *Learning in science: The implications of children's science*. Auckland, NZ: Heinemann.

Treagust, D.F., Duit, R., & Fraser, B.J. (Eds.), (1996). *Improving teaching and learning in science and mathematics*. New York: Teachers College Press.

李亞東(1995)：《科學的足跡》，新竹，凡異出版社。

Traditional approach

Common Assessment Rubric

Name: _____ **Student no.** _____ **Module :** _____ **Assignment :** _____

Category	Criteria	Distinction	Credit	Average	Marginal Pass	Fail
Content	☐ **Focus** *(Relevance and clarity of goals)*	Very clear and relevant	Clear and relevant	Quite clear and relevant	Barely clear and relevant	Very vague, irrelevant
(70%)	☐ **Knowledge and application** *(Understanding of subject knowledge/theories/concepts and application of these to inquire/ design lessons/resolve problems)*	In-depth and accurate understanding; excellent applications	Good understanding and effective applications	Rather superficial understanding; satisfactory applications	Misconceptions quite obvious; limited applications	Lack of proper understanding, applications very limited
	☐ **Methods of inquiry/problem solving** *(Validity and reliability of methodology for inquiry or problem-solving)*	Very valid and reliable, innovative	Valid and reliable	Reasonably valid but not quite reliable	Barely valid and reliable	Not valid and reliable
	☐ **Evidence and arguments** *(Citation of evidence from literature/empirical studies/trials of teaching as basis of arguments for the purpose of research/analysis/problem resolution/reflection/ evaluation; Demonstration of analytical and critical thinking)*	Very comprehensive and logical discussion with substantial evidence; in-depth and critical analysis	Comprehensive and logical discussion with good evidence; reasonably in-depth analysis	Fairly comprehensive and logical discussion with some evidence cited; analysis not in-depth enough	Perspectives too narrow with only minimal evidence; a bit illogical; analysis tends to be superficial and with biases	Illogical with little evidence, very superficial or biased analysis
	☐ **Format of citations and references** *(Format and accuracy of citations and references)*	Highly accurate	Accurate	Not quite accurate, with some omissions	Inaccurate, with substantial omissions	No citations or reference lists
	☐ **Discipline/teaching-related skills** *(Use of discipline/teaching-related skills to inquire/resolve problems/design lessons/micro-teach/fulfill tasks)*	Excellent mastery and creative use of a wide range of skills	Effective utilization of a wide range of skills	Satisfactory utilization of essential skills	Essential skills vaguely demonstrated; skills not well integrated	Lack of essential skills; skills utilized ineffectively
	☐ **Others**					
	Score	10 9	8 7	6 5	4	< 3
Organization and presentation	☐ **Organization** *(Coherence, orderliness, timing)*	Very well-structured and highly coherent	Tightly structured and coherent	Systematically structured and fairly coherent	Loosely structured	Disorganized
(30%)	☐ **Presentation** *(Effectiveness of modes of presentation, articulateness, fluency)*	Highly effective, clear, succinct and fluent	Effective, clear, precise and fluent	Quite effective, clear but not precise and fluent enough	Minimally effective, not clear enough; some problems with expression	Ineffective, unclear, substantial problems with expression
	Score	10 9	8 7	6 5	4	< 3

Total: _____

Characteristics of the OBL approach - **CILO**

Objectives

To enable students to

a. demonstrate a basic understanding of children's science thinking through their own and established research findings;
b. based on findings about children's science learning, implement a range of strategies that promote children's science learning; and
c. develop strategies that facilitate children's science learning as by being sensitive to gender differences, the use of language and social issues.

Course Intended Learning Outcomes (CILOs)

By the end of the module, students will be able to:

1. Knowledge, skills and attitudes

$CILO_1$ understand the children's learning process to identify and explain the occurrence of alternative conceptions or scientific preconceptions in children.

$CILO_2$ apply the knowledge of science learning process in children to develop teaching strategies for facilitating children in learning science concepts

$CILO_3$ apply the teaching strategies to develop assessment tools for assessing the learning effectiveness of science conceptions and determining any alternative conceptions in children.

$CILO_4$ analyze data critically and information from case studies or researches to evaluate the effectiveness of children in learning science concepts.

Characteristics of the OBL approach - **CILO**

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To enable students to

a. demonstrate a basic understanding of children's science thinking through their own and established research findings;

b. based on findings about children's science learning, implement a range of strategies that promote children's science learning; and

c. develop strategies that facilitate children's science learning as by being sensitive to gender differences, the use of language and social issues.

Course Intended Learning Outcomes (CILOs)

By the end of the module, students will be able to:

2. Measurable verbs

3. Outcome based

$CILO_1$ understand the children's learning process to identify and explain the occurrence of alternative conceptions or scientific preconceptions in children.

$CILO_2$ apply the knowledge of science learning process in children to develop teaching strategies for facilitating children in learning science concepts

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Characteristics of the OBL approach - **CILO**

1. Knowledge, skills and attitude
2. Measurable verbs
3. Outcome based

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Course Intended Learning Outcomes (CILOs)
By the end of the module, students will be able to:

$CILO_1$ identify and explain the occurrence of alternative conceptions in children's science learning process.

$CILO_2$ apply the understandings of science learning process in children to develop teaching strategies for facilitating children in learning science concepts

$CILO_3$ develop assessment tools for assessing the learning effectiveness of science conceptions and determining any alternative conceptions in children.

$CILO_4$ critically analyze results of current research studies and assessment tools for children.

Characteristics of the OBL approach – **contents and T&L activities**

Course Intended Learning Outcomes (CILOs)
By the end of the course, students will be able to:

$CILO_1$ identify and explain the occurrence of alternative conceptions in children's science learning process.
$CILO_2$ apply the understandings of science learning process in children to develop teaching strategies for facilitating children in learning science concepts
$CILO_3$ develop assessment tools for assessing the learning effectiveness of science conceptions and determining any alternative conceptions in children.
$CILO_4$ critically analyze results of current research studies and assessment tools for children.

Content and Teaching & Learning Activities

CILO	Teaching Content	Teaching & Learning Activities
$CILO_1$	Science of learning in children (physiology of learning and cognitive development of children)	Lectures, case study, class activities / experiments, model display, video play
$CILO_1$ & $CILO_4$	Understanding the origin, nature of children's alternative conceptions about science and implications of research studies on children's science thinking in different science topics	Lecture, case study, literature reviews, group discussion, group presentation
$CILO_2$	Strategies for facilitating children in learning science - stimulate children thinking about science (e.g. concept maps)	Lecture, class activities, group discussion
$CILO_2$	Strategies of inquiry teaching and understanding the process of science	Lecture, class activity, case study, group discussion, group presentation

Characteristics of the OBL approach – **contents and T&L activities**

Course Intended Learning Outcomes (CILOs)
By the end of the course, students will be able to:

Understanding the children's learning process

$CILO_1$	identify and explain the occurrence of alternative conceptions in children's science learning process.
$CILO_2$	apply the understandings of science learning process in children to develop teaching strategies for facilitating children in learning science concepts
$CILO_3$	develop assessment tools for assessing the learning effectiveness of science conceptions and determining any alternative conceptions in children.
$CILO_4$	critically analyze results of current research studies and assessment tools for children.

Content and Teaching & Learning Activities

CILO	Teaching Content	Teaching & Learning Activities
$CILO_1$	Science of learning in children (physiology of learning and cognitive development of children)	Lectures, case study, class activities / experiments, model display, video play
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$CILO_2$	Strategies of inquiry teaching and understanding the process of science	Lecture, class activity, case study, group discussion, group presentation

Literature reviews

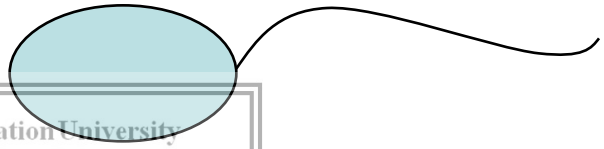
Learning-Dependent Synaptic Modifications in the Cerebellar Cortex of the Adult Rat Persist for at Least Four Weeks

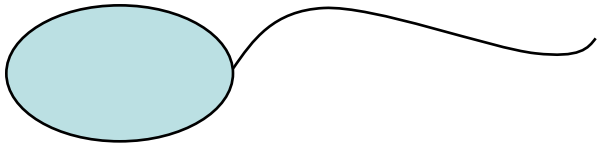
Jeffrey A. Kleim,[1,4] Kapil Vij,[4] David H. Ballard,[4] and William T. Greenough[1,2,3,4]

Departments of [1]Psychology and [2]Cell and Structural Biology, and [3]Neuroscience Program, and [4]Beckman Institute, University of Illinois, Urbana, Illinois 61801

Several experiments have demonstrated increased synapse number within the cerebellar cortex in association with motor skill learning but not with motor activity alone. The persistence of these synaptic changes in the absence of continued training was examined in the present experiment. Adult female rats were randomly allocated to either an acrobatic condition (AC) or a motor activity condition (MC). The AC animals were trained to traverse a complex series of obstacles, and each AC animal was pair-matched with an MC animal that traversed an obstacle-free runway. These animals were further assigned to one of three training conditions. Animals in the EARLY condition were trained for 10 consecutive days before being killed, animals in the DELAY condition received the same 10 d of training followed by a 28 d period without training, and animals in the CONTINUOUS condition were trained for the entire 38 d. Unbiased stereological techniques were used to obtain estimates of the number of synapses per Purkinje cell within the cerebellar paramedian lobule. Results showed the AC animals to have significantly more synapses per Purkinje cell than the MC animals in all three training conditions. There were no differences in the number of synapses per Purkinje cell among the EARLY, DELAY, and CONTINUOUS conditions. These data demonstrate that both the motor skills and the increases in synapse number presumed to support them persist in the absence of continued training.

Key words: motor learning; synaptogenesis; persistence; cerebellum; synaptic plasticity; rat





Acrobatic condition AC (training) **Motor activity condition MC (no training)**

Results

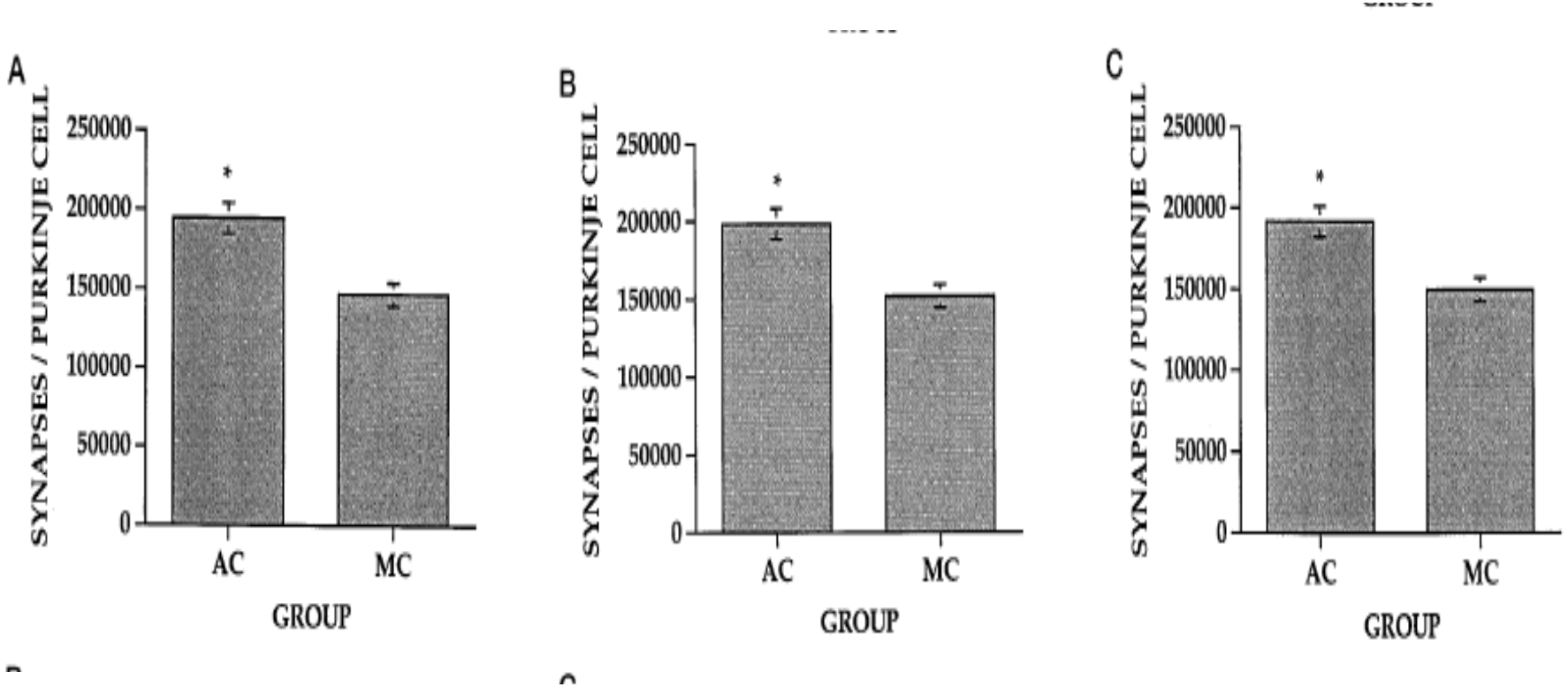


Figure 3. Number of synapses per Purkinje cell (±SEM) within the PML. Multiple comparisons (*Student–Newman–Keuls, $p < 0.05$) showed that the AC animals had significantly more synapses per Purkinje cell than the MC animals in the EARLY (*A*), DELAY (*B*), and CONTINUOUS (*C*) conditions.

Video play

- Chimpanzee vs human child learning http://www.youtube.com/watch?v=pIAoJsS9Ix8
- Chimpanzee short term memory

  http://www.youtube.com/watch?v=zJAH4ZJBiN8&feature=related

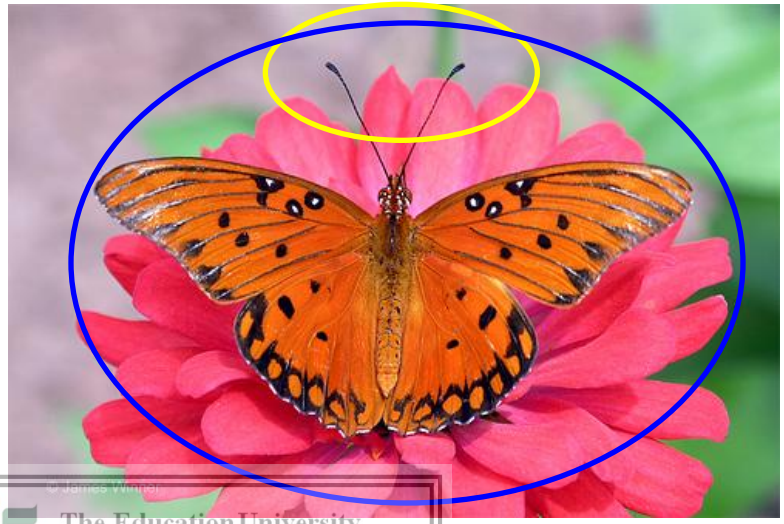
Game

What is it? bugs with big & beautiful wings → butterfly

(assimilation)

New Schema: bugs with big & beautiful wings & antennae with clubbed-end → butterfly

(accommodation)



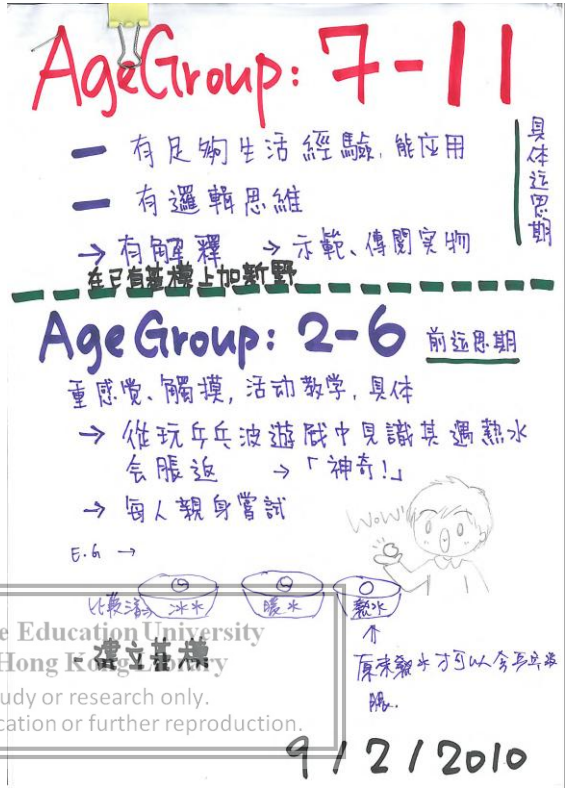
butterfly

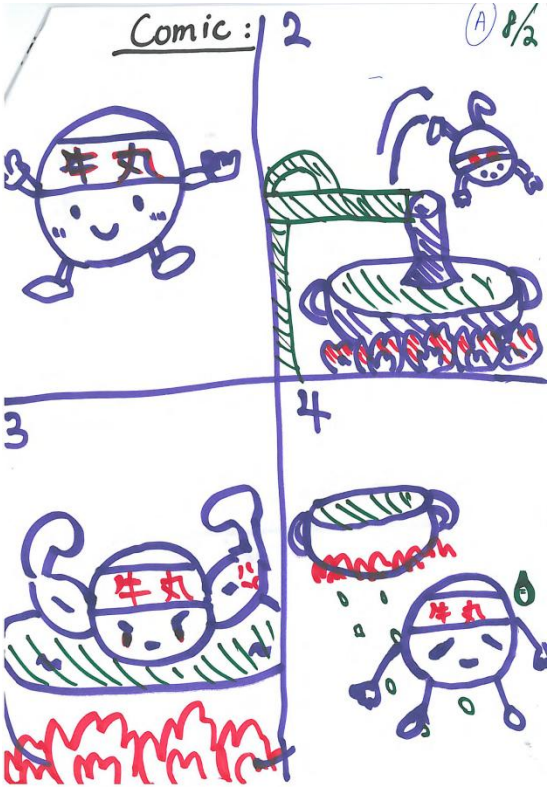
moth

? difference

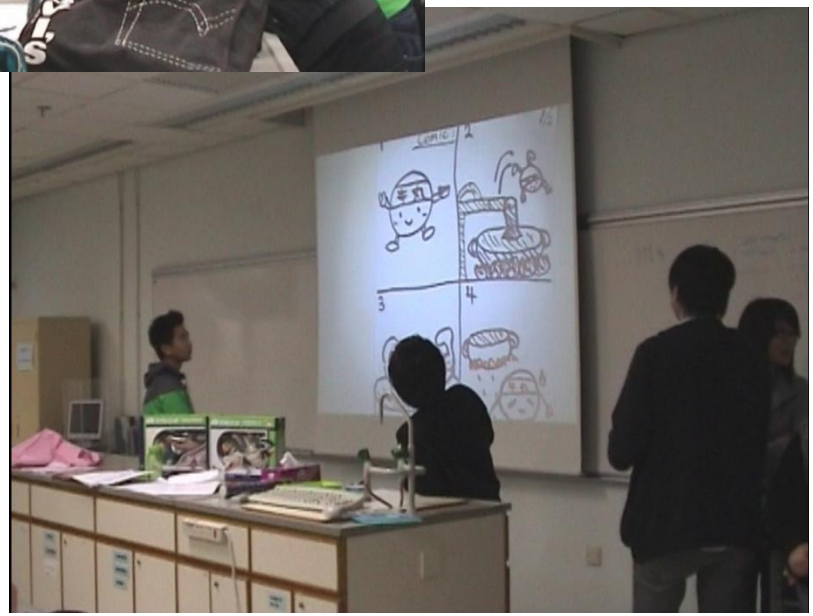
Class activity

- 8 groups: 2 groups share the same task
- Based on the characteristics of brain development and CIP, design a simple teaching activity (flow) to facilitate the students in learning the following concepts
- E.g. Photosynthesis 光合作用 / Changes of phases 物態變化
- Give a 5-minute presentation and explain how the characteristics of the brain development involved in the activity's design





Characteristics of the OBL approach - **contents and T&L activities**



Characteristics of the OBL approach - **assessments**

Course Intended Learning Outcomes (CILOs)
By the end of the course, students will be able to:

$CILO_1$	identify and explain the occurrence of alternative conceptions in children's science learning process.
$CILO_2$	apply the understandings of science learning process in children to develop teaching strategies for facilitating children in learning science concepts g

strategies for facilitating children in learning science concepts

Assessment

CILO	Assessment Tasks	Weighting (%)
$CILO_1$, $CILO_2$, $CILO_3$ & $CILO_4$	Group presentation - Each group may select a science topic from daily living and identify any alternative conceptions possibly made by children from literature reviews and current research studies. The group needs to find out the reasons behind the occurrence of alternative conceptions in perspectives of children's science learning process. A teaching activity by using the scientific inquiry approach is designed to generate scientific understanding of the children and facilitate them in learning science concepts. The group is also required to develop assessment tools for assessing the learning effectiveness of science conceptions.	30

Characteristics of the OBL approach - **assessments**

Assessment

CILO	Assessment Tasks	Weighting (%)
$CILO_1$, $CILO_2$, $CILO_3$ & $CILO_4$	Group presentation - Each group may select a science topic from daily living and identify any alternative conceptions possibly made by children from literature reviews and current research studies. The group needs to find out the reasons behind the occurrence of alternative conceptions in perspectives of children's science learning process. A teaching activity by using the scientific inquiry approach is designed to generate scientific understanding of the children and facilitate them in learning science concepts. The group is also required to develop assessment tools for assessing the learning effectiveness of science conceptions.	30
$CILO_1$, $CILO_2$, $CILO_3$ & $CILO_4$	An individual project - Each student is required to select a scientific topic from which alternative conceptions are commonly found in children's thinking and understanding as evidenced by literature reviews and current research studies. The student then develops assessment tools for determining any alternative conceptions and the reasons for such conceptions. A number of primary school pupils are assessed and the results are critically analyzed to diagnose the alternative conceptions and explain their occurrence. Appropriate teaching strategies are developed based on the analyzed results for facilitating children in learning science concepts. Finally the teaching strategies developed by the student are evaluated in the section of reflection.	70

Clear instructions

Assignment

1. Group presentation

a. Form 8 groups (5 students each).
b. Each group may select a science topic from daily living, e.g. Animals living in our home.
c. Identify any alternative conceptions possibly made by children on the topic from literature reviews and current research studies, e.g. Many insects are living with us, for example cockroach, ants and spider (Spider is not an insect).
d. Each group refers science learning process of children (need literature reviews) and develops teaching strategies with an activity in scientific inquiry approach to generate scientific understanding of the children and facilitate them in learning science concepts.
e. The group is also required to develop assessment tools for assessing the learning effectiveness of science conceptions.
f. The PowerPoint presentation should include the brief introduction of the presentation topic (the reason why the topic is selected – supported by research studies if necessary) and the objectives, identification of alternative conceptions, scientific inquiry activity, theoretical background of the activity (critical reviews of literatures), methodology, identification of variables (if necessary), possible limitations and the self-evaluation of the teaching strategies.
g. Each group will have strictly 12 minutes for presentation (with PowerPoint) and 5-minute for discussion (Q&A or comments). All students are required to participate in the presentation.

2. Individual project

a. Each student is required to review literature and current research studies to select a scientific topic from which alternative conceptions are commonly found in children's thinking and understanding.
b. The student is required to develop assessment tools for determining any alternative conceptions and the reasons for such conceptions.
c. A number of primary school pupils are assessed (the number, level and age group of the pupils are not restricted)
d. The assessment's results are critically analyzed to identify any alternative conceptions and find out the reasons for the occurrence of such conceptions. Any correlation with gender, social, language or other issues are also considered.
e. Appropriate teaching strategies for facilitating children in learning science concepts is developed based on the analyzed results.
f. The effectiveness of the learning activity is evaluated in the section of reflection.
g. Write an essay (~2000 words) to report the project.
h. At least 10 references are required to be cited (reference list only accept books 參考書籍 or journal articles 學術期刊所發表的文獻, any articles extracted from newspaper, website or magazines are NOT accepted)
e. Submit your assignment with a cover page (with student's particulars and word count) on or before X/X/2010 to Dr. Tsoi Kwok Ho through the assignment dropbox of the Department of Science and Environmental Studies (D3-1/F-37A).

Rubrics: submitted OBL version - characteristics

1. CILOs – outcome specific

Common Assessment Rubric

Name: _____ **Student no.**_____ **Module :** Children's Science Learning **Assignment :** Group presentation

	Criteria	Distinction	Credit	Average	Marginal Pass	Fail	Score
Contents (70%)	☐ **Focus of the presentation** *(Relevance and clarity of goals)*	Very clear and relevant	Clear and relevant	Quite clear and relevant	Barely clear and relevant	Very vague and irrelevant	
	☐ **Identification of alternative conceptions from literature reviews and explanation of their occurrence in children's science learning process (CILO$_1$)**	Very clear and the reasons are highly accurate and very comprehensive	Clear and the reasons are accurate and comprehensive	Quite clear and the reasons are supportive but some important reasons are overlook	Barely clear and weak reasons	Very vague and the confusing and totally unconvincing reasons are given	
	☐ **Development of teaching strategies to facilitate children science learning (CILO$_2$)**	Highly effective and well developed strategies	Effective and moderately developed strategies	Quite effective and minimally developed strategies	Barely effective and poorly developed strategies	Totally ineffective and very poorly developed strategies / no strategy	
	☐ **Methods of scientific inquiry** *(Validity and reliability of methodology for inquiry tasks)*	Very valid and reliable	Valid and reliable	Reasonably valid but not quite reliable	Barely valid and reliable	Not valid and reliable	
	☐ **Development of assessment tools for assessing the learning effectiveness of science conceptions (CILO$_3$)**	Highly effective and well developed tools	Effective and moderately developed tools	Quite effective and minimally developed tools	Barely effective and poorly developed tools	Totally ineffective and very poorly developed tools / no tool is developed	
	☐ **Critical analysis of current research studies (CILO$_4$)**	Very comprehensive and logical discussion with substantial evidence	Comprehensive and logical discussion with good evidence	Fairly comprehensive and logical discussion with some evidence cited	Perspectives too narrow with only minimal evidence; a bit illogical	Illogical with little evidence	
	☐ **Format of citations and references** *(Format and accuracy)*	Highly accurate	Accurate	Not quite accurate, with some omissions	Inaccurate, with substantial omissions	No citations or reference lists	
	Score	5	4	3	2	1	
Presentation (30%)	☐ **Organization** *(Coherence, orderliness)*	Very well-structured and highly coherent	Tightly structured and coherent	Systematically structured and fairly coherent	Loosely structured	Disorganized	
	☐ **Collaboration skills** *(interaction with team members, cooperation with teammates)*	Clearly team functioned well, organized transition of team members	Good teamwork, fairly organized transition of team members	Fair interaction between team members, somewhat disorganized transition	Poor interaction, some team members do not contribute	Very poor interaction, most team members do not contribute	
	☐ **Presentation – effective use of visual aids**	Highly effective	Effective	Quite effective	Minimally effective	Ineffective	
	☐ **Presentation – articulateness, fluency and enunciation**	Highly succinct and precise, fluent and clear enunciation	Succinct and precise , fluent and words clearly enunciated	Not succinct but precise enough, fluent enough, fairly clear words enunciated	Some problems in expression, not fluent enough, and words occasionally slurred	Substantial problems with expression, and words slurred all the time	
	Score	5	4	3	2	1	

2. Presentation specific

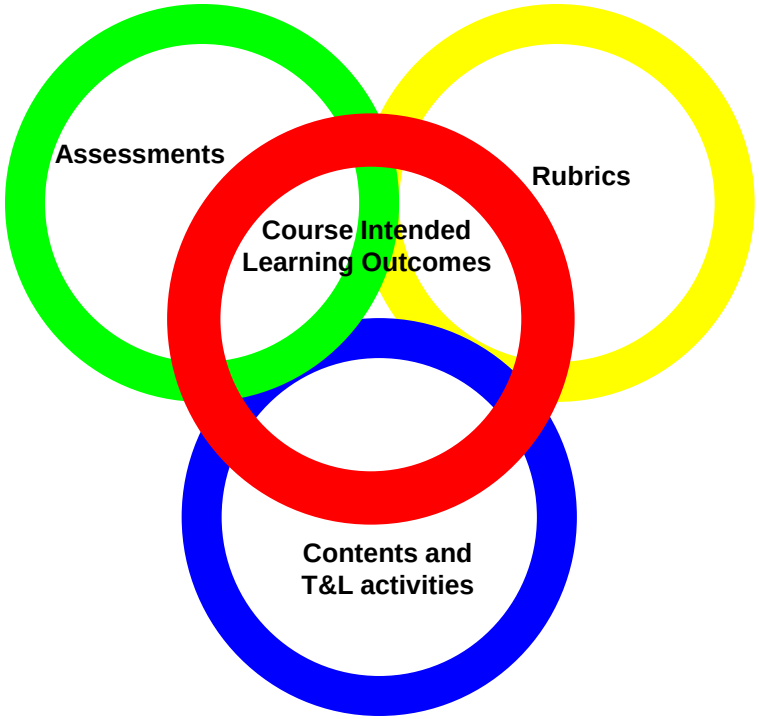
3. Score

Evaluation of OBL approach

- Self evaluation
- Departmental discussion
- Students' feedbacks
  - Questionnaires
  - Academic performance: different assessment tasks
    - Presentation
    - Assignment – group reports
    - Examination

Self evaluation

- Values:
  - For the instructor: Clear understanding of the course structure
  - For students:
    - Shift the focus from 'Teaching' to 'Learning (Anderson et al. 2005)
    - Strong alignment → effective learning
    - greater transparency in their assessments
      - Criterion-referenced – statements of actions and performances achieved by students (not teachers' intention) (Paterson Davenport et al. 2005)
      - Motivate students to study and improve - the primary role of assessment is to promote learning (Kennedy 2009)



Self evaluation

- Critics
  - Outcomes for behaviours and attitudes are hard to define (Harden et al. 1999)
  - Reduces knowledge to a list of essential facts (Stobo et al. 1998)

Course Intended Learning Outcomes (CILOs)

By the end of the course, students will be able to:

Understanding of the children's learning process,

$CILO_1$	identify and explain the occurrence of alternative conceptions in children's science learning process.
$CILO_2$	apply the understandings of science learning process in children to develop teaching strategies for facilitating children in learning science concepts
$CILO_3$	develop assessment tools for assessing the learning effectiveness of science conceptions and determining any alternative conceptions in children.
$CILO_4$	critically analyze results of current research studies and assessment tools for children.

? Processes / pre-requisite conditions

Self evaluation

- Critics
  - Outcomes for behaviours and attitudes are hard to define (Harden et al. 1999)
  - Reduces knowledge to a list of essential facts (Stobo et al. 1998)

Course Intended Learning Outcomes (CILOs)

By the end of the course, students will be able to:

CILO5 describe and explain the learning process of children …

$CILO_1$ identify and explain the occurrence of alternative conceptions in children's science learning process.

$CILO_2$ apply the understandings of science learning process in children to develop teaching strategies for facilitating children in learning science concepts

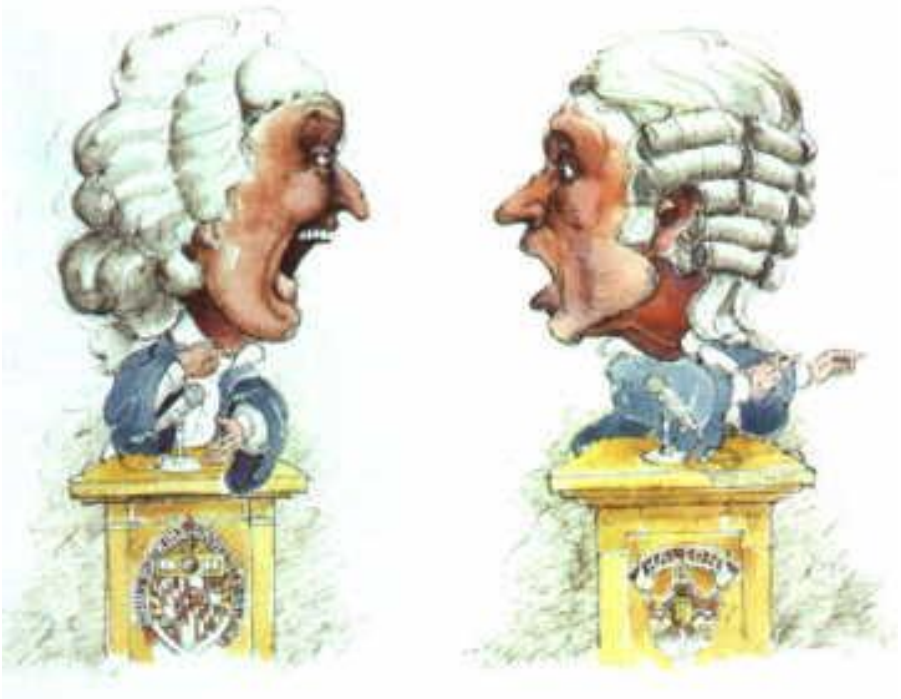
$CILO_3$ develop assessment tools for assessing the learning effectiveness of science conceptions and determining any alternative conceptions in children.

$CILO_4$ critically analyze results of current research studies and assessment tools for children.

? Processes / pre-requisite conditions

Departmental discussion

- Critics on assessment rubrics
  - Any inappropriate criteria?
  - Different scoring weight?
  - Resolving power of the newly developed rubrics?



OBL submitted version

Common Assessment Rubric

Name: _____ **Student no.**_____ **Module :** Children's Science Learning **Assignment :** Group presentation

	Criteria	Distinction	Credit	Average	Marginal Pass	Fail	Score
Contents (70%)	☐ **Focus of the presentation** *(Relevance and clarity of goals)*	Very clear and relevant	Clear and relevant	Quite clear and relevant	Barely clear and relevant	Very vague and irrelevant	
	☐ **Identification of alternative conceptions from literature reviews and explanation of their occurrence in children's science learning process (CILO$_1$)**	Very clear and the reasons are highly accurate and very comprehensive	Clear and the reasons are accurate and comprehensive	Quite clear and the reasons are supportive but some important reasons are overlook	Barely clear and weak reasons	Very vague and the confusing and totally unconvincing reasons are given	
	☐ **Development of teaching strategies to facilitate children science learning (CILO$_2$)**	Highly effective and well developed strategies	Effective and moderately developed strategies	Quite effective and minimally developed strategies	Barely effective and poorly developed strategies	Totally ineffective and very poorly developed strategies / no strategy	
	☐ **Methods of scientific inquiry** *(Validity and reliability of methodology for inquiry tasks)*	Very valid and reliable	Valid and reliable	Reasonably valid but not quite reliable	Barely valid and reliable	Not valid and reliable	
	☐ **Development of assessment tools for assessing the learning effectiveness of science conceptions (CILO$_3$)**	Highly effective and well developed tools	Effective and moderately developed tools	Quite effective and minimally developed tools	Barely effective and poorly developed tools	Totally ineffective and very poorly developed tools / no tool is developed	
	☐ **Critical analysis of current research studies (CILO$_4$)**	Very comprehensive and logical discussion with substantial evidence	Comprehensive and logical discussion with good evidence	Fairly comprehensive and logical discussion with some evidence cited	Perspectives too narrow with only minimal evidence; a bit illogical	Illogical with little evidence	
	☐ **Format of citations and references** *(Format and accuracy)*	Highly accurate	Accurate	Not quite accurate, with some omissions	Inaccurate, with substantial omissions	No citations or reference lists	
	Score	5	4	3	2	1	
Presentation (30%)	☐ **Organization** *(Coherence, orderliness)*	Very well-structured and highly coherent	Tightly structured and coherent	Systematically structured and fairly coherent	Loosely structured	Disorganized	
	☐ **Collaboration skills** *(interaction with team members, cooperation with teammates)*	Clearly team functioned well, organized transition of team members	Good teamwork, fairly organized transition of team members	Fair interaction between team members, somewhat disorganized transition	Poor interaction, some team members do not contribute	Very poor interaction, most team members do not contribute	
	☐ **Presentation – effective use of visual aids**	Highly effective	Effective	Quite effective	Minimally effective	Ineffective	
	☐ **Presentation – articulateness, fluency and enunciation**	Highly succinct and precise, fluent and clear enunciation	Succinct and precise , fluent and words clearly enunciated	Not succinct but precise enough, fluent enough, fairly clear words enunciated	Some problems in expression, not fluent enough, and words occasionally slurred	Substantial problems with expression, and words slurred all the time	
	Score	5	4	3	2	1	

Inappropriate criterion

? Different scoring weight → complexity

Resolving power

Revised OBL format

Cut all inappropriate criteria

Common Assessment Rubric

Name: _____ **Module :** Children's Science Learning **Assignment :** Group presentation

	Criteria	Distinction 5	Credit 4	Average 3	Marginal Pass 2	Fail 1
Contents (70%)	☐ **Focus of the presentation** *(Relevance and clarity of goals)* **10%**	Very clear and relevant	Clear and relevant	Quite clear and relevant	Barely clear and relevant	Very vague and irrelevant
		10	8	6	4	2
	☐ **Identification of alternative conceptions from literature reviews and explanation of their occurrence in children's science learning process ($CILO_1$) 10%**	Very clear and the reasons are highly accurate and very comprehensive	Clear and the reasons are accurate and comprehensive	Quite clear and the reasons are supportive but some important reasons are overlook	Barely clear and weak reasons	Very vague and the confusing and totally unconvincing reasons are given
		10	8	6	4	2
	☐ **Development of teaching strategies to facilitate children science learning ($CILO_2$) 20%**	Highly effective and well developed strategies	Effective and moderately developed strategies	Quite effective and minimally developed strategies	Barely effective and poorly developed strategies	Totally ineffective and very poorly developed strategies / no strategy
		20	16	12	8	4
	☐ **Development of assessment tools for assessing the learning effectiveness of science conceptions ($CILO_3$) 20%**	Highly effective and well developed tools	Effective and moderately developed tools	Quite effective and minimally developed tools	Barely effective and poorly developed tools	Totally ineffective and very poorly developed tools / no tool is developed
		20	16	12	8	4
	☐ **Critical analysis of current research studies ($CILO_4$) 10%**	Very comprehensive and logical discussion with substantial evidence	Comprehensive and logical discussion with good evidence	Fairly comprehensive and logical discussion with some evidence cited	Perspectives too narrow with only minimal evidence; a bit illogical	Illogical with little evidence
		10	8	6	4	2
Presentation (30%)	☐ **Organization** *(Coherence, orderliness)* **10%**	Very well-structured and highly coherent	Tightly structured and coherent	Systematically structured and fairly coherent	Loosely structured	Disorganized
		10	8	6	4	2
	☐ **Collaboration skills** *(interaction with team members, cooperation with teammates)* **5%**	Clearly team functioned well, organized transition of team members	Good teamwork, fairly organized transition of team members	Fair interaction between team members, somewhat disorganized transition	Poor interaction, some team members do not contribute	Very poor interaction, most team members do not contribute
		5	4	3	2	1
	☐ **Presentation – effective use of visual aids 5%**	Highly effective	Effective	Quite effective	Minimally effective	Ineffective
		5	4	3	2	1
	☐ **Presentation – articulateness, fluency and enunciation 10%**	Highly succinct and precise, fluent and clear enunciation	Succinct and precise , fluent and words clearly enunciated	Not succinct but precise enough, fluent enough, fairly clear words enunciated	Some problems in expression, not fluent enough, and words occasionally slurred	Substantial problems with expression, and words slurred all the time
		10	8	6	4	2

☐ **weight is counted → user friendly version**

Total Score: _____

Nam[redacted] A7

Common Assessment Rubric

Module : Children's Science Learning **Assignment :** Group presentation

	Criteria	Distinction 5	Credit 4	Average 3	Marginal Pass 2	Fail 1
Contents (70%)	☐ **Focus of the presentation** *(Relevance and clarity of goals)* 10%	Very clear and relevant	Clear and relevant	Quite clear and relevant	Barely clear and relevant	Very vague and irrelevant
		10	8	6	4	2
	☐ **Identification of alternative conceptions from literature reviews and explanation of their occurrence in children's science learning process ($CILO_1$)** 10%	Very clear and the reasons are highly accurate and very comprehensive	Clear and the reasons are accurate and comprehensive	Quite clear and the reasons are supportive but some important reasons are overlook	Barely clear and weak reasons	Very vague and the confusing and totally unconvincing reasons are given
		10	8	6	4	2
	☐ **Development of teaching strategies to facilitate children science learning ($CILO_2$)** 20%	Highly effective and well developed strategies	Effective and moderately developed strategies	Quite effective and minimally developed strategies	Barely effective and poorly developed strategies	Totally ineffective and very poorly developed strategies / no strategy
		20	16	12	8	4
	☐ **Development of assessment tools for assessing the learning effectiveness of science conceptions ($CILO_3$)** 20%	Highly effective and well developed tools	Effective and moderately developed tools	Quite effective and minimally developed tools	Barely effective and poorly developed tools	Totally ineffective and very poorly developed tools / no tool is developed
		20	16	12	8	4
	☐ **Critical analysis of current research studies ($CILO_4$)** 10%	Very comprehensive and logical discussion with substantial evidence	Comprehensive and logical discussion with good evidence	Fairly comprehensive and logical discussion with some evidence cited	Perspectives too narrow with only minimal evidence; a bit illogical	Illogical with little evidence
		10	8	6	4	2
Presentation (30%)	☐ **Organization** *(Coherence, orderliness)* 10%	Very well-structured and highly coherent	Tightly structured and coherent	Systematically structured and fairly coherent	Loosely structured	Disorganized
		10	8	6	4	2
	☐ **Collaboration skills** *(interaction with team members, cooperation with teammates)* 5%	Clearly team functioned well, organized transition of team members	Good teamwork, fairly organized transition of team members	Fair interaction between team members, somewhat disorganized transition	Poor interaction, some team members do not contribute	Very poor interaction, most team members do not contribute
		5	4	3	2	1
	☐ **Presentation – effective use of visual aids** 5%	Highly effective	Effective	Quite effective	Minimally effective	Ineffective
		5	4	3	2	1
	☐ **Presentation – articulateness, fluency and enunciation** 10%	Highly succinct and precise, fluent and clear enunciation	Succinct and precise , fluent and words clearly enunciated	Not succinct but precise enough, fluent enough, fairly clear words enunciated	Some problems in expression, not fluent enough, and words occasionally slurred	Substantial problems with expression, and words slurred all the time
		10	8	6	4	2

B **Total Score:** 70

Revised OBL format

Cut all inappropriate criteria

Common Assessment Rubric

Name: _____ **Module :** Children's Science Learning **Assignment :** Group presentation

	Criteria	Distinction 5	Credit 4	Average 3	Marginal Pass 2	Fail 1
Contents (70%)	☐ **Focus of the presentation** *(Relevance and clarity of goals)* **10%**	Very clear and relevant	Clear and relevant	Quite clear and relevant	Barely clear and relevant	Very vague and irrelevant
		10	8	6	4	2
	☐ **Identification of alternative conceptions from literature reviews and explanation of their occurrence in children's science learning process ($CILO_1$) 10%**	Very clear and the reasons are highly accurate and very comprehensive	Clear and the reasons are accurate and comprehensive	Quite clear and the reasons are supportive but some important reasons are overlook	Barely clear and weak reasons	Very vague and the confusing and totally unconvincing reasons are given
		10	8	6	4	2
	☐ **Development of teaching strategies to facilitate children science learning ($CILO_2$) 20%**	Highly effective and well developed strategies	Effective and moderately developed strategies	Quite effective and minimally developed strategies	Barely effective and poorly developed strategies	Totally ineffective and very poorly developed strategies / no strategy
		20	16	12	8	4
	☐ **Development of assessment tools for assessing the learning effectiveness of science conceptions ($CILO_3$) 20%**	Highly effective and well developed tools	Effective and moderately developed tools	Quite effective and minimally developed tools	Barely effective and poorly developed tools	Totally ineffective and very poorly developed tools / no tool is developed
		20	16	12	8	4
	☐ **Critical analysis of current research studies ($CILO_4$) 10%**	Very comprehensive and logical discussion with substantial evidence	Comprehensive and logical discussion with good evidence	Fairly comprehensive and logical discussion with some evidence cited	Perspectives too narrow with only minimal evidence; a bit illogical	Illogical with little evidence
		10	8	6	4	2
Presentation (30%)	☐ **Organization** *(Coherence, orderliness)* **10%**	Very well-structured and highly coherent	Tightly structured and coherent	Systematically structured and fairly coherent	Loosely structured	Disorganized
		10	8	6	4	2
	☐ **Collaboration skills** *(interaction with team members, cooperation with teammates)* **5%**	Clearly team functioned well, organized transition of team members	Good teamwork, fairly organized transition of team members	Fair interaction between team members, somewhat disorganized transition	Poor interaction, some team members do not contribute	Very poor interaction, most team members do not contribute
		5	4	3	2	1
	☐ **Presentation – effective use of visual aids 5%**	Highly effective	Effective	Quite effective	Minimally effective	Ineffective
		5	4	3	2	1
	☐ **Presentation – articulateness, fluency and enunciation 10%**	Highly succinct and precise, fluent and clear enunciation	Succinct and precise , fluent and words clearly enunciated	Not succinct but precise enough, fluent enough, fairly clear words enunciated	Some problems in expression, not fluent enough, and words occasionally slurred	Substantial problems with expression, and words slurred all the time
		10	8	6	4	2

Total Score: _____

weight is counted → user friendly revision

Resolving power → trial

Grade-Mark Conversion

Grade	Mark
A+	**97-100**
A	**90-96**
A-	**83-89**
B+	**76-82**
B	**70-75**
B-	**63-69**
C+	**57-62**
C	**51-56**
C-	**45-50**
D	**40-44**
F	**0-39**

Comparison of students' performance under 2 different versions of the assessment rubrics

	Group	Traditional (MSST)	Submitted OBL version		Revised OBL format	
Class A (42)	1	B-	68	B-	73	B
	2	A-	86.5	A-	82	B+
	3	A-	90	A	88	A-
	4	B+	86	A-	87	A-
	5	B-	65	B-	65	B-
	6	A-	84.5	A-	91	A
	7	B	71	B	70	B
	8	B+	76.5	B+	80	B+
Class B (40)	1	B+	78	B+	80	B+
	2	B+	78.5	B+	82	B+
	3	A-	83	A-	88	A-
	4	B-	65.5	B-	65	B-
	5	B-	69	B-	73	B
	6	B	72	B	74	B
	7	B+	76	B+	83	A-
	8	B-	66.5	B-	66	B-

Sample size: not scientific

Comparison of students' performance under 2 different versions of the assessment rubrics

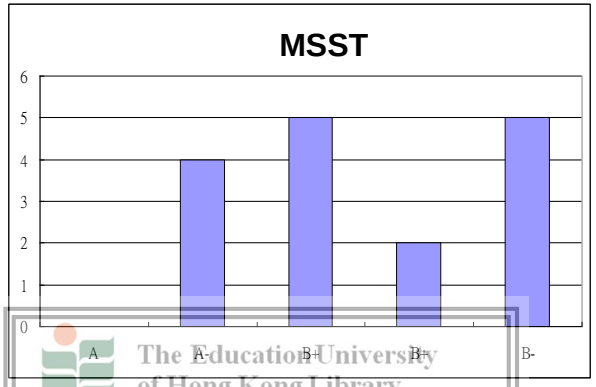
	Group	Traditional (MSST)	Revised OBL format		Change
Class A (42)	1	B-	73	B	↑
	2	A-	82	B+	↓
	3	A-	88	A-	=
	4	B+	87	A-	↑
	5	B-	65	B-	=
	6	A-	91	A	↑
	7	B	70	B	=
	8	B+	80	B+	=
Class B (40)	1	B+	80	B+	=
	2	B+	82	B+	=
	3	A-	88	A-	=
	4	B-	65	B-	=
	5	B-	73	B	↑
	6	B	74	B	=
	7	B+	83	A-	↑
	8	B-	66	B-	=

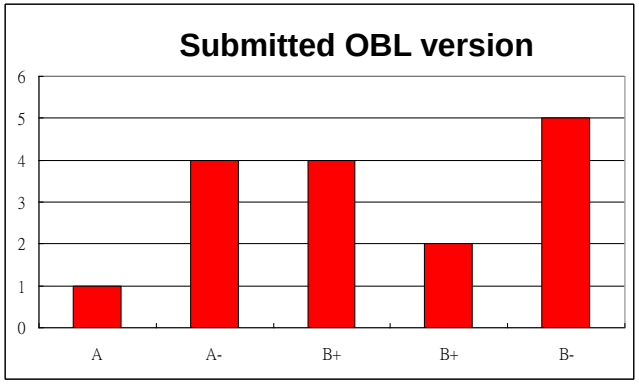
= 63%
↑ 31%
↓ 6%

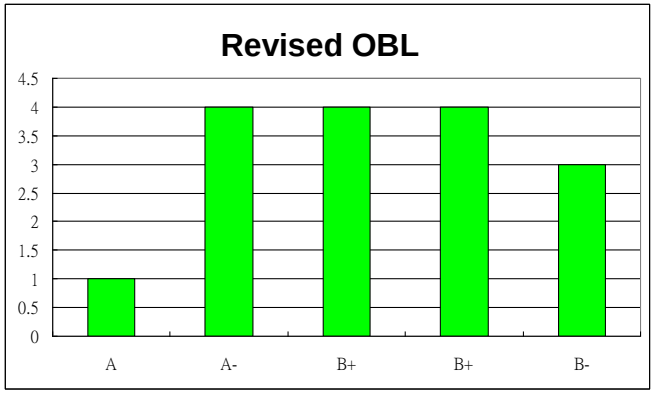
Sample size: not scientific

Score distributions

	Group	Traditional (MSST)	Submitted OBL version		Revised OBL format		Change
Class A (42)	1	B-	68	B-	73	B	↑
	2	A-	86.5	A-	82	B+	↓
	3	A-	90	A	88	A-	=
	4	B+	86	A-	87	A-	↑
	5	B-	65	B-	65	B-	=
	6	A-	84.5	A-	91	A	↑
	7	B	71	B	70	B	=
	8	B+	76.5	B+	80	B+	=
Class B (40)	1	B+	78	B+	80	B+	=
	2	B+	78.5	B+	82	B+	=
	3	A-	83	A-	88	A-	=
	4	B-	65.5	B-	65	B-	=
	5	B-	69	B-	73	B	↑
	6	B	72	B	74	B	=
	7	B+	76	B+	83	A-	↑
	8	B-	66.5	B-	66	B-	=







Students' feedback - questionnaires

- Children's Science Learning (26 students)

		6	5	4	3	2	1
		Strongly agree	Mostly agree	Moderately agree	Slightly agree	Mostly disagree	Strongly disagree
		完全同意	大致上同意	一般同意	稍微同意	大致上不同意	完全不同意
1	**The stated learning outcomes of the course have a valuable relationship to my degree programme.** 課程所述的學習成果與我的學位課程有重要的關聯。	7.7%	46.2%	26.9%	19.2%		
2	**The stated learning outcomes of the course have a valuable relationship with my practice as a teacher.** 課程所述的學習成果與我將來成爲一位教師有重要的關聯。	7.7%	42.3%	34.6%	11.5%	3.8%	
3	**The stated learning outcomes are clear and understandable.** 課程所述的學習成果很清楚且容易理解。	11.5%	42.3%	30.8%	11.5%	3.8%	
4	**The stated learning outcomes agree with what is actually taught in the course.** 課程所述學習成果與實際教學內容相符。		50.0%	30.8%	19.2%		
5	**Tutor lectures contribute to my understanding of the course content.** 導師講課有助我了解課程內容。	19.2%	38.5%	26.9%	15.4%		
6	**Course activities are well prepared and carefully explained.** 導師在課程活動方面準備充足且講解清楚。	30.8%	23.1%	34.6%	11.5%		

Students' feedback - questionnaires

- Children's Science Learning (26 students)

		6	5	4	3	2	1
		Strongly agree	Mostly agree	Moderately agree	Slightly agree	Mostly disagree	Strongly disagree
		完全同意	大致上同意	一般同意	稍微同意	大致上不同意	完全不同意
7	The required reading materials /texts are helpful and practical. 課程閱讀材料很有幫助與實用。	7.7%	42.3%	34.6%	11.5%		
8	There is a clear relationship between the teaching and learning activities and the stated course outcomes. 教學活動和課程所述學習成果之間有清楚的關聯。	3.8%	50.0%	34.6%	11.5%		
9	Lectures, group work and other learning activities have a clear relationship to course assessment. 講課、小組活動和其他教學活動與課程評量之間有清楚的關聯。	7.7%	50.0%	23.1%	19.2%		
10	The feedback I have received on examinations/graded materials helps my improvement. 我在考試或其他評量中所得到的意見可以幫助我進步。		42.3%	38.5%	15.4%	3.8%	
11	Course methods of evaluating student work are fair and appropriate. 此課程採用的評量方式公平及適當。	3.8%	50.0%	34.6%	11.5%		
12	Examinations/graded materials test the course content as emphasized by the instructor. 考試或其他評量考核到導師強調的重點。		46.1%	34.6%	19.2%		

Student's feedback – academic performances

- Values:
  - For the course development: Assessment results and feedbacks should be used for purposes of improving the course

Students' performance on group presentations – Children's Science Learning

	Distinction		Credit		Average		marginal pass		Fail	
Focus of the presentation (Relevance and clarity of goals) 10%	1	6.25	9	56.3	6	37.5		0.0		
Identification of alternative conceptions from literature reviews and explanation of their (CILO1) occurrence in children's science learning process	10	62.5	4	25.0	2	12.5		0.0		
Development of teaching strategies to facilitate children science learning ($CILO_2$) 20%	2	12.5	7	43.8	6	37.5	1	6.3		
Development of assessment tools for assessing the learning effectiveness of science conceptions ($CILO_3$) 20%	6	37.5	4	25.0	5	31.3	1	6.3		
Critical analysis of current research studies ($CILO_4$) 10%	2	12.5	9	56.3	5	31.3		0.0		
		0		0.0		0.0		0.0		
Organization (Coherence, orderliness)	2	12.5	6	37.5	8	50.0		0.0		
Collaboration skills (interaction with team members, cooperation with teammates)	4	25	7	43.8	5	31.3		0.0		
Presentation – effective use of visual aids 5%	7	43.75	9	56.3		0.0		0.0		
Presentation – articulateness, fluency and enunciation 10%	4	25	11	68.8	1	6.3		0.0		

Students' performance on individual assignments

Children's Science Learning

Individual assignment	Distinction		Credit		Average		Marginal pass		Fail		Total
Assessment criteria	no.	%	no.	%	no.	%	no.	%	no.	%	
Focus of the report (Relevance and clarity of goals) 10%	14	17.3	23	28.4	37	45.7	7	8.6	0	0.0	81
Identification of alternative conceptions from assessment results and explanation of their occurrence in children's science learning process (CILO1) 10%	23	28.4	32	39.5	21	25.9	5	6.2	0	0.0	81
Development of assessment tools for determining any alternative conceptions in children and the reasons for the conceptions (CILO3) 10%	27	33.3	23	28.4	27	33.3	4	4.9	0	0.0	81
Critical analysis of assessment results (CILO4) 10%	22	27.2	24	29.6	29	35.8	5	6.2	1	1.2	81
Development of teaching strategies to facilitate children science learning (CILO2) 20%	17	21.0	15	18.5	34	42.0	14	17.3	1	1.2	81
Evaluation of the strategies 10%	1	1.2	25	30.9	25	30.9	24	29.6	6	7.4	81
Organization 10%	10	12.3	29	35.8	35	43.2	7	8.6	0	0.0	81
Presentation 10%	20	24.7	41	50.6	20	24.7	0	0.0	0	0.0	81
Format of citations and references 10%	7	8.6	19	23.5	26	32.1	27	33.3	2	2.5	81

Students' performance on individual assignments

- Summary:
- ~98% of 81 students (combing two classes) have achieved all the 4 CILOs (have got a pass or above grade in relevant assessment criteria of the rubrics).
- ~27% of students have got a distinction grade in these criteria.
- 1 student failed to meet the criterion of 'Critical analysis of assessment results'.
- 1 student failed in the 'Development of teaching strategies to facilitate children science learning'.
- 6 students failed in the 'Evaluation of teaching strategies'
- 2 students failed in the 'Format of citation and references'
- → The results provide significant insights into the future development of the course and the learning focus.

Students' feedback - questionnaires

Science for Global and Environmental Studies

(N=43)	Strongly agree	Agree	Acceptable	Disagree	Strongly disagree	Unknown
The stated learning outcomes of the course have a valuable relationship with my practice as a responsible citizen with multi-perspective views.	11.4%	47.7%	31.8%	9.1%	0.0%	0.0%
The stated learning outcomes are clear and understandable.	13.6%	34.1%	34.1%	13.6%	2.3%	2.3%
The stated learning outcomes agree with what is actually taught in the course (teaching contents and T&L activities)	13.6%	45.5%	36.4%	2.3%	0.0%	2.3%
Tutor lectures contribute to my understanding of the course content.	22.7%	40.9%	27.3%	9.1%	0.0%	0.0%
Course activities are well prepared and carefully explained.	29.5%	45.5%	25.0%	0.0%	0.0%	0.0%
The required reading materials /texts are helpful and practical.	6.8%	50.0%	34.1%	4.5%	0.0%	4.5%
There is a clear relationship between the teaching and learning activities and the stated course outcomes.	11.4%	54.5%	29.5%	0.0%	2.3%	2.3%
Lectures, group work and other learning activities have a clear relationship to course assessment.	7.0%	62.8%	30.2%	0.0%	0.0%	0.0%
The feedback I have received on examinations/graded materials helps my improvement.	6.8%	54.5%	20.5%	0.0%	0.0%	18.2%
Course methods of evaluating student work are fair and appropriate.	6.8%	52.3%	31.8%	0.0%	0.0%	20.5%
I enjoy this course	18.2%	29.5%	40.9%	6.8%	4.5%	0.0%

Students' performances – revision quizzes

- **Science for Global and Environmental Studies**
  - **Course Intended Learning Outcomes** (CILOs)
  - At the end of the course, the learners will be able to:
    - CILO1 describe the components of an ecosystem by using the scientific concepts of matter and energy.
    - CILO2 explain and analyze the effects of the ecological factors on species diversity and community structure by using the scientific concepts of ecosystem.
    - CILO3 explain and analyze the correlation between the ecosystem stability and the environmental sustainability.
    - CILO4 critically analyze numerical data from case studies to accurately explain the environmental phenomena.
    - CILO5 critically evaluate how science affects the society and the environment.

Students' performances – revision quizzes

- **Science for Global and Environmental Studies**
- CILO1 describe the components of an ecosystem by using the scientific concepts of matter and energy

(N=43)	Strongly agree	Agree	Acceptable	Disagree	Strongly disagree	Unknown
I know the scientific concepts of matter and energy	11.4%	31.8%	29.5%	15.9%	11.4% (27.3%)	0.0%
I understand the laws of conservation of matter and energy	11.4%	36.4%	29.5%	15.9%	6.8% (22.7%)	0%
Matter can be recycled ✓	31.8%	31.8%	15.9%	6.8%	2.3%	11.4%
Energy can be recycled ✗	7%	18.6%	11.6%	11.6%	34.9%	16.3%
Energy is converted from one form to another, always ends up with lower quality or less usable energy than started with (laws of thermodynamics) ✓	46.5%	25.6%	18.6%	0.0%	4.7%	4.7%
Energy cannot be created but can be destroyed ✗	13.6%	9.1%	13.6%	18.2%	36.4% (54.6%)	9.1%
.....						

Students' performances – examination

- **Science for Global and Environmental Studies**
- CILO1 describe the components of an ecosystem by using the scientific concepts of matter and energy

(N=43)	Strongly agree	Agree	Acceptable	Disagree	Strongly disagree	Unknown
…..						

Conclusion

- OBL approach: Children's Science Learning and Science for Global and Environmental Studies
  - Values vs criticisms
  - Some problems are required to be solved
    - Outcomes for behaviours and attitudes are hard to define (Harden et al. 1999)
    - Reduces knowledge to a list of essential facts (Stobo et al. 1998)
  - ? Perfect approach ? Need modification?
  - Invaluable experience of learning
  - Personal feeling:

    learning by trial and error /
    wading across the stream
    by feeling the way

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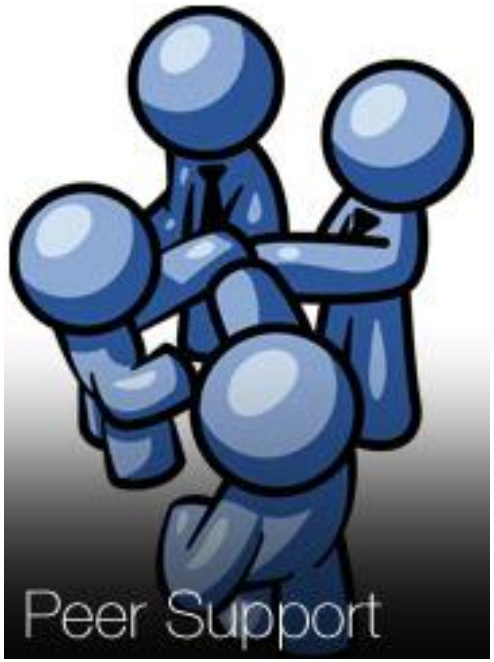
Thank You

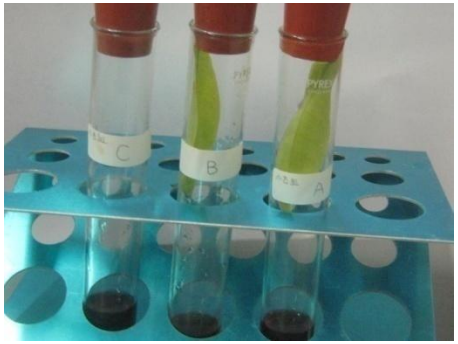
Departmental development

- Informal trial – Science in the Contemporary World
- Departmental sharing
- Seeking for expert opinions



Departmental supports

- Informal trial – Science in the Contemporary World



Course intended learning outcomes

- By the end of the course, students will:
  - CILO1 develop an objective attitude and positive values towards science
  - CILO2 understand the nature and process of science
  - CILO3 acquire basic scientific knowledge and concepts about major areas of science and their impacts on contemporary world

Activities to be assessed

- Experiments
- Group Discussion (video recording)
- Online assessment
- Debate
- Case study
- Online learning
- Questionnaires

- Reading or watching of related issues/news (e.g. tv programmes, newspaper cutting, etc.)

CILO1- Attitude & Value questionnaire

- 17 questions (based on 5-point Likert scale)
- Analysis showed that students have a positive attitude towards science (mean = 2.23, sd = 0.85; Reliability Cronbach's alpha = 0.93
- ?practical ? Affective outcomes

Summary

Cognitive - a knowledge about the object, the beliefs, ideas components

1. Science makes our lives easier, healthier and more comfortable. (1) (4) (7) (8)
2. Science benefits more than it harms. (1) (4)
3. Science is important for society/ human development/ development of civilisation. (1) (4)
4. Science is useful for solving everyday problems. (5)
5. Science will help me understand more about world-wide problems/ the natural world/ our human world. (3)
6. I am growing intellectually after taking science-related module. (6)

Affective - a feeling about the object, like or dislike component

7. Science lessons are interesting. (5)
8. Science promotes my appreciation of the life and nature.

SKills - a tendency-towards-action the object component

9. I am obtaining new skills after taking science-related module. (6)
10. Scientific thinking process helps me to make sensible decisions. (3)
11. Scientific thinking process helps me to understand social and environmental issues.
12. Science will be important to me in my life's work. (9)

NOS/ Process of science

13. Science education focuses on the learning of scientific process and scientific facts as well. (2)
14. "Scientific method" is transferable from one scientific investigation to another. (2)
15. Collecting evidence is an important step of making a decision. (3)
16. Scientific methods/ inquiry can be applied to discuss social issues
17. Scientific theory is forever true.

Departmental supports

- Seeking for expert opinions:
- 2 guest consultants
- 29/3-1/4 陳秉初教授 Prof. Chen Bing Chu
  Professor, Zhejiang Normal University 浙江師範大學
- 27-30/4 郭重吉教授 Prof. Guo Chorng-jee
  Chair Professor of Science Education, National Changhau University of Education 彰化師大 (台東大學退休校長)
- Departmental seminars and individual consultations

Prof. Chen's comments about affective outcomes

生物兴趣水平量表

1. 我对生物课的兴趣是最大的。
2. 我很希望上生物课。
3. 上生物课时我经常希望快些下课。
4. 课下我喜欢翻阅生物教师尚未讲到的内容。
5. 生物课上我常积极思考老师提出的问题。
9. 生物课上我经常走神或是打瞌睡。
10. 我将来愿意终生从事与生物有关的职业。
11. 我希望老师就某些生物问题讲得深些。
12. 如果有时间看电视，我一定不会错过与生物知识有关的科普节目.
13. 总觉得生物知识学起来很枯燥。
17. 我常用学过的生物知识去思考解决生活中的一些实际问题。
18. 我不愿复习生物, 除非临考时实在没办法只得复习一下
19. 我经常阅读生物课外书。
20. 我希望老师不布置作业。
21. 我常觉得学习生物是一种负担。
26做有一定难度的生物题，我感到愉快。
27. 如果课前知道生物课不上了, 我会感到高兴。
28. 一翻开生物书我就犯困。
29. 我喜欢搞清生物概念之间的区别和联系。
30. 学习生物中遇到疑难问题时，我常想方设法搞明白。

I like biology lessons.

Prof. Chen's comments about affective outcomes

- Be measurable ✗
- Questionnaire:
  - "I like biology lessons".
  - Rating scale:
    - Strongly Agree
    - Agree
    - Neutral
    - Disagree
    - Strongly Disagree

- Too subjective

Prof. Chen's comments about affective outcomes

- → be measurable (specific)
- Behavioral performance:
  - Assumption:
    - Affection → specific behavior
      - Participation (duration) in discussion
      - Asking questions (in number) about the topic
      - Frequency (duration) of falling asleep during the lessons

Prof. Guo's comments

1. **The OBE approach in course development is in line with recent theories on learning. Besides being student-centered, subject-matter centered, and assessment-centered, it is suggested that attention be paid to the important roles that community (such as class, family, etc.) plays in the design of learning environment and teaching activities.**
2. **It is suggested that the intended learning outcomes *relate to specific levels of learning*, and that the learning outcomes are *brief, clear and specific.* As a general guideline, an ideal statement of learning outcome is expected to include three major elements, namely, behavior, condition, and criteria.**
   (Please refer to my PPT presentation for further details.)
3. **At the course level, it is important that there is a clear logic and correspondence among the CILOs, teaching contents, teaching & learning activities, and assessment tasks. It will take a recursive design process to establish a sound relationship among these components. Assessment criteria, corresponding to the CILOs, should be established and made available to students in advance.**

Prof. Guo's comments

Specific Suggestion (SG):

1. 在 Synopsis 中宜簡要說明本課程之設計理念(包括本課程的重要性、和 Program 以及其他課程的關聯等)、教學目標和教學方法。
2. 加強 CILOs 與教學內容和活動之間的對應。避免一個 CILO 對應到所有(或太多)的教學內容(不論是以單元或主題的方式呈現)，那表示此一 CILO 過於一般化，可以普遍適用，這雖然無可厚非，但若能配合教學內容的特性，重新改寫或修飾使其更爲具體、明確、特定，將更有利 assessment 和學生的學習。
3. CILO 的敘寫應該要指明預期學生可以達到的 level。
4. 針對特定的 CILO 及教學內容，宜建立評分標準(assessment criteria or rubrics)，並事先讓學生知道。

Chorng-Jee Guo Chorng-Jee Guo April 30, 2010
Chair Professor of Science Education
National Changhua University of Education

Prof. Guo's comments

Course Intended Learning Outcomes (CILOs)
By the end of the module, students will be able to:

$CILO_1$ identify and explain the occurrence of alternative conceptions in children's science learning process.

too generalized ?

Content and Teaching & Learning Activities

CILO	Teaching Content	Teaching & Learning Activities
$CILO_1$	Science of learning in children (physiology of learning and cognitive development of children)	Lectures, case study, class activities / experiments, model display, video play
$CILO_1$ & $CILO_4$	Understanding the origin, nature of children's alternative conceptions about science and implications of research studies on children's science thinking in different science topics	Lecture, case study, literature reviews, group discussion, group presentation
$CILO_2$	Strategies for facilitating children in learning science - stimulate children thinking about science (e.g. concept maps)	Lecture, class activities, group discussion
$CILO_2$	Strategies of inquiry teaching and understanding the process of science	Lecture, class activity, case study, group discussion, group presentation
$CILO_2$ & $CILO_3$	Science at home - designing and assessing scientific investigative activities in daily life	Lecture, class activity, group presentation
$CILO_1$, $CILO_2$ & $CILO_3$	Methods for assessing children's thinking and understandings	Lecture, group discussion, group presentation, literature reviews
$CILO_1$, $CILO_2$, $CILO_3$ & $CILO_4$	Gender sensitivity in science teaching and learning – gender difference in science learning	Lecture, case study, literature reviews
$CILO_1$, $CILO_2$, $CILO_3$ & $CILO_4$	Effects of social issues on children's science learning process	Lecture, case study, group discussion, class activities, newspaper discussion
$CILO_1$, $CILO_2$, $CILO_3$ & $CILO_4$	Science literacy - science inventions - current science issues - scientists' stories - science and culture	Lecture, literature reviews, class activities, model display, newspaper discussion, elearning