

Articulating Programme & Course Outcomes in Sciences: Synergies Across the Faculty of Science at CUHK

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Content



- Outcome-based approach
- How we proceed
- Articulating programme-level learning outcomes in CUHK science programmes
- Articulating course-level learning outcomes
- Recent initiatives in CUHK Science Faculty

Outcome-based Approach?



- What is OBA?
 - Outcome-based Approach
 - Outcomes-based Approach
 - Outcome-based Learning
 - Outcome-based Education

- Many of us have no knowledge on this

- UGC
 - Not straightjacket
 - Institutions should take ownership
 - Inter-institutional task force established



- Areas attracted much discussion
 - Internationally recognized direction?
 - Worth the effort?
 - Criterion referencing vs norm-referencing
 - Assessment rubric
 - Emphasis on nurturing generic skills
 - Measuring outcomes
 - Too student driven

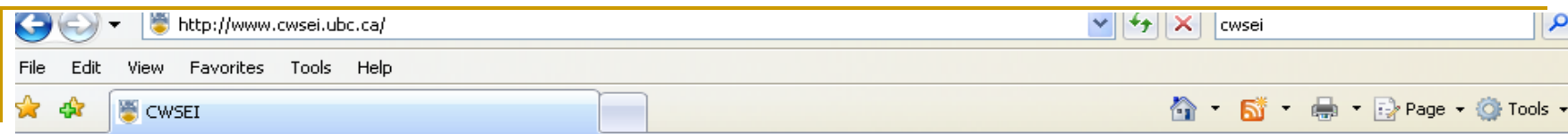


- General consensus
 - Clearly articulated learning outcomes
 - Curriculum components (content, learning activities, assessment) align with learning outcomes
 - Assessing outcomes and collecting feedback

- These concepts are part of our culture
 - We are not eloquent in using the language

- OBA has long been used
 - implicit rather than explicit manner

<http://www.cwsei.ubc.ca>



Carl Wieman Science Education Initiative
at the University of British Columbia



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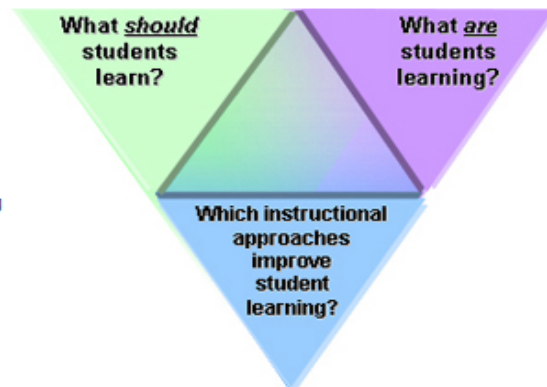
THE CARL WIEMAN SCIENCE EDUCATION INITIATIVE

*Achieving the most effective, evidence-based science education
(effective science education, backed by evidence)*

The Carl Wieman Science Education Initiative (CWSEI) is a five-year, \$12M project at The University of British Columbia aimed at dramatically improving undergraduate science education.

The CWSEI helps departments take a four-step, scientific approach to teaching:

- ✓ Establish what students should learn
- ✓ Scientifically measure what students are actually learning
- ✓ Adapt instructional methods and curriculum and incorporate effective use of technology and pedagogical research to achieve desired learning outcomes
- ✓ Disseminate and adopt what works



IMPACT AND INVOLVEMENT:

[RSS](#)

NEW VIDEOS

[SEI Video page](#) – **New video clips added Nov 2009.** Includes short videos on using clickers in the classroom -- benefits & practical tips and using clickers in upper division courses. More to come!

DEPARTMENTAL ACTIVITIES UPDATE

April 2009 update of Departmental activities

CWSEI END-OF-YEAR EVENT APRIL 29, 2009

Talks, Posters, Workshops
[Details of the CWSEI EOY event](#)

UBC REPORTS ARTICLE

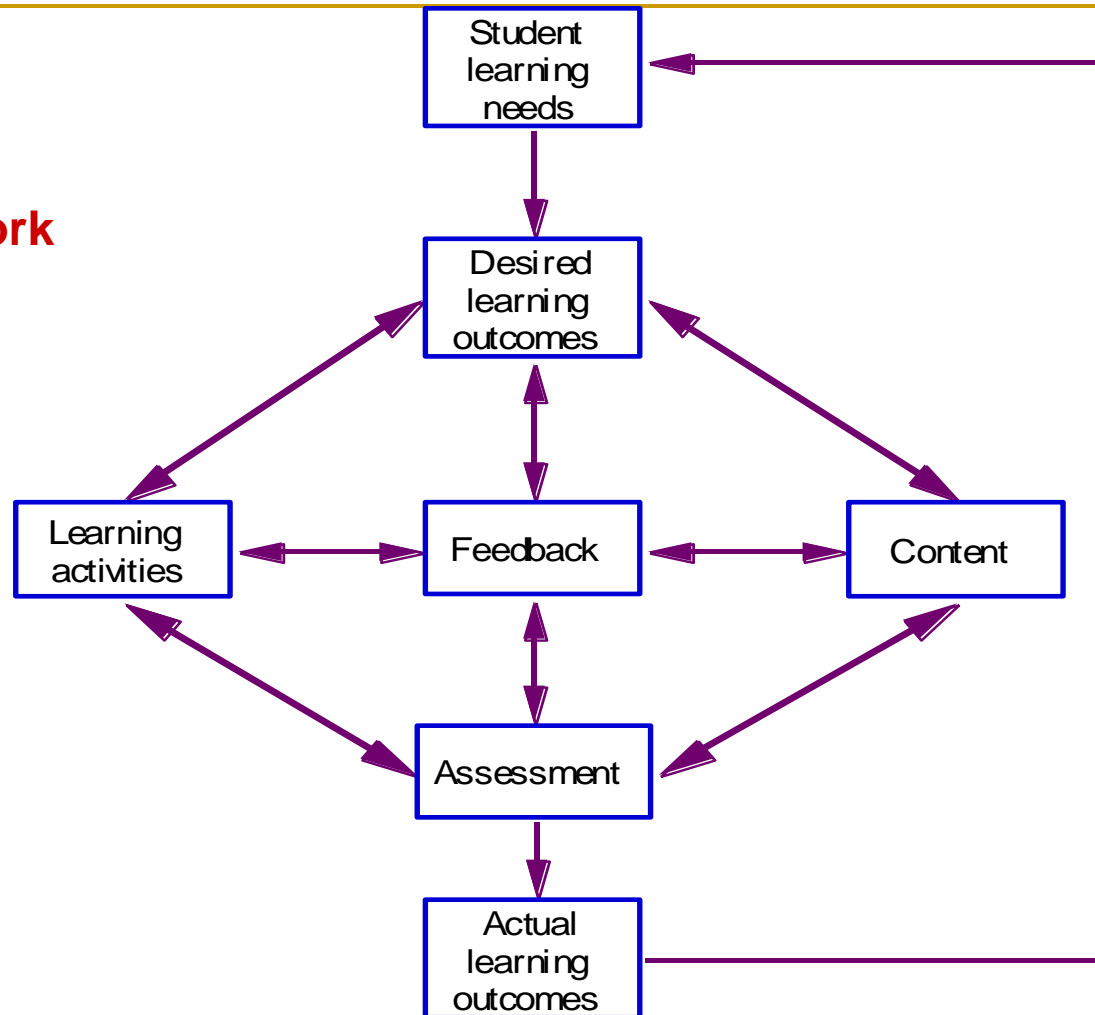
March 2009 [The Joy of Teaching:](#)

... Outcome-based Approach?



CUHK

Integrated Framework



How we proceed?



- Take into consideration
 - Non straightjacket
 - Institutions should take ownership
 - Consensus on the framework
- What are important?
 - Take ownership
 - What we have done and plan to do?
 - Analyze the range of activities with reference to the framework
 - Provide support



■ Taking ownership

- What are the issues that an OBA parameter intends to address?
- What are the expected “outcomes” of an OBA policy?
- What can we do to address these issues and achieve the same “outcomes”?
- Almost all teaching and learning initiatives are (80% ~ 90%) related to OBA

■ Providing support

- To fill the gap (10% ~ 20%)
 - help professors to become eloquent in using the OBA language
- Tangible, practical, hands-on, discipline-specific support

Example: Articulating LOs in Science Programmes



- 2006: from management
 - All programme should explicitly articulate the desired learning outcomes

- Reaction of some professors
 - Why?
 - What for?
 - How to do it?
 - Have no resources to do it.



- 2005-2006: from professors
 - Need programme-specific items to supplement the SEQ
 - SEQ: Student engagement questionnaire
 - to assess students' achievement in various aspects
 - apply to all undergraduate programmes

- This is related to OBA



- **Management and professors**
 - Address the same issue
 - Achievement of students
 - What are the expected “outcomes”?
 - Management: Learning outcome statements
 - Professors: Programme-specific questionnaire items
- **Bridged the Gap**
 - Learning outcome statements = questionnaire items



■ Provide support

- Faculty coordinated several programmes and CLEAR
 - to develop a TDG project
 - Develop programme-specific items in SEQ
 - Help programmes articulating programme-level learning outcomes



■ Support

- Literature review
 - Generic and Programme specific information
- Build website to share information
- Focus group interviews
 - to develop programme-specific questionnaire items
 - learning outcomes



Information on an Outcomes-based Approach

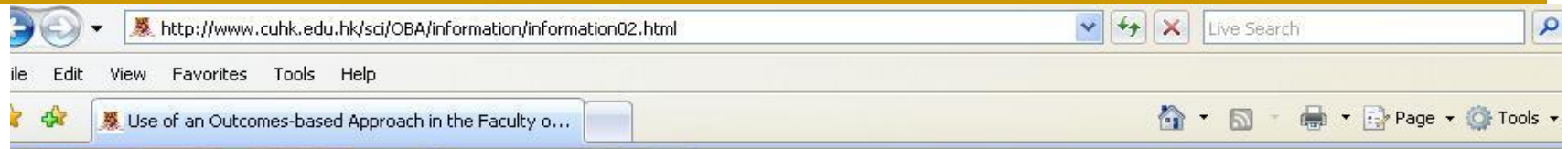
- Outcomes-based Approach
- Examples of **Science** Learning Outcomes in Other Countries
- Specific Information on OBAs for **individual subjects**
- Merits and Effectiveness of the Outcomes-based Approach
- General Resources

Use of an Outcomes-based Approach in the Faculty of Science at The Chinese University of Hong Kong

- Introduction
- Project Progress
- **Information on an Outcomes-based Approach**
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Examples of science learning outcomes in other countries



Information on an Outcomes-based Approach > Examples of science learning outcomes in other countries

■ QAA Subject benchmark statements, academic standards

The **Quality Assurance Agency for Higher Education (QAA)** was established in 1997 to provide an integrated quality assurance service for UK higher education by adopting the OBA.

 Agriculture, forestry, agricultural sciences, food sciences and consumer sciences

 Biomedical Science

 Biosciences

 Chemistry

 Earth sciences, environmental sciences and environmental studies

 Mathematics, statistics and operational research

 Physics, astronomy and astrophysics

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Information on an OBA ■

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... Examples of science learning outcomes in other countries



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■ Programme outcomes, assessment and achievement of learning outcomes for programmes at the University of Oxford

The **University of Oxford** is one of the participants of the QAA, with most of its science subjects using an OBA.

 Biological Sciences

 Human Sciences

 Chemistry

 Mathematics

 Physics

Top

■ Summary of outcomes, learning, teaching and assessment methods for OBA by Tuning

Internet

100%

Specific information on OBAs for individual subjects



http://www.cuhk.edu.hk/sci/OBA/information/information03.html

Use of an Outcomes-based Approach in the Faculty o...

Information on an Outcomes-based Approach >

Specific information on OBAs for individual subjects

- Biochemistry >
- Biology >
- Chemistry >
- Environmental science >
- Food & Nutrition sciences >
- Mathematics >
- Physics >
- Statistics >

Outcomes-based Approach *
Examples of Science Learning *
Outcomes in Other Countries *
Ments & Effectiveness of the OBA *
General Resources *
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Biochemistry

Sample learning outcomes by B.S. Biochemistry Program in the Department of Chemistry and Biochemistry, College of Science and Mathematics, Kennesaw State University, Kennesaw, Georgia:
<http://www.kennesaw.edu/ie/presentations/Biochemistry.pdf>

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Biology

A biology assessment study in the UK on the use of learning outcomes and distractions during a poster assessment for undergraduate students:
Orsmond, P., Merry, S., & Sheffield, D. (2006). A quantitative and qualitative study of changes in the use of learning outcomes and distractions by students and tutors during a biology poster assessment. *Studies in Educational Evaluation*, 32, 262-287.

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Chemistry

... Specific information on OBAs for individual subjects



Chemistry

A study on first-year undergraduate chemistry and physics classes in Australia showed that a student-focused approach to teaching, which is the main characteristic of the OBA, is a part of good teaching, as this approach is likely to be associated with higher quality learning outcomes:

Trigwell, K., Prosser, M., & Waterhouse, F. (1999). Relations between teachers' approaches to teaching and students' approaches to learning. *Higher Education*, 37, 57-70.

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Environmental Science

A study that provides teaching strategies and learning outcomes that appear to be instrumental in equipping students with the skills needed to engage in decision making regarding environmental problems:

Dresner, M., & Blatner, J. S. (2006). Approaching civic responsibility using guided controversies about environmental issues. *College Teaching*, 54(2), 213-219.

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Food & Nutrition Sciences

The **Institute of Food Technologists** (IFT) – most Food Science programmes in the US, and some in Mexico and Canada, are members of this organisation. A task force was

... *Specific information on OBAs for individual subjects*



■ Mathematics

Supporting Assessment in Undergraduate Mathematics (SAUM) by the Mathematical Association of America (MAA) aims to encourage and support faculties in the design and implementation of effective programmes to assess student learning in undergraduate mathematics. Many case studies on assessments of learning outcomes are demonstrated in the following reports.

<http://www.maa.org/saum/cases/welcome.html>

Guidelines for Programs and Departments in Undergraduate Mathematical Sciences, MAA, 2001:

<http://www.maa.org/guidelines/guidelines.html>

Supporting Good Practice in Assessment in Mathematics, Statistics and Operational Research, by Neil Challis, Ken Houston and David Stirling, provides guides, together with examples, for lecturers on how to align assessment tasks, assessment methods, methods of learning and the intended learning outcomes of programmes and modules:

<http://mathstore.ac.uk/publications/staff.pdf>

The following is a study on the field trialing of inventory scales that reflect variations in student mathematics study and learning processes. These scales predict learning outcomes, but with differentiated patterns of relationships to those outcomes.

Eley, M. G., & Meyer, J. H. F. (2004). Modelling the influences on learning outcomes of study processes in university mathematics. *Higher Education*, 47, 437-454.

... Specific information on OBAs for individual subjects



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■ Physics

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■ Statistics

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Conducting focus groups for programmes



- by a coordinator
 - provide reference material in advance
 - supportive attitude
 - help draft the learning outcome statements
 - Content
 - Professional and generic skills
 - Value
 - help convert the learning outcomes into programme-specific items in the questionnaire
 - share information

“Outcomes” of the project



- Learning outcomes have been articulated
- Programme-specific questionnaire items developed to supplement the university-wide questionnaire
- Started with several programmes in 2006 and all programmes had completed the development in 2007

... Outcomes of the project



Examples of
Science LOs

Project Progress >
Project deliverables

[Examples of Science Learning Outcomes](#)

click for details

Programme	Drafted Learning Outcomes*	Drafted Questionnaires*
Biochemistry	✓	✓
Biology	✓	✓
Chinese Medicine	✓	✓
Chemistry	✓	✓
Environmental Science	✓	✓
Food and Nutritional Sciences	✓	✓
Mathematics	✓	Planning
Molecular Biotechnology	✓	✓
Physics	✓	✓
Risk Management Science	✓	✓
Statistics	✓	✓

*For each programme, the preliminary outcome statements and questionnaires have been discussed and evaluated amongst the programme's members. Feedback was collected to refine the outcome statements.

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Example: Involving students in the development of course-level learning outcomes



- Many programmes have developed the *Learning outcome x course matrix*
 - by professors

	Course 1	Course 2	Course 3	Course 4	Course 5
Outcome 1	xxx	xx	xxx	xxx	xx
Outcome 2	xx	x	xx	xxx	xxx
Outcome 3	xxx	xxx	x	xx	x
Outcome 4	x	x	x	x	x



- From management
 - Involve students in the OBA development
 - It is important to have students' buy-in

- Professors queries
 - Why?
 - Do students know what they should learn?



- From programmes
 - Staff-student consultative committee
 - Seek students' feedback in (each course) staff-student meetings
- Support: A coordinator to conduct the discussion
 - Build the discussion with reference to the *course x learning outcome* matrix
 - A student version *course x learning outcome* matrix,
- Objectives achieved

Lesson learned



- Don't let the OBA terminologies scare us
- Taking ownership
 - No need to follow others' works
 - Value diversity
 - Encourage initiatives
 - Initiatives good for students definitely fall within the OBA framework
- Providing support
 - fill the gap
 - work in teams
 - leverage resource
 - Synergy
- Instill more meaningful substance into OBA

Recent Initiatives in the Faculty of Science



- Engaging science students in the design & enactment of assessment
- Promote assessment as a learning activity
- Engage students in self- and peer-assessments

<http://www.cuhk.edu.hk/sci/TDG/>

Engaging Science Students in the Design & Enactment of Assessment - Windows Internet Explorer

http://www.cuhk.edu.hk/sci/TDG/

File Edit View Favorites Tools Help

Engaging Science Students in the Design & Enactment...

Engaging Science Students in the Design & Enactment of Assessment

Assessment drives the curriculum

Assessment System

Introduction
Project Team
Details of the Project
Project Activities
Case Studies
Assessment Criterion Bank
Constructing Performance Indicators
Evaluation
Useful Links
Publications
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exam
essay
report
project
presentation
research paper

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Centre for Learning
Enhancement And Research

Designed and produced by Centre for Promoting Science Education CUHK.

... Recent Initiatives in the Faculty of Science



- Using clickers to enhance teaching and learning: Pilot case studies in science programmes
- Enhance interaction
- Facilitate formative assessment
- Evaluate students' achievement of learning outcomes

A screenshot of a web browser displaying a website. The browser's address bar shows the URL <http://www.cuhk.edu.hk/sci/clicker/>. The website has a light blue and white color scheme with a pattern of small circles. On the left, there is a navigation menu with the following items: Overview, Project Team, Information on Clicker, Recommendations, Project Activities, Case Studies, Students' Evaluation, and Teachers' Experiences. In the center, there is a large image of three silver clickers with the text "Clickers System" overlaid. To the left of the clickers, there is a smaller image with the text "Using Clickers To Enhance Teaching And Learning Pilot Case Studies in Science Programmes" and "in ENGLISH" and "in CHINESE" buttons. Below the main image, there are "PLAY" and "STOP" buttons. At the bottom right, there is a "Site Map" button. The footer of the website reads "Designed and produced by Faculty of Science, Centre for Promoting Science Education, CUHK, Copyright 2009, The Chinese University of Hong Kong".

<http://www.cuhk.edu.hk/sci/clicker/>



The screenshot shows a Windows Internet Explorer browser window displaying the website http://www.cuhk.edu.hk/sci/education/teachlearn_e.html. The browser title is "Faculty of Science, the Chinese University of Hong Kong website - Windows Internet Explorer". The address bar shows the URL. The website header includes the CUHK crest and the text "Faculty of Science, 理學院". Below the header is a navigation menu with links: NEWS/EVENTS, GENERAL, EDUCATION, RESEARCH, STUDENT AFFAIRS, and e-NEWSLETTERS. The main content area is titled "Teaching and Learning" and features a section for "1. Recent initiatives". This section describes the Teaching Development Grant (TDG) Project "Using Clickers to Enhance Teaching and Learning: Pilot Case Studies in Science Programmes" launched in December 2008. It mentions that a group of motivated teachers have spearheaded the use of this student response system. The website URL for the clicker project is provided: <http://www.cuhk.edu.hk/sci/clicker>. Below the text is a small thumbnail image of a computer screen displaying the clicker project website. On the left side of the website, there is a sidebar with the heading "Teaching & Learning" and a list of links: 4-year Curriculum Design, Teaching Quality Assurance, Outcomes-based Approach, Recent Initiatives, Events, and Useful Links. At the bottom of the sidebar, there is a box for "Academic honesty Requirements". The browser status bar at the bottom shows "Done", "Internet", and "100%".



The End

Thank You Very Much

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