



Carl Wieman Science Education Initiative
at the University of British Columbia

2008-9 End of Year Event

Talks

Carl Wieman, Overview of CWSEI progress

Kim Voll, Adventures in Problem-Based Classroom Learning

Doug Bonn, Large Scale Measurements of Student Conceptual Learning and Attitudes

Poster session 11-1:30 Details on everything being done and learned Room 261

Workshops

1:30 – 3:00pm, room 260 – **Using Clickers Effectively**

3:00 – 4:30pm, room 260 – **Invention Activities: Stimulating Students to Transfer Their Learning to Novel Situations**

3:00 – 4:00pm, room 261 – **Improving Learning by Reducing Demands on Working Memory**

What is the CWSEI all about?

A scientific approach to teaching

- Practices based on good data on student learning
- Guided by research on learning
- Disseminate results & copy what works
- Use technology effectively



**students learn more, faculty and students use
time more efficiently**

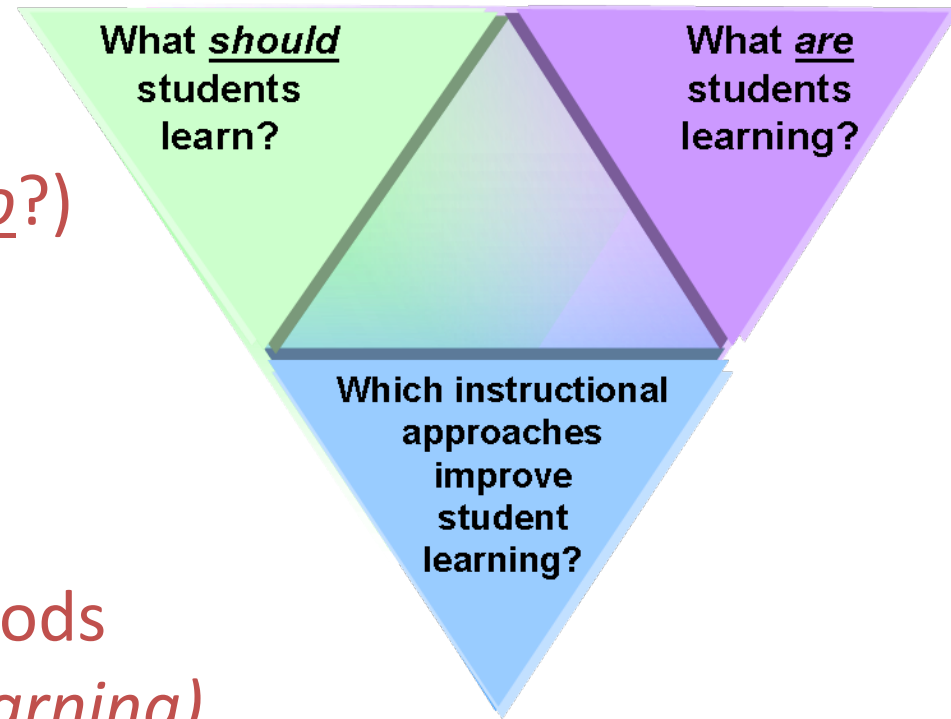
CWSEI “Holy Trinity” for each course

1st: Learning goals. (what should students be able to do?)

2nd: Good assessment
(validated tests)

3rd: Improved teaching methods
(research based, improve learning)

Materials, assessment tools, homework, notes ...
saved, reused, improved.



Carl Wieman Science Education Initiative

Started 2 years ago \Rightarrow widespread improvement in science education.

Funds projects across multiple departments, various scales and levels of maturity

Large scale mature-- Earth and Ocean Sciences

Large scale young-- Physics and Astronomy
Computer Science

Smaller scale -- Math, Chemistry, Statistics

Intermediate-- Life Sciences

unfunded participant -- Nursing

CWSEI central-- online archive system, website with resources, research on student success factors, science education research reading group (~60), guidance.

1. samples of CWSEI central products
2. Overview of departmental efforts.

CWSEI website www.cwsei.ubc.ca -- resources



THE UNIVERSITY OF BRITISH COLUMBIA



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at the University of British Columbia



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Instructor Guidance

» **More on learning goals on the [Learning Goals page](#)**

» **More clicker resources on the [Clickers page](#)**

Assessments That Support Student Learning

2-page summary of key points and factors from the review paper "Conditions Under Which Assessment Supports Student Learning," including CWSEI suggestions on implementing good assessment and feedback without spending excessive time marking.

Clicker Resource Guide

An instructor's guide to the effective use of personal response systems ("clickers") in teaching, prepared by CU-SEI and UBC-CWSEI staff & associates.

[Classroom Response System \("Clickers"\) Bibliography \(Vanderbilt Center for Teaching\)](#)

A very extensive bibliography on clicker use and research (with links to digitally available papers).

First Day of Class

Recommendations for Instructors on establishing the course environment early in the Term.

Group Work in Educational Settings

A short description of different approaches to student group work and their benefits, requirements, and implementation logistics, prepared by CU-SEI and UBC-CWSEI staff & associates.

[How to Prepare Better Multiple-Choice Test Items: Guidelines for University Faculty](#)

An excellent guide for the creation of good multiple choice test questions, including discussion about when and how multiple choice tests are best used and avoiding common flaws. (Brigham Young University Testing Center)

Learning Goals/Objectives Examples

Good examples of learning goals: developed by departments involved in the Science Education Initiatives at UBC and the University of Colorado.

Learning Goals - Computer Science

Learning goals developed for 5 UBC Computer Science courses.

More on learning goals on the [Learning Goals page](#)

Rubric for evaluating student presentations

Rubric for peer evaluation of students' "News Reports" presentations in EOSC 310, prepared by Sara Harris in Earth and Ocean Sciences with input from many others.

The screenshot shows a Windows Internet Explorer browser window displaying the SEI Course Materials website. The browser's address bar shows the URL <http://www.sei.ubc.ca/materials/Welcome.do?ticket=IT5jDI50K7bXtWGGE7rmJA@@>. The website header includes the title "SEI Course Materials" and a navigation menu with "Departments/Programs" and "Categories" dropdowns, and a search box. Below the header, the user is greeted with "Hi, Carl Wieman" and a "Log out" button. The main content area features a welcome message: "Welcome to the Science Education Initiative Course Materials System. Materials for undergraduate science courses at the University of British Columbia (UBC) and the University of Colorado (CU) are stored here, as well as notes on the purpose and design of the courses and the use and effectiveness of the materials. The system contains materials developed by departments participating in the Science Education Initiatives at UBC and CU, and is intended to be an open resource for educators. The materials can be accessed by browsing the courses listed under the departments on the left, or by searching for keywords. This system is operational, but is still undergoing modification to add functionality and has not been extensively tested. If you have any suggestions for improvements (for example to increase its usefulness or make it easier to use), please contact Sarah Gilbert, UBC CWSEI Associate Director: sarah.gilbert@ubc.ca. If you have questions about how to use this system, please contact Massoud Kohan, CWSEI IT Projects Leader: massoud.kohan@ubc.ca".

The left sidebar contains a "Help" link and a "Departments/Programs" section with a list of departments: UBC, Chemistry, Computer Science, Earth & Ocean Sciences, Life Sciences, Mathematics, Physics & Astronomy, and Statistics. Below this is the "University of Colorado" section with a list of departments: Chemistry & Biochemistry, Geological Sciences, Integrative Physiology, Molecular, Cellular, & Developmental Biology, and Physics.

The right sidebar features a "Quick Links" section with links to CWSEI, CU-SEI, PhET, CU, UBC, and Basecamp Forum. At the bottom of the sidebar, there is an "Admin" link.


The browser's status bar at the bottom shows "Error on page." and "Internet" with a 100% zoom level. The Windows taskbar at the very bottom displays the Start button, several open applications (Microsoft Office Word, Microsoft PowerPoint, and the SEI Course Materials browser window), and the system tray showing the time as 9:02 AM and battery level at 97%.

- Overview
- Learning
- Goals/Objectives
- Course Calendar
- Student Difficulties
- Lecture Notes
- Concept/Clicker Questions
- Demos & Simulations
- In-Class Activities/Tutorials
- Lab/Field Activities
- Assignments/Homework
- Instructor Reflection
- Course Logistics
- Resources
- Password Protected**
- Exams
- Ungraded Assessment Tools
- Course Data
- Other (solutions, etc.)

EOSC 350 : Environmental, Geotechnical and Exploration Geophysics I

NOTE: Throughout this eos350 archive, references to "GPG" are chapters in the unpublished electronic text by F. Jones and D. Oldenburg. It is not yet part of the archive because it is close to 100 MBytes.

The file (Word Document) is the syllabus for the course outline, including original goals and logistics (grading scheme, etc.).

File:  syllabus.doc

EOSC 350 Topics
<u>3. Potential Fields methods</u>
<u>4. Propagating Waves methods</u>
<u>5. Electrical methods</u>
<u>1. Introduction</u>
<u>6. Review</u>
<u>2. Fundamentals</u>

2. Overview of departmental efforts

*Appetizer-- whet appetite for full course meal
in poster session-- some areas of emphasis in bold*

Full update of departmental activities
on CWSEI website

Math 1 Science Teaching Learning Fellow

activities:

- Developing learning goals
- Addition of numerical computation labs to courses
- **Diagnostic test--evaluating its effectiveness, identifying what incoming mastery students need to succeed**
- **Assessment of calculus learning workshops**
⇒ **clear data on how to enhance effectiveness**

Chemistry 1 STLF

- **First year intro chem labs-- learning goals and extensive assessment on basic lab skills.**
⇒ **clear data on how to enhance effectiveness**
- Data on attitudes about chemistry, how impacted by intro

Statistics

-- transformed large intro course
learning goals, better assessment, improved teaching
methods (“SEI Holy Trinity”)

new simulation labs--assessing effectiveness
research on attitudes

Life Sciences 2 STLFs several faculty members

- attitude survey development and application
- exit survey of graduating students
- examination of instructor consistency-- coverage and assessment
- assessments of learning on natural selection, what chemistry needed in life sciences courses, ...
- **Implementation and research on effectiveness of learning groups and invention activities (teaching creativity!)**

Computer Science-- 1 going on 2 STLFs, ~ 12 faculty

- **Comprehensive set of learning goals 8 core courses**
- Significant curriculum changes in intro courses
- 1 course: full trinity (goals, assessment, teaching methods)
- ~8 courses, portions of trinity
- ~6 research projects on effectiveness of different teaching and testing methods

Physics and Astronomy -- 2.7 STLFs, ~ 9 faculty members

- 3 courses: LGs, assessment, improved teaching methods
- 6 courses: some elements of the trinity
- TA training--extensive program implemented
- **Very extensive assessment of learning and attitudes. Many courses, many levels (Doug Bonn talk)**
- Research on learning, diagnostics development

Earth and Ocean Sciences -- 4 STLFs, 37 faculty!

- **9 courses: full trinity (LGs, assessment, methods)**
- **9 other courses: some elements of the trinity, most in progress toward full trinity**
- Substantial reexamination of curriculum
 - service courses
 - environmental sciences
 - geophysics
 - geology
- Exit survey of graduating students
- TA training program
- Research: attitudes about earth sciences & effects of courses, how teaching practices impact level of classroom engagement
- Seminars on teaching, monthly EOS CWSEI newsletter, retreat

Questions?

Kim Voll, Computer Science,
Adventures in Problem-Based Classroom Learning

Doug Bonn, Physics and Astronomy,
Large Scale Measurements of Student Conceptual
Learning and Attitudes