Earth and Ocean Sciences Department

Earth & Ocean Sciences received full funding from CWSEI in 2007 and began the efforts listed below in Summer 2007. The EOS-SEI program is making excellent progress with 19 courses currently at various stages of transformation and 9 more courses "unofficially" being improved using the principles of research-based effective pedagogy. Over 60% of EOS faculty are involved in the SEI in some capacity (committees, working groups and/or making changes to their courses). The overarching goal of the EOS-SEI is to promote cultural change in our approach to teaching and learning and establish sustainable processes to continue and improve the work accomplished during the CWSEI project.

SEI Director: Sara Harris

STLFs: Francis Jones, Brett Gilley, Erin Lane, Joshua Caulkins, Ben Kennedy (emeritus)

Faculty (instructors teaching targeted courses): S. Allen, G. Andrews, R. Beckie, M.L. Bevier, M. Bostock, , G. Dipple, E. Eberhardt, J. Finnis, R. Francois, M. Grey, S. Harris, K. Hickey, W. Hsieh, M. Jellinek, C. Johnson, M. Kopylova, M. Maldonado, U. Mayer, S. Mills, J. Mortensen, K. Orians, R. Pawlowicz, J. Scoates, R. Stull, S. Sutherland

Faculty (others involved in working groups, committees, or ad-hoc support): P. Austin, K. Grimm, P. Hammer, E. Hearn, O. Hungr, M. Lipsen, L. Ver, P. Smith, D. Steyn, P. Tortell, M. Bustin, L. Groat, C. Suttle, K. Russell, T. Ivanochko

Students: L. Bailey, L. Beranek, D. Cassis, J. Dohaney, R. Eso, L. Gurney, M. Halverson, S. Henderson, K. Hodge, A. Jolley, P. Lelievre, C. Leslie, J. Mcalister, J. Rhajiak, B. Smithyman

Course Transformation

Course	Learning Goals	Assessments	Improved methods
EOSC 111: Laboratory Exploration of Planet Earth (Sept '07 start) Faculty: S. Harris STLF: Brett Gilley Transformation completed in Fall '08 w/ ongoing updates to pre-post assessment, lab activities, and quizzes	Course level goals: complete Lab-level goals: complete	Individual and group quizzes 3rd draft of Pre/Post assessment complete for all topics Post-lab surveys for each lab End-of-term survey	Invention activities (Introduction, Plankton & Marine Ecosystems) Student-derived methods (Earthquakes, Groundwater, Dinosaurs, Waves, Estuaries) Contrasting cases (Sediments & Sedimentary Rocks)
EOSC 112: The Fluid Earth: Atmosphere and Ocean (Jan '08 start) Faculty: R. Francois, S. Harris, W. Hsieh STLF: Erin Lane	Course-level goals: draft Lecture-level goals: drafts for all lectures	Midterm & end-of-term surveys 16-question draft pre-post test on student misconceptions in oceanography & climate change Student engagement observations	Widespread use of thought-provoking clicker questions Peer instruction Relevance slide added to each lecture, relevance added throughout class
EOSC 114: The Catastrophic Earth: Natural Disasters (Sept '07 start) Faculty: R. Stull, E. Eberhardt, M.L. Bevier, S. Sutherland, J. Finnis, G. Andrews STLF: Francis Jones Transformation is concluding, but further refinements are expected.	Course-level goals: complete Lecture-level goals for all lectures: complete	Midterm & end-of-term surveys Pre-course diagnostic on basic skills Online homework based on text readings introduced Fall 2008 Attitudes survey	Vista Course Management System and a custom website used extensively for content delivery, quizzing, surveying, logistics Use of thought-provoking clicker questions in all lectures Pre-post question "wrappers" around video clips to focus and assess student learning from videos Custom text introduced Off-schedule pre-exam review/question sessions Fall'09: Preliminary experiment with PeerWise in one section Multiple sequential instructors with one lead instructor and administrative support

EOSC 210: Earth Science for Engineers (Jan '08 start) Faculty: E. Eberhardt, U. Mayer, S. Sutherland STLF: Brett Gilley	Course-level goals: complete Lecture-level goals: complete Goals for all labs: complete	End-of-term survey Mineral exam	Use of PeerWise (http://peerwise.cs.auckland.ac.nz/) for student generation of questions Widespread use of clicker questions (4-8 in each 1.5 hour lecture), focus attention, test understanding, and drive discussion Small group or pair discussions in most classes Many case studies relevant to lectures Labs redesigned with new activities linked to learning goals
EOSC 211: Computer Methods in Earth, Ocean & Atmosph. Sciences (Jan '09 start) Faculty: R. Pawlowicz, C. Johnson STLF: Joshua Caulkins	Course-level goals: draft Lecture-level goals: draft for all lectures Learning goals for Labs/Assignments: draft	Pre-post assessment: Administered in Teach 1, currently undergoing revisions Midterm and end-of-term surveys New types of exam questions based on computer science concepts	In-class worksheets for every lecture Pair-programming used in all labs and assignments Name-Sticks used to call on students Post-lecture Interviews
EOSC 212: Topics in the Earth & Planetary Sciences (Jan '08 start) Faculty: M. Jellinek, M. Bostock STLF: Francis Jones	Course-level goals: complete Focus is on science thinking skills rather than content	End-of-term survey for project evaluation Quizzes on readings for both individual and teams Two projects (presentation and poster) Pre-post test related to model-based reasoning Peer assessment of some homework and both projects Regular graded abstract writing and question-posing assignments Student participation in rubric design for reading, writing and questioning	Vista Course Management System used extensively for content delivery, quizzing, surveying, logistics Team Based Learning elements: individual/team quiz protocols & in-class team activities Content from Scientific American and other articles and lectures Three modules chosen to highlight Departmental research strengths Guest speakers for each module Instruction and practice at developing science article reading and questioning skills Project topics are student-determined Question posing, abstract writing and model based reasoning rubrics are used A capstone week revisits core learning goals Two instructors with roughly half the classes attended by both
EOSC 220: Introductory Mineralogy (Jan '08 start) Faculty: M.L. Bevier STLF: Joshua Caulkins	Course-level goals: draft Lecture-level goals: draft for all lectures	Midterm and end-of-term surveys Lab quizzes	1+ discussion activities per lecture Labs entirely reworked and provided more structure Poster project Create your own reference "mineral book"

EOSC 221: Introductory Petrology (Sept '07 start) Faculty: M. Kopylova STLF: Brett Gilley	Course-level goals: complete Lecture-level goals: complete	Pre/post assessment	Labs rewritten - more structure activities linked to goals Small group lecture activities in each lecture 3x5 cards for ongoing assessment of students and the course Many smaller quizzes after each module Improved course framework (spaced lectures that do more to highlight differences rather than massed lectures, covering all of one rock type)
EOSC 252: Introduction to Experimental Geophysics (Sept '09 start) Faculty: F. Herrmann STLF: Francis Jones Being taught for the first time in Jan '10	Course-level goals: draft Lecture-level goals: under development		
EOSC 322: Metamorphic Petrology (Sept '08 start) Faculty: G. Dipple STLF: Erin Lane	Course-level goals: draft Topic-level goals: drafts for all modules	Midterm survey	Rock sample and relevance in lectures
EOSC 332: Tectonic Evolution of North America (Sept '08 start) Faculty: J. Mortensen STLF: Brett Gilley	Course-level goals: draft Module-level goals: draft	Pre/Post Assessment rewritten for Jan 2010 (validated with former students) Midterm survey End-of-term survey	Activities and discussions planned for some lectures Just-in-Time-Teaching (pre-readings and online quizzes given prior to each module)
EOSC 355: The Planets (Sept '08 start) Faculty: C. Johnson STLF: Francis Jones New course, taught 1st time in Spring 2009.	Course-level goals: complete Module-level goals: being finalized for Spring 2010 term.	Pre-course skills diagnostic, "attitudes toward planetary sciences" and "Getting to know you" surveys Midterm survey for improving course delivery and focus Frequent in-class quizzes Clickers, homework quizzes, in-class worksheets Major project, including staged delivery, some options for re-submission, and some peer assessment.	Vista Course Management System is used extensively for content delivery, quizzing, surveying, logistics Use of permanent teams for frequent in-class worksheet-based activities Clicker use: pre-lecture prediction/invention; mid-lecture for driving thought provoking discussions; post-lecture to ascertain progress and comprehension Several online and in-class quizzes per term, especially to ensure accountability and assess comprehension of basic content, thus permitting higher level in-class activities & lectures No final exam Major poster presentation projects are a primary source of grades
EOSC 372: Introductory Oceanography: Circulation and Plankton (Jan '09 start) Faculty: S. Allen, K. Orians, M. Maldonado STLF: Erin Lane	Course-level goals: draft	In preparation	In preparation

EOSC 373: Introductory Oceanography: Climate and Ecosystems (Sept '09 start) Faculty: M. Maldonado, S. Allen, R. Francois STLF: Erin Lane Being taught for the first time in Jan '10	Course-level goals: draft Lecture-level goals: under development		
EOSC 472: Introduction to Marine Chemistry and Geochemistry (Sep '09 start) Faculty: K. Orians STLF: Joshua Caulkins	Course-level goals: draft Lecture-level goals: under development	Midterm and end-of-term surveys Reading quizzes introduced Reworked homework sets	Weekly worksheet activities Post-lecture student interviews

The following courses are in the planning stage (Jan '10 start):

EOSC 321: Igneous Petrology - Faculty: M. Kopylova, STLF: Brett Gilley
EOSC 326: Earth and Life Through Time - Faculty: S. Sutherland, STLF: Francis Jones
EOSC 329: Groundwater Hydrology - Faculty: R. Beckie, STLF: Joshua Caulkins
EOSC 331: Mineral Deposits - Faculty: J. Scoates, K. Hickey, STLF: Brett Gilley

EOSC 110 (Used Geoscience Concept Inventory), EOSC 116, ATSC 201 (Just-in-Time Teaching), EOSC 223 (pre-post assessments and in-field assessments), EOSC 315 (clickers), 324 (no longer offered), 340 (JiTT, clickers), 350 (Team Based Learning), and ENVR 200 & 300 (team projects, metacognition) are other dept. courses undergoing improvement without specific STLF help (or ad-hoc help).

Curriculum

Service Courses Curriculum Committee evaluated precedents, conducted surveys, and analyzed student data to articulate a list of learning goals for all service courses under the subheading "Knowledge and Major Concepts", "Skills", and "Habits and Attitudes". The list was revised based on faculty input, and was presented at the department's retreat. A workshop for faculty teaching service courses is planned.

Environmental Science Curriculum Committee conducted student focus groups and extensive data analysis on student enrollment data. A set of recommendations and a draft revised curriculum has come out of this work (D. Steyn, chair)

Geophysics Curriculum Committee proposed reinstating the Geophysics Majors program (E. Hearn, chair)

Geology Curriculum Committee proposed reinstating the Geology Majors program (K. Russell, chair)

TA Development

Established a **TA training course** for graduate students (EOSC 516: Teaching and Learning in Earth & Ocean Sciences)
Course is run primarily by graduate students who have facilitator training. Enrolment is about 15/year

Learning goals: Course level goals, Learning goals for each session

Assessments: Using Physics' Teaching Attitudes Survey as Pre/Post, Formative Evaluation after each session, Summative Evaluation

Methods and materials: Mini-lesson practice, Group discussions, Lab redesign project

Research

Student Attitudes about Earth Science Survey (SAESS): Survey developed to gauge the students' attitudes and beliefs about learning earth & ocean sciences. Administered in both majors- and non-majors courses early in the term (pre-) and late in the term (post-) to measure the effects of courses on student attitudes. The survey has been administered in >25 courses both at UBC and other institutions. More than 6000 students have participated over the past 2 years.

Classroom Observations, Protocol & Results: We developed an objective, quantitative classroom observation protocol to measure student engagement in a large first year Oceanography course. Observation data show that student engagement is strongly correlated to teaching practices and is higher when instructors employ active learning techniques. Observations of three instructors with different teaching expertise showed similar trends in engagement. The classroom observation data help identify best teaching practices and provide continual feedback to instructors.

Undergraduate Thesis Research: Jamil Rhajiak completed an Honours thesis entitled "Understanding Geological Time: A Proposed Assessment Mechanism for Beginner and Advanced Geology Students. Alison Jolley (Honours student, 2009-2010) is currently working on her thesis entitled "Landscape Identification and Formation: The Development of a Test to Measure Student Knowledge and Confidence". This project involves development of the Landscape Identification and Formation Test (LIFT) to investigate why upper level students have increased skill yet decreased confidence at identifying landscapes and the timescales involved in their formation.

Other

EOS-SEI Times: Approximately monthly newsletter containing results from courses, tips and information for instructors (8 editions so far)

Brown Bag Seminars: Assessing Geoscience Programs; What should we teach?; Just-in-Time-Teaching; Setting Exams

Learning Goals Workshops: 3 facilitated by STLFs for participants outside EOS.

Visitors: Cathy Manduca, director of the Science Education Resource Center at Carleton College.

Exit Survey: An online survey has been developed for graduating 4th year EOS students from all streams. The exit survey will provide us with student perspectives on the EOS academic program, career goals and curriculum recommendations. This information will help us improve our program structure, content, and courses. The survey will be initiated in April 2009 with a permanent version for annual use established by April 2010 along with sustainable analysis procedures. Future considerations may include an alumni survey.

Physics and Astronomy Department

Physics & Astronomy received seed funding in 2007 and began the efforts listed below in the Fall of that year. The department moved to full funding starting in 2008 and now has a complement of five STLFs: Peter Newbury and Louis DesLauriers are full-time, Jim Carolan is an emeritus faculty member, and James Day and Ido Roll are part-time.

SEI Director: Doug Bonn, Mona Berciu

STLFs: Jim Carolan, James Day, Louis Deslauriers, Peter Newbury, Ido Roll

Faculty: D. Bonn, J. Folk, B. Gladman, J. Iqbal, D. Jones, A. Kotlicki, K. Madison, J. Matthews, H. Richer, I. Stairs, M. Van Raamsdonk, S. Reinsberg, G. Rieger, L. Van Waerbeke, C. Waltham, C. Wieman, J. Zibin

Students: M. Gendre, S. Martinuk, D. Mazur, B. Ramshaw, M. Warren, S. Vafaei, C. Veenstra, R. Wong, S. Vafaei

Course Transformation

Course	Learning Goals	Assessments	Improved methods
ASTR 310: Exploring the Universe I: The Solar System (Summer '08 start) Faculty: H. Richer, B. Gladman STLF: Peter Newbury Grad Student: M. Gendre	Course-level goals: complete Topic-level goals: complete	Improved midterm and final exam questions based on clicker questions and tutorials	Created 6 activities for tutorials including guidelines for TAs for facilitating the activities Began using clickers (Richer), Just-in-time teaching (JITT)(Gladman)
ASTR 311: Exploring the Universe II: Stars and Galaxies (Summer '09 start) Faculty: L. Van Waerbeke, J. Zibin STLF: Peter Newbury Grad Student: S. Vafaei	Course-level goals: complete Topic-level goals: 95% complete	Developing pre/post concept test for tutorial activities improved final exam questions based on tutorial activities.	Developed six 50-minute activities for tutorial sessions including guidelines for TAs for facilitating the activities Began using clickers in classroom (Van Waerbeke)
PHYS 100: Introductory Physics (Sept '07 start) Faculty: G. Rieger, A. Kotlicki STLF: Louis Deslauriers, Jim Carolan Grad Student: S. Martinuk	Course-level goals: complete Topic-level goals: complete	Conducting study on impact of learning goals on student self assessment of understanding	Provided feedback for clicker question improvement and more student engagement in lectures.
PHYS 107 & 109: Physics 1 lab and Intro to Experimental Physics (Sept '07 start) Faculty: D. Bonn STLF: James Day	Course-level goals: complete Topic-level goals: complete	Developed & validated physics lab pre-post diagnostic Conducting study on the impact of invention activities completed preceding versus following a lesson End-of-term survey	Developed 15 invention activities on data interpretation and analysis Developed marking rubrics for all labs and for formal reports Incorporated classroom discussion of pros and cons of novel student solutions to invention activity problems
PHYS 200: Relativity and Quanta (Sept '08 start) Faculty: M. Van Raamsdonk STLF: Louis Deslauriers	Course-level goals: complete Topic-level goals: complete	Lecture observations Final exam questions Analyze Mid-term Midterm & end-of-term survey Observe HW sessions	Weekly tutorials developed Improved clicker questions
PHYS 250: Introduction to Modern Physics (Jan '09 start) Faculty: C. Wieman STLF: Louis Deslauriers	Course-level goals: complete Topic-level goals: complete	Development of a Quantum Mechanical Conceptual Survey Lecture observations Final exam questions Analyze Mid-term Midterm & end-of-term survey Observe HW sessions	Weekly tutorials developed Improved clicker questions

PHYS 257: Thermodynamics Mechanics (Jan '10 start) Faculty: S. Reinsberg STLF: Louis Deslauriers	Course and topic-level goals: first draft started		Design a Thermo Conceptual survey
PHYS 304: Quantum Mechanics (Jan '10 start) Faculty: K. Madison STLF: Louis Deslauriers	Course and topic-level goals: 10% complete	Lecture observations Observe HW sessions	Creating a bank of clicker questions Designing in- class activities
PHYS 408: Optics (Sept '09 start) Faculty: D. Jones STLF: Louis Deslauriers	Course-level goals: complete Topic-level goals: complete	Development of a Optics Conceptual Survey Lecture observations Final exam questions Analyze Mid-term Observe HW sessions	Created a bank of clicker questions Design in class activities
PHYS 450: Quantum Mechanics (Jan '09 start) Faculty: J. Folk STLF: Louis Deslauriers	Course and topic -level learning goals: 95% complete	Lecture observations Analyze Mid-term Observe HW sessions Conducting study on impact of student peer discussions vs. classic instruction on students' knowledge retention	Created a bank of clicker questions (including isomorphic questions to test longer-term retention)

PHYS 170 – A mechanics diagnostic survey was administered to determine conceptual learning gains and aid future course development. Clicker usage is being developed in this large multi-section engineering course with extensive observation and advice from STLF Jim Carolan
PHYS 101 & 108 - clicker usage is being developed and improved in these large freshman courses with extensive observation and advice from STLF Jim Carolan

Curriculum

Extensive diagnostic testing by Jim Carolan and Louis Deslauriers is starting to uncover information that will inform upcoming curriculum decisions. These will likely include a new 'terminal' physics stream that starts with PHYS 100, but does not then go into the usual 101/102 sequence for which the students' mechanics preparation is insufficient. Extensive testing of first and upper year students using an electricity and magnetism concept survey (BEMA) is providing information on learning gains and retention. The results from the survey are being used in decisions about merging the Eng. Phys and Honours Phys. streams of E&M. These results will also feed into upcoming decisions about the freshman treatment of E&M concepts. Efforts are also getting underway to write learning goals for all our upper year courses, and by so doing to insure that the various courses cover the expected curriculum in a consistent manner.

TA Development

Graduate student Mya Warren spearheaded this effort and assembled a strong team (Joss Ives, Sandy Martinuk) to develop and run a very successful two-day workshop, which started in the beginning of 2007 Fall Term. The workshop was required for incoming graduate students and available to veterans as well. A system of mentor TAs was initiated to provide a structure in which senior graduate students can oversee other graduate students in the first year undergraduate courses and help to develop their teaching skills. Further improvements to the TA training program have been implemented in Fall 2008 with more students contributing to the development and long-term continuity (Veenstra). An addition to the program in 2008 was the mentor TAs taking TAG's course in Peer Evaluation to prepare them for providing feedback to the TAs under their supervision. This program is enhanced by a new graduate course in pedagogy in Physics & Astronomy: PHYS 520, *Teaching Techniques in Physics and Astronomy.* This course exposed students to current PER literature and culminated in the development of a set of Invention Activities that will be deployed in courses next year.

In 2009, the TAs were asked for input on how to improve TA retention in first year labs and solve various other TA-raised issues. This process is still ongoing, but significant changes may result from it, such as the creation of a departmental committee with both faculty and TA representation, for deciding the distribution of TA jobs and solving other TA issues. The TA training program took place again very successfully this year with a change to the model. There was a one day introductory workshop. Then 'super-TAs' were deployed in each of the large multi-section courses and given the task of developing a course-specific training as a follow-up through the early weeks of the term.

Research

James Day & Doug Bonn, with further assistance from students Hiroko Nakahara and Brad Ramshaw, have been studying the effectiveness of invention activities to improve students' data interpretation and analysis skills and understanding. This has included classroom observation, pre/post testing with a lab diagnostic and data-mining of students' laboratory notebooks. The latter activity is being used to uncover evidence of transfer that may not be apparent in a multiple choice pre/post test. One paper on invention activities already submitted to the Physics teacher.

Peter Newbury and Melanie Gendre are readying results of ASTR 310 tutorial exercises, such as the Human Orrery, for presentation at conferences this summer and eventual publication.

Louis Deslauriers, Joshua Folk, and Goerg Rieger are studying the impact of learning goals on student self assessment of their understanding in Physics 100 and Physics 101.

Louis Deslauriers and Joshua Folk are conducting a study in PHYS 450 aimed at comparing the effect of peer discussions and classic instruction on students' knowledge retention.

Other

Widespread deployment of conceptual inventories to assess student understanding of mechanics and electricity & magnetism concepts. These include an extensive vertical survey from first to fourth year using the new lab diagnostic, a similar vertical survey using the BEMA diagnostic, and use of the FCI in freshman classes and sophomore mechanics.

Widespread deployment of CLASS student attitudes about science surveys in all first year courses, with testing done in Sept., at the end of the first term, and again at the end of the second term.

Participating in CWSEI-wide study on why some students do poorly (particularly focusing on high-failure-rate courses)

Louis Deslauriers has developed a math diagnostic to assess upper-level physics students' grasp of the math skills needed to succeed in the senior courses. This tool will be used to make judgments about curriculum and will feed discussions with the math department about their curriculum. This complements the math department's own efforts on entrance-level testing of math skills.

An archive system has now been developed and extensively tested as a tool to store course information.

Computer Science Department

Computer Science received seed funding from CWSEI in 2007 and began the efforts listed below in the Fall. The department moved to full funding starting in mid-2008. We currently have one full-time STLF, and recruiting efforts for a second STLF are in progress.

SEI Director: Paul Carter

STLFs: Ben Yu

Ray Lister (emeritus) – involved in CPSC 111 and APSC 160, CPSC 260

Beth Simon (emeritus) – involved in the early work of CPSC 101, 111, 121, 211, 213, and 221

Faculty: D. Acton, M. Allen, P. Belleville, G. Carenini, P. Carter, C. Conati, A. Condon, M. Dulat, K. Eiselt, M. Feeley, W. Heidrich, H. Hoos, E. Knorr, K. Leyton-Brown, J. Luk, D. Poole, G. Tsiknis, K. Voll, S. Wolfman

Post-doc: Frank Hutter, Gabriel Murray

Course Transformation

Course	Learning Goals	Assessments	Improved methods
CPSC 101: Connecting with Computer Science (Sept '07 start) Faculty: M. Allen, A. Condon, S. Wolfman, H. Hoos STLF: Ben Yu	Course-level goals: complete Topic-level goals: complete	Performed study of instructor & student perception and use of learning goals Developing assessment to probe student understanding of JavaScript code	Use clicker questions in class Developed broad set of clicker questions
CPSC 111: Introduction to Computation (Sept '07 start) Faculty: K. Eiselt, C. Conati, W. Heidrich, J. Luk STLF: Ray Lister	Course-level goals: complete Topic-level goals: complete	Attitudinal survey revised and administered at start and end of term in all sections of summer and fall terms. Cognitive pre-test developed and administered at start of course. The same test was administered to students in APSC 160. Questions targeting specific learning goals have been included on exams. A lab checklist has been developed to track the kinds of problems that students run in to during labs.	
CPSC 121: Models of Computation (Sept '07 start) Faculty: S. Wolfman, P. Belleville STLF: Ben Yu	Learning goals have been further categorized to identify pre-class learning goals. Students are expected to achieve pre-class learning goals on their own in advance of the corresponding class.	Attitudinal surveys developed and administered in summer and fall terms. Student interviews conducted in summer and fall terms. Pre and post-tests developed and administered in fall term. MCQs developed for final exam that target specific learning goals.	Two-stage exam conducted in summer term. Results published in ICERI 2009 and further analysis to appear at SIGCSE 2010. Refined online quizzes used to assess pre-class learning goals on the basis of previous term's quiz results. Re-structured in-class problem solving activities to be based on progressive clicker questions with solo- and group-response format. Approximately 160 clicker questions developed and used in class. Continued work on labs to make them "open-ended" and driven by student exploration rather than closed-ended.

CPSC 211: Introduction to Software Development (Sept '07 start) Faculty: D. Poole, M. Dulat STLF: Ben Yu	Course-level goals: complete Topic-level goals: complete	Attitudinal survey developed and administered at start and end of both sections of fall term.	
CPSC 213: Introduction to Computer Systems (Sept '07 start) Faculty: G. Tsiknis STLF: Ben Yu	Course-level goals: complete Topic-level goals: complete	Pre and post-tests developed and administered during summer term.	Two-stage exam conducted in summer term. Results published in ICERI 2009 and further analysis to appear at SIGCSE 2010.
CPSC 221: Basic Algorithms and Data Structures (Sept '07 start) Faculty: K. Voll, E. Knorr STLF: Ben Yu	Course-level goals: complete Topic-level goals: complete	Post-test developed and administered at end of summer term. Attitudinal survey revised and administered at end of 2009 fall term.	Use JITT, in-class group problem solving and peer instruction, clickers or non-electronic clicker equivalents, and web-based quizzes to shift focus of courses to higher-level analysis and problem solving.
CPSC 304: Introduction to Relational Databases (Sept '09 start) Faculty: E. Knorr STLF: Ben Yu	Topic-level goals: draft	Attitudinal survey developed and administered at start and end of term. Pre and post-tests developed to assess change in learning. Student interviews conducted during fall term.	Clicker questions developed and used in fall offering of course. Two-stage exams conducted in both midterms of fall 2009 term.
CPSC 320: Intermediate Algorithms and Data Structures (Sept '09 start) Faculty: K. Voll		A test of expected prerequisite knowledge was developed and administered at the start of the term.	
CPSC 322: Artificial Intelligence (Summer '08 start) Faculty: G. Carenini, K. Leyton-Brown Post-doc: Frank Hutter STLF: Ben Yu	Course-level goals: complete Topic-level goals: complete	A large body of questions have been developed to be used as the core of future exams	A set of practice problems complete with solutions have been developed. Two new AI Space applets have been developed.
CPSC 404: Advanced Database Systems (Sept '09 start) Faculty: E. Knorr STLF: Ben Yu	Topic-level learning goals drafted	Attitudinal survey developed and administered at start and end of term.	
CPSC 422: Intelligent Systems (Sept '09 start) Faculty: C. Conati, K. Leyton-Brown Post-doc: Frank Hutter	Learning goals under development.		All assignments have been revised with respect to learning goals and two new assignments have been developed.
APSC 160: Introduction to Computation in Engineering Design (Sept '09 start) Faculty: P. Carter STLF: Ray Lister, Ben Yu	Topic-level goals: complete	Attitudinal survey developed and administered at start and end of term. Analysis pending. Surveys assessing impact of Peer Instruction conducted in week 4 and week 8 of term.	A series of approximately 30 screencasts have been developed that introduce students to basic concepts. Students are asked to study the screencasts before coming to class. Clicker questions have been developed to assess students' comprehension of the concepts presented in the screencasts. A series of in-class problem sets have been developed that allow students to further develop their understanding of the concepts learned in the screencasts.

Learning goals for core courses (CPSC 110, 111, 121, 210, 211, 213, 221, 310, 313, 320): A comprehensive set of learning goals (both course-level and topic-level) has been developed for all 1st and 2nd year core courses. Most of these courses use LGs regularly to some extent in class (e.g., many 111 instructors now show the LGs associated with each unit as they lecture on the unit). CPSC 313 also has rough draft LGs. Draft course-level learning goals for the new CPSC 110 and CPSC 210 have been completed.

CPSC 260: Object-Oriented Program Design: Don Acton and Ben Yu are investigating the correlation of student performance with different components of this course.

Attitudinal Surveys: Survey instruments have been developed for CPSC 101, 111, 221, 317, 320, 404, and APSC 160. These instruments will facilitate the tracking of students' attitudes about the curriculum, their interest in Computer Science, and their expectations throughout their undergraduate years.

Curriculum

Code communication in APSC 160, CPSC 111,CPSC 260: Exploring how students' ability to communicate about code changes during our core courses A style of question that involves explaining the purpose of code is used across several exams to see how and whether students progress in their ability to succinctly and abstractly describe the purpose of code fragments.

Research

- **PeerWise:** Conducted study of the use of PeerWise (an online collaborative multiple-choice question repository) by students in 2nd and 4th year courses in 2007/08. Surveyed students about how they use PeerWise and whether they feel submitting or answering questions helps them learn.
- **Self-theories:** Conducted a study in 2007/08 of impact of students' self-theories relating to learning and ability on their success and persistence in beginning programming courses.
- **Learning Goals:** Explicit use of learning goals in the classroom to aid student learning has been explored and is the subject of an article accepted for publication in the Journal of College Science Teaching. Explicit use of learning goals has also spread to the Computer Science and Engineering department at UC San Diego, home institution of our first STLF.
- **Just-in-time-teaching in APSC 160:** Instructor is developing screencasts to introduce basic content to students and working with the STLF to have the screencasts evaluated by APSC 160 students before the videos are presented to the entire class in 2009/10. A set of in-class problem sets has also been developed that will allow students to explore their understanding of more advanced content.
- **Just –in-time teaching in CPSC 121:** Instructor has identified a subset of learning goals called `pre-class` learning goals. These are goals that students are expected to meet before coming to class. On-line tests have been developed to assess student learning for those goals. A set of in-class problems have been developed that address more advanced learning goals. Comparative survey work indicates dramatic increases in percentages of students that use the textbook and find it useful to their learning.
- **Just-in-time-teaching in CPSC 221:** One instructor taught both sections in 2008/09 Winter term 2. Students in one section are seeing a JITT approach and the use of in-class activities involving peer instruction and discussion. Students in the other section are receiving more traditional instruction. Students in both sections are writing the same exams and completing the same homework assignments.
- **Parson's puzzles:** Conducted a study in 2007/08 of a new type of exam question for assessing similar skills to code writing questions. Results have been published in the proceedings of the Fourth International Computing Education Research Workshop.

Life Sciences Program

The Life Sciences Program (Depts. of Zoology, Botany, and Microbiology & Immunology) received funding from CWSEI in 2007 and began the efforts listed below in the Fall. We are currently testing survey tools in first year to measure development of expert attitudes; developing and testing an alternative form of tutorials in a large first year class; developing and testing attitudes toward the environment in ecology courses, testing student learning in natural selection using a concept inventory test, developing and applying a 4th year satisfaction survey, and aiding in the development of the upper level ecology courses.

SEI Director: G. Spiegelman

STLFs: J. Taylor, M. Hansen, H. Yurk (emeritus), T. Kelly (emeritus)

Faculty participating currently: First Year Surveys: W. Goodey, T. Kion, J. Klenz, K. Nomme, R. Redfield, G. Spiegelman, K. Smith **Evolution Concept Surveys (2008-09):** G. Bradfield, C. Brauner, W. Goodey, M. Hawkes, D. Irwin, C. Leander, R. Redfield, E. Taylor, J. Whitton **Ecological Attitude Survey (2008-09):** G. Bradfield, W. Goodey, D. Irwin, T. Sinclair, R. Turkington, M. Vellend **Upper Level Ecology Course Transformation:** D. Srivastava, G. Bradfield, J. Goheen, W. Goodey, R. Turkington, M. Vellend

Invention Activities: J. Taylor, K. Smith, G. Spiegelman

Skylight Affiliate: G. Birol

Students: Peter van Stolk

Course Transformation

Course	Learning Goals	Assessments	Improved methods
BIOL 111: Cell and Organismal Biology (Sept '07 - Sept '08) Faculty: K. Nomme, J. Klenz Skylight Liaison: G. Birol	Course-level goals: completed Topic-level goals: completed	Midterm student evaluations Focus groups Biology attitudinal survey Clicker questions	Case studies Group activities Vista reading quizzes Peer tutor support Intentional alignment of topics with student work and assessment
BIOL 112: Cell Biology (Sept '07 start) Faculty: G. Spiegelman, E. Gaynor, T. Kion STLF: Jared Taylor	Course-level goals: completed Topic-level goals: completed	End-of-term surveys Student interviews to assess problem solving abilities End-of-term assessment of learning and invention groups to assess transfer abilities Biology attitudinal survey	Developed and refined 8 invention activities for in class once per week. Just-in-Time Teaching incorporated with pre-class readings In-class writing assignments, iClickers End of week problems PeerWise used in all sections
BIOL 121: Ecology, Genetics and Evolution (Sept '07 –08) Faculty: C. Pollock, Teaching Team, A. O'Neill Skylight Liaison: G. Birol	Course-level goals: completed Topic-level goals: completed	Mapping of multi-section course outcomes onto assessments Biology attitudinal survey Meiosis concept inventory (in preparation)	Peer tutors Learning centre PeerWise used in some sections Writing project with Rosie Redfield, 2008/09
BIOL 201: Cell Biology II: Introduction to Biochemistry (Jan '08 – Sept '08) Faculty: W. Bingle, S. Chowrira, J. Richards STLF: Jared Taylor	Lecture -level goals: completed	Chemistry concept pre-test Focus group interviews Focus group follow-up survey (entire class) Biology attitudinal survey	Recommendations provided to faculty
BIOL 204: Vertebrate Structure and Function (Jan '08- May '08) Faculty: B. Milsom, A. O'Neill	Course-level goals: completed Topic-level goals: completed	Clicker questions Post test: Vista Reading/Content quizzes New study questions Midterm teaching evaluation	Improvement of group activities and discussions in class Revised course content and lecture materials incorporating real life examples Enhanced problem solving approach including comparisons

BIOL 304: Fundamentals of Ecology (Sept '09 start) Faculty: R. Turkington, J. Goheen, W. Goodey, M. Vellend, D. Srivastava STLF: Malin Hansen	Course-level goals: completed	Pre and post attitude and conceptual surveys were developed and used in the fall of 2009. Student interviews were conducted in the fall of 2009 to assess class activities and methods. Survey was developed and used in the fall of 2009 to assess class activities and methods.	iClickers were used. Pre-reading assignments were issued each week Small group discussions were incorporated as a classroom activity. Three mandatory field labs were implemented. Improvements and adjustments of the above activities are planned for the winter of 2010.
BIOL 306: Advanced Ecology (Sept '09 start) Faculty:, G. Bradfield, W. Goodey STLF: Malin Hansen	Course-level and topic-level goals: to be completed before the winter of 2010.		

Transformations in the following courses have been undertaken by individual faculty members (with advice provided by CWSEI-Life Science Departmental Director, George Spiegelman)

Microbiology 300: Microbial Ecology (Faculty: W. Mohn) – Course-level and topic-level learning goals completed, survey, in-class group problems, poster made by learning group, in-class and out-of-class student learning group problems, clickers.

Microbiology 409: Advanced Microbial Genetics (Faculty: S Hallam) – Course-level and topic-level learning goals completed, student survey, in-class workshops suing groups of students, clickers.

Curriculum

Evidence Based Approach to Curriculum Design:

- **4th year Biology Satisfaction Survey:** Evaluation of Student Satisfaction and Skills by Harald Yurk and Gülnur Birol provided evidence about student satisfaction and areas for improvement in the program.
- **Attitudinal Survey:** First year pre-post survey
- **Ecological Attitude Surveys:** Harald Yurk conducted surveys on ecological attitudes of students before and after ecology instruction and at different program levels 1st, 3rd, and 4th year, and grad students. The survey use was based on the learning goal that ecology education should build an informed citizenry which can be measured as an attitude change towards environmental issues.
- **Chemistry Concepts:** Jared Taylor conducted a review of UBC biology courses to determine the required chemistry knowledge. As a starting point, the required courses for the Cell Biology and Genetics (CB&G) program were analyzed to determine the relevant chemistry content. This was followed by a general survey of other UBC biology courses. The report provided important insight into decisions regarding the chemistry content.
- **Concept Tests:** Investigating Conceptual Understanding of Natural Selection: Harald Yurk has been assessing conceptual understanding of natural selection in 1st and 3rd year students before and after instruction, using a multiple choice survey (Conceptual Inventory of Natural Selection, CINS, developed at San Diego State University). The CINS measures the presence and absence of the seven key principles of natural selection plus three other concepts that are related to natural selection but are not considered key concepts, such as speciation. Harald also used another short answer instrument in BIOL 336 to test for common misconceptions about natural selection.
- **UBC PAIR data**
- **Focus Group Interviews:** e.g. BIOL 111, BIOL 121, BIOL 201, 4th year students 2007-2009
- **Learning Objectives:** At present 16 out of 51 biology courses (200 level and up) have topic level learning objectives, some of which were developed by faculty members only and some other with the help of STLFs. In addition, all first year biology lecture courses have topic level learning objectives. These objectives are helpful to guide the work of discipline specific committees in identifying the depth and breadth of concepts.

Organizational Planning:

- Biology Program curriculum working group has proposed extensive changes to the program. G. Birol is on the committee with faculty from Botany and Zoology.
- Established a methodology for developing learning objectives (e.g. Angie O'Neill's work within the scope of BIOL 204 resulted in development of 3rd year physiology courses' learning outcomes with Trish Schulte and Agnes Lacombe)
- Developed a comprehensive project plan for the new upper level ecology courses led by Diana Srivastava with the help of Harald Yurk 2007/2008.

Research

CWSEI funded:

- **Learning Objectives:** Jared Taylor in collaboration with Beth Simon, STLF in Computer Science, conducted a study of student and faculty perceptions of the usefulness of learning goals. Their paper on this work is accepted for publication in the Journal of College Science Teaching.
- **Invention Activities:** Jared Taylor, George Spiegelman and Karen Smith are conducting a study of the effectiveness of invention activities and learning group activities in developing students' reasoning/problem solving skills and ability to transfer knowledge to novel situations.
- **Biology Attitudinal Survey:** Gülnur Birol administered the Biology attitudinal survey in all sections of BIOL 111, 112, 121 classes this year. . Survey has been used for two years running. Two manuscripts are in preparation one in collaboration with the Colorado group and one that Gulnur Birol, Malin Hansen and Kathy Nomme are working on that compares student attitudes in first and third year courses.
- **Student Satisfaction Survey:** Harald Yurk and Gülnur Birol investigated student satisfaction within the biology program. In April 09, 2009, student responses were collected in fourteen forth year biology courses. The analysis of the data is completed. As part of the project, we are planning to conduct surveys with potential employers of life science graduates to assess needs of employers with regard to the biology curriculum and general scientific skill sets. A special assistant has been hired for this latter project.
- **Writing Assignment Study:** Rosie Redfield and Tamara Kelly conducted a study on the effect of different types of assignments on student's writing and clarity of thought January – April 2008.

Spin-off projects with funding from other resources (e.g. TLEF, Skylight, Faculty/Graduate Student Teaching Certificate Program) in addition to CWSEI funding:

- **Course Curriculum Mapping in a Multi Section Course:** Angie O'Neill, Gülnur Birol and Carol Pollock have submitted a paper on the teaching and assessment of learning outcomes in a multi-section first year biology course.
- **Non-majors Biology Course Development:** Kathy Nomme and Gülnur Birol are conducting a study on student attitudes and beliefs towards biological sciences in a non-majors first year biology course using focus group interviews, midterm evaluations and attitudinal survey data.
- **Study Habits of Students in a 2nd year Biology Course:** Gülnur Birol, Lacey Samuels, Ellen Rosenberg and Joanne Nakonechny are conducting a study on students' study habits in BIOL 200 using both quantitative and qualitative data collected over a period of three years.
- **Questions for Biology:** Two Skylight grants were obtained to begin developing concept questions for first year Biology courses using material collected in BIOL 112 and BIOL 121. People involved are Jared Taylor, Gulnur Birol, Leah MacFadyen, George Spiegelman. Karen Smith, Tracy Kion, Carol Pollock, Angie O'Neill, Pam Kalas, Carol Pollock and Jennifer Klenz.

Other

- **BIOL 310: September - December 2008** Leticia Aviles and Harald Yurk conducted a study on the usefulness of group discussions in class through in-class observations and focus groups.
- **MICB 202: January – April 2008:** Yiannis Himaras did a MICB 448 project under the supervision of Tracy Kion and Gülnur Birol to conduct an exploratory project to investigate student learning in MICB 202.

Chemistry Department

The Chemistry CWSEI program started in 2008 and has hired a Science Teaching and Learning Fellow, Jennifer Duis. The Chemistry CWSEI program is presently concentrating on evaluation and redesign of the CHEM 123 lab – Physical and Organic Chemistry. The First Year Assessment sub-committee of the Chemistry Lab Committee is overseeing this project. The sub-committee members are: Laurel Schafer (chair), Guillaume Bussiere, Brian Cliff, Sophia Nussbaum, John Sherman, Jackie Stewart, Robin Stoodley, and Mark Thachuk. In conjunction with these efforts, undergraduate laboratory revitalization for years 2 - 4 is ongoing in the department.

Skylight Affiliate Jackie Stewart has been involved with the CWSEI since the start of the overall initiative in 2007 and has been doing substantial redesign of CHEM 233 Organic Chemistry for the Biological Sciences and working with the teaching teams in CHEM 121 and 202 to improve learning in those courses (independently funded by the department and TLEF).

In addition to CWSEI teaching initiatives, the department has undergone an independently funded external review of our 1st year chemistry program. Also, Mike Wolf, Derek Gates and Jackie Stewart have developed improved course support materials for CHEM 121 (tailored in-house textbook, homework sets, power point notes for instructors, etc.) independently supported by TLEF and Skylight. Additionally, seven interactive online tutorials have been developed and implemented over the past eight years to complement existing Chem 121 lab experiments as part of an ongoing co-operative between Sophia Nussbaum and the ChemCollective of Carnegie Mellon University. Recent funding from Skylight was used to develop yet another interactive tutorial and refine two existing tutorials with Carnegie Mellon.

SEI Director: Laurel Schafer

STLF: Jennifer Duis

Faculty: B. Cliff, G. Dake, N. Dryden, S. Nussbaum, L. Schafer, J. Sherman, R. Stoodley, and M. Thachuck

Skylight Affiliate: Jackie Stewart

Visiting Scholar: Pam Wolff

Students: Aalia Sachedina, James Zhou

Course Transformation

Course	Learning Goals	Assessments	Improved methods
CHEM 121: Structural Chemistry, with Application to Chemistry of the Elements (Lab component)(Oct '08 start) Faculty: S. Nussbaum STLF: Jennifer Duis	Course-level goals: Outline from CHEM 123, focus on transferable skill acquisition Experiment-level goals: process for development established Course-level outline and experiment-level development process appropriate for the entire lab program	Development and implementation of end-of-term technique assessments o Year 1: TA visual assessment of technique with provided guide o Year 2: Visual assessment guide refined and technique questions added to the end-of-term quiz	Alterations made to increase alignment with 1st-year lab goals o Marks re-allocated to increase emphasis on maintaining a lab notebook o Addition of carbonless copy paper to emphasize taking clear observations and data *during* completion of experiments
CHEM 123: Physical and Organic Chemistry (Lab component) (July '08 start) Faculty: S. Nussbaum, L. Schafer STLF: Jennifer Duis Skylight: Jackie Stewart	Course-level goals: working version, inspired by Rice University's interdisciplinary science lab learning objectives, approved by Chemistry Lab Committee Experiment-level goals: (developed from existing course materials) 4 of 4 experiments complete and approved by Chemistry Lab Committee	Chemistry background and demographics survey developed and given 3 Terms Attitudes survey (C-LASS CHEM) given 3 Terms Lab skills survey (written) developed & given 3 Terms Hands-on lab skills assessment implemented and under refinement for 2nd iteration Assessments of experiment specific learning goal achievement (surveys, observations, interviews) o 2nd round of refinement, validation, and implementation underway	Learning Goals incorporated into lab manual Alterations made to increase alignment with learning goals o Marks re-allocated to increase emphasis on maintaining a lab notebook o Addition of carbonless copy paper to emphasize taking clear observations and data *during* completion of experiments

- **CHEM 113, 121, 415, 425, 449:** Attitudes survey (C-LASS CHEM) administered Spring '09 (CHEM 113 & 121 also participated in the written Lab Skills Survey)
- **CHEM 425/448:** Engaging students in cutting edge chemical education research, report writing, and presentations.

Curriculum

- As CHEM 121/123 is in many ways a service course, identify interdisciplinary science lab skills that other science streams consider to be important and/or are expecting students to get from 1st year chemistry to improve "service".
- Survey Co-op employers to aid in determining impact on upper level laboratory revitalization.
- Modification of course curriculum for CHEM 415/425 approved by Chemistry Department to expand research opportunities to chemistry majors.

TA Development

The second round of modified TA training was implemented by Anka Lekhi and Sophia Nussbaum, with support from the TA Training Program through the Provost and Vice-President Academic Office and the Chemistry Department.

Research

Attitudinal Survey: C-LASS CHEM given in multiple courses, statistical comparisons between UBC and CU-Boulder.
CHEM 123 Lab Learning Goals: Assess students' achievement of lab learning goals.
1st Year Practical Lab Skills: Compare students' achievement of practical lab skills as determined by written vs. hands-on assessment
CHEM 233 Learning Objectives Alignment Study: Investigating students' perceptions of the alignment between learning objectives and assessment, probing their ability to judge cognitive complexity of learning objectives, assessment items, and study tactics.
Chemistry Concept Diagnostic Tests: Propose administration and validation of an existing chemistry concept test to first year chemistry students.

Other

Presentations at national/international meetings: 237th American Chemical Society National Meeting, 92nd Canadian Chemistry Conference, Improving University Teaching 34th International Meeting.

Mathematics Department

Starting in 2008, the UBC Mathematics Department is participating in the Carl Wieman Science Education Initiative (CWSEI) to improve undergraduate science education. Currently projects are concentrated in two areas:

The first area is computing and computer labs in Math 152, Math 257, Mech 221 (Math 256), Mech 222 (Math 253) and Math 307. These courses have all recently introduced computing as an intrinsic part of the course. The Math CWSEI will help in the creation of tutorials and lab materials, assist in integrating the computational component into the course material and developing testing methods, and assess the effectiveness of the computational component.

The second area is support for the workshops and the basic skills test in Math 180/184. The Math CWSEI will help to assess the effectiveness of the workshops and assist in the study of how well the basic skills test predicts success in the course.

In 2009-2010, the focus will be mainly on in-depth assessment of student activities and engagement, improvements to course materials based on data collected in the previous year, and better coordination of workshops and labs with course lectures.

In addition to the existing projects, the Math CWSEI will also help in developing and implementing assessment strategies to measure students' attitudes toward computer labs in Math 102 and Math 103, as well as the effectiveness of a new online homework system in use in Math 104 and Math 105. The Math CWSEI will also provide resources to help with the course transformation currently underway in Math 318.

SEI Director: Stephanie van Willigenburg

STLF: Costanza Piccolo, Warren Code, Paul Ottaway (emeritus)

Faculty: R. Anstee, R. Froese, R. Gupta, L. Keshet, P. Loewen, M. MacLean, A. Peirce, G. Slade, V. Vatsal, B. Wetton

TA's, Postdocs, & Lecturers: M. Berube, R. Liang

Course Transformation

Course	Learning Goals	Assessments	Improved methods
MATH 180/184: Differential Calculus (Workshop component) (Sept '08 start) Faculty: R. Gupta STLF: Costanza Piccolo	Course-level goals: drafts completed Workshop goals: complete	Student surveys on workshop activities Weekly quizzes Midterm and end-of-term survey	Workshops 1-12 completed: added workshop-level learning goals and list of required basic skills; created new workshop problems with subject-specific applications.
MATH 152: Linear Systems (Computer Labs component) (Sept '08 start) Faculty: B. Wetton STLF: Warren Code	Topic-level goals: first draft completed	Pre- and post-tests on linear systems End-of-term student survey on computer labs	Labs rewritten to tie in more closely with the course material
Math 253 (Mech 222): Multivariable Calculus (Computer Labs component) (Sept '08 start) Faculty: P. Loewen STLF: Warren Code TA: W. Thompson	Course-level goals: first draft completed		All labs have been revised to tie in more closely with the course material
Math 256 (Mech 221): Differential Equations (Computer Labs component) (Sept '08 start) Faculty: B. Wetton STLF: Paul Ottaway TA: W. Thompson	Learning goals: first draft completed. Revisions started	Student observation during lab periods. Interviews and attitude survey given at the end of term and compared to last year's results. Targeted questions designed for the final exams and used to assess learning in the lab sessions.	All labs are being edited based on feedback from last year's offering as well as input from the STLF and the lab TA. Final exam questions have been designed based on the mutually agreed upon learning goals.

Math 257/316: Partial Differential Equations (Computer Labs component) (Sept '08 start) Faculty: A. Peirce STLF: Costanza Piccolo	Topic-level goals: first draft started		5 online tutorials completed: Basic EXCEL; Fourier series of a function; Fourier series for the 1D heat equation; solve differential equations numerically: the heat equation; differential equations numerically: the wave equation
Math 307: Applied Linear Algebra (Computer Labs component) (Sept '08 start) Faculty: R. Froese STLF: Costanza Piccolo	Course-level goal: first draft completed Topic-level goals: first draft completed	Student surveys Pre-reading quizzes Special homework assignments with extensive use of Matlab	Lecture Notes in process of being updated

Statistics Department

The Statistics CWSEI program started in 2007 and has concentrated on the transformation of STAT 200 – *Elementary Statistics for Applications.*

SEI Director: Bruce Dunham

Faculty: B. Dunham, N. Heckman, E. Yu

Course Transformation

Course	Learning Goals	Assessments	Improved methods
STAT 200: Elementary Statistics for Applications (2007 start) Faculty: B. Dunham, E. Yu, N. Heckman	Course-level goals: complete Topic-level goals: complete	Compared the effectiveness of two different types of lab in helping students understand sampling distributions On-going study to assess what students retain from STAT 200 several months after they have completed the course	Extensive use of clickers to stimulate class discussion More assigned homework Labs improved to focus on key concepts that learners typically find difficult

STAT 100 – Statistical Thinking: A rather novel introductory course in the discipline, STAT 100 involves six "modules", each on a different theme in statistical science accessible to learners who have not had previous exposure to the discipline. The course was offered for the second time in 2009, and after the first run it was decided by the teaching team (of five instructors) that clickers would be used in future to help improve student engagement. This idea was implemented, and in-house training and support was offered by Eugenia Yu. In total about half of the faculty in the department now have used clickers in their teaching.

STAT 335 – Statistics in Quality Assurance: This course was revived in 2008, having not been offered for some years. The new incarnation of the course was enhanced using CWSEI methodology. In particular:

(a) Learning outcomes were devised.
(b) Detailed books of notes covering the material were created and posted online.
(c) In-class activities were used in the lectures, during which the students would work in groups on an activity, aided by the support of the instructor.
(d) Laboratory activities involving group work were used to illustrate concepts using computer applications.

STAT 447 – Time Series and Forecasting: Having been twice previously offered as a "topics" course, this "new" addition to the department's upper-level offerings was improved this year by instruction that placed less emphasis on the traditional lecture. In a similar fashion to STAT 335, students worked in groups on activities within the classes, with instructor support. Often concepts were introduced informally in an activity before a more formal presentation of the idea was provided in a short lecture. Solutions to an in-class activity were posted shortly after the class for timely feedback. As measured by student performance and satisfaction, this change in instruction style has been successful.

Research

Student Attitude Surveys

Near the start and end of STAT 200, students are expected to complete an on-line attitude survey. The survey attempts to gauge how students perceive the relevance of the discipline, their enthusiasm for studying it and how they go about learning in Statistics. A robust method of analyzing the resulting data has been devised that uses a re-sampling method known as bootstrapping. The approach has been encoded in R (a freely available package for statistical computing), and a user guide created. Anyone wishing to implement our method on their own data should contact Dr. Bruce Dunham at b.dunham@stat.ubc.ca. A description of the method, and our findings from the analysis of our data, are being written up for future publication.