Summary of CWSEI Activities in Physics and Astronomy – April 2012

Course	Learning Goals/Assessments	Improved Methods
ASTR 310: Exploring the Universe I: The Solar System (Summer '08 start) Faculty: B. Gladman,, H. Richer STLF: Peter Newbury Grad Students: M. Milkeraitis, S. Lawler, M. Gendre, S. Vafaei, J. Emmel	• Course-level goals: complete • Topic-level goals: complete • Improved midterm and final exam questions based on assessing learning goals.	• Created 6 activities for tutorials including guidelines for TAs • Using MasteringAstronomy for Just-in-time teaching (Gladman) • Aligning lecture material with learning goals • Peer instruction using clickers and Lecture-Tutorial workbooks (Richer)
ASTR 311: Exploring the Universe II: Stars and Galaxies (Summer '09 start) Faculty: I. Stairs, J. Heyl, L. Van Waerbeke, J. Zibin. STLF: Peter Newbury Grad Students: M. Gendre, T. Vernstrom	• Course-level goals: complete • Topic-level goals: complete • Pre/post concept test for tutorial activities • Improved final exam based on learning goals. • Light and Spectroscopy Concept Inventory (LSCI) pre- and posttest (Stairs) • Pre-, Post-testing with the Test of Astronomy Standards (TOAST).	• Developed seven 50-minute activities for tutorial sessions including guidelines for TAs • peer-instruction with clickers, lecture-tutorial workbook, in-class worksheets (Stairs).
PHYS 100: Introductory Physics (Sept '07 start) Faculty: G. Rieger, A. Kotlicki STLF: Ido Roll (current), Jim Carolan, Louis Deslauriers Grad Student: S. Martinuk, M. Sitwell	• Course-level goals: complete • Topic-level goals: complete • Lab goals revised towards skills development • Exams aligned with learning goals • Surveys: CLASS, Problem-Solving Survey, Course and Lab Survey • Lab diagnostic & interviews • Improved lab skills assessment • Study comparing different forms of invention activities and support for group work. • Study on impact of learning goals on student self assessment of understanding.	• Pre-reading assignments, In-class worksheets and peer instruction with clickers • Tutorials dedicated to problem solving based on context-rich problems • Revised labs with homework: students do experiments prior to coming to the lab for data analysis. Labs and homework build on each other from week to week.
PHYS 101: Energy and Waves (Sept '07 start) Faculty: F. Bates, G. Rieger, C. Heiner, J. Iqbal, A. Mackay STLF: Cynthia Heiner (current), Peter Newbury	• Course-level goals: complete • Topic-level goals: complete • Exams aligned with learning goals • CLASS survey, Math diagnostic • End-of-term survey targeting students approach to and learning from pre-readings, clickers, and in-class worksheets.	• Pre-reading assignments, In-class worksheets and peer instruction with clickers for the entire term • Developed new lab experiments on measurement/uncertainty and interference.
PHYS 102: Electricity, Light and Radiation (Sept '09 start) Faculty: F. Bates, G. Rieger STLF: Peter Newbury, Louis Deslauriers	• Course-level goals: complete • Topic-level goals: complete • Exams aligned with learning goals • CLASS survey, BEMA survey	• Pre-reading assignments, In-class worksheets and peer instruction with clickers • Revised lab experiments and pre-lab exercises using PhET simulations
PHYS 107 & 109: Physics 1 lab and Intro to Experimental Physics (Sept '07 start) Faculty: D. Bonn STLF: James Day, Ido Roll Grad Student: N. Holmes	• Course-level goals: complete • Topic-level goals: complete • Developed & validated physics lab pre-post diagnostic. • End-of-term survey • Study on the impact of structure in invention activities. • Study on how students practice their scientific reasoning skills during invention activities and whether these skills improve over the term • Statistics diagnostics added to gauge cumulative effect of statefocused invention activities.	• 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. • Invention activities and associated instruction now delivered by computer (the Invention • Support Environment).
PHYS 107: Enriched Physics I (Sept '10 start) Faculty: I. Affleck STLF: Jim Carolan	• Course-level goals: complete • Topic-level goals: under development • Pre/post concept surveys • Student post course interviews • Pre and post problem solving skills surveys	• Pre-reading assignments with online quizzes • Peer instruction with clickers • In-class worksheet activities under continuing development • Weekly tutorials developed
PHYS 153: Elements of Physics (Sept '10 start) Faculty: S. Burke, M. Hasinoff, A. Kotlicki, D. Witt STLF: Cynthia Heiner (current), Louis Deslauriers	• Course-level goals: complete • Topic-level goals: complete (term1), under development (term2) • Exams aligned with learning goals • Surveys: CLASS, BEMA, midterm surveys • Compared student performance on exams in transformed course vs. earlier traditional version.	• Bank of clicker questions • In-class activities for entire term • Pre-reading assignments with online quizzes for the entire term. • Peer instruction with clickers

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PHYS 153: Elements of Physics (LAB) (Nov' 11 start) Faculty: J. Young, M. Hasinoff, B. McCutcheon, D. Witt, B. Unruh, E. Koster. STLF: James Day	• Course-level goals: complete • Two final lab exams created, aligned with course-level learning goals.	• Three tutorials (i.e. use of spreadsheet, basic stats, uncertainty analysis, and linear regression). • Rubrics created for individual labs. • Brief pre-lab exercises created. • Implementation of online post-lab submission.
PHYS 200: Relativity and Quanta (Sept '08 start) Faculty: M. Van Raamsdonk STLF: Louis Deslauriers	• Course-level goals: complete • Topic-level goals: complete • Analyze midterm and final exam questions • Midterm & end-of-term survey	• Weekly interactive tutorials developed • Improved clicker questions
PHYS 250: Introduction to Modern Physics (Jan '09 start) Faculty: L. Deslauriers, C. Wieman STLF: Louis Deslauriers	• Course-level goals: complete • Topic-level goals: complete • Development of an extended Quantum Mechanical Conceptual Survey; Measuring long term retention of quantum concepts • Analyze midterm and final exam questions • Dual individual/group exam • Midterm & end-of-term survey	• Weekly tutorials developed • Bank of clicker questions • In-class activities for entire term • Measurement of long term retention for the quantum part of course • Intervention with lower performing students
PHYS 304: Quantum Mechanics (Jan '10 start) Faculty: K. Madison STLF: Louis Deslauriers	• Course and topic-level goals: 80% complete • Measured effect of BONUS clicker questions on student engagement during voting period. • Compared student performance to previous terms. • Measured student engagement in general. Compared it to other courses the eng phys cohorts were taking at the same time.	• Creating a bank of clicker questions • Designing in- class activities for every lecture • Improved engagement during clicker questions by adding BONUS questions.
PHYS 315: Physics of Materials (Sept '11 start) Faculty: V. Hinkov STLF: James Day	• Course-level goals: complete • Topic-level goals: complete • Homework assignments aligned to learning goals.	• New clicker questions & older clicker questions improved. • Training on peer instruction with clickers. • In-class group activities • Implementation of pre-reading. • One lecture video taped so that instructor can associate objective feedback on style with actual footage. • Formative midterm and year-end feedback form created.
PHYS 401: Electromagnetic Theory (Sept '11 start) Faculty: D. Bryman STLF: Peter Newbury	• Course-level goals: draft • Topic-level goals: drafted for 90% of the course	• In-class worksheets, designed to explore content and practice expert problem-solving skills. • Targeted pre-reading assignment and quiz for every class. • Focus on moving from instructor-centred to student-centred instruction.
PHYS 408: Optics (Sept '09 start) Faculty: D. Jones STLF: Louis Deslauriers	• Course-level goals: complete • Topic-level goals: complete • Analyze midterm and final exam questions • Development of Optics Conceptual Survey • Compared student performance in transformed course to previous terms • Measured student engagement. Compared it to other courses the eng phys cohorts were taking at the same time.	• Created a bank of clicker questions • In-class activities for entire term • Developed a remedial tutorial for students lacking pre-requisite in signal processing (Fourier Transforms)
PHYS 450: Quantum Mechanics (Jan '09 start) Faculty: J. Folk STLF: Louis Deslauriers	• Course and topic –level learning goals: 95% complete • Analyze midterm questions • 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 & 270 STLF: Jim Carolan	• Mechanics diagnostic surveys	
TA Development Faculty: Doug Bonn Grad students (current): Natasha Holmes, Jonathan Massey- Allard, Sandra Myers	• Learning Goals: Practical teaching skills, Buy-in to evidence-based and learner-centered pedagogies • Formative Evaluations • Surveys	• Course specific training • Mentorship program • TA support structure (community of practice) • Long-term training opportunities including PD for senior-level Tas • PHYS 520 course: Teaching Techniques in Physics and Astronomy.