Supplemental Materials 2 – Articles List

Teaching practice	Discipline	Journal	Year	Lead Author	Article Title
Analogy	Physics	Physical Review Special Topics-Physics Education Research	2007	Podolefsky	Analogical scaffolding and the learning of abstract ideas in physics: Empirical Studies
Analogy	Physics	Physical Review Special Topics-Physics Education Research	2007	Podolefsky	Analogical scaffolding and the learning of abstract ideas in physics: An example from electromagnetic waves
Argument-driven inquiry	Chemistry	*International Journal of Science Education*	2014	Grooms	Comparing the effectiveness of verification and inquiry laboratories in supporting undergraduate science students in constructing arguments around socioscientific issues
Argument-driven inquiry	Chemistry	*Journal of Chemical Education*	2013	Walker	Argument-Driven Inquiry - Using the laboratory to improve undergraduates' science writing skills through meaningful science writing, peer-review, and revision
Argument-driven inquiry	Chemistry	*Journal of College Science Teaching*	2012	Walker	Argument-Driven Inquiry in undergraduate chemistry labs: The Impact on students' conceptual understanding, argument skills, and attitudes toward science
Case-based Learning	Biology	*Biochemistry and molecular biology education*	2007	Rybarczyk	A case - comprehension of cellular respiration concepts
Challenge-Based learning	Engineering	*Journal of Engineering Education*	2009	Cordray	A Research Synthesis of the Effectiveness, Replicability, and Generality of the VaNTH Challenge in Bioengineering
Challenge-Based learning	Physics	*New Directions for teaching and Learning*	2006	Klein	The effect of a bioengineering unit across high school contexts: An initial investigation in urban, suburban, and rural domains.
Challenge-Based learning/Clickers	Engineering	*Journal of Engineering Education*	2006	Roselli	Effectiveness of Challenge-Based Instruction in Biomechanics
Classroom dialogue/ Discussion/ Writing	Physics	*Science Education*	2002	Naiz	Arguments, contradictions, resistances, and conceptual change in students' understanding of atomic structure

Clickers	Biology	*CBE- Life Sciences Education*	2007	Armstrong	Cooperative learning in industrial-sized biology classes
Clickers	Physics	*Science*	2011	Deslauriers	Improved learning in a large-enrollment physics class.
Collaborative Learning	Collaborative Learning	*Journal of College Student Development*	2002	Cabrera	Collaborative learning: Its impact on college students' development and diversity
Collaborative Learning	Engineering	*Research in higher education*	2001	Cabrera	Developing performance indicators for assessing classroom teaching practices and student learning
Collaborative Learning		*Science Education*	2000	Rivard	The effect of talk and writing on learning science: An exploratory study
Collaborative Learning		*Review of Education Research*	1999	Springer	Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis.
Collaborative Learning	Engineering	*Journal of Engineering Education*	2011	Stump	Collaborative learning in engineering students: Gender and achievement.
Collaborative Learning	Biology	*Journal of Research in Science Teaching*	2007	Taraban	Effects of active and behaviors in high school biology.
Collaborative Learning/Demonstrations	Physics	*American Journal of Physics*	2006	Sorenson	The New Studio format for instruction of introductory physics
Computer simulations	Physics	*Physical Review Special Topics-Physics Education Research*	2005	Finkelstein	When learning about the real world is better done virtually: A study of substituting computer simulations for laboratory equipment.
Computer simulations	Chemistry	*Journal of Research in Science Teaching*	2009	Frailich	Enhancing students' understanding of the concept of chemical bonding by using activities provided on an interactive website
Computer simulations	Science	*Journal of Research in Science Teaching*	2011	Scalise	Student learning in science simulations: Design features that promote learning gains
Computer Simulations	Biology	*CBE- Life Sciences Education*	2007	McDaniel	Increased learning observed in redesigned introductory Biology course that employed web-enhanced, interactive pedagogy

Computer simulations/ Challenge-based learning	Engineering	*Journal of Engineering Education*	2003	Greenberg	Instructional module in fourier spectral analysis, based on principles of “how people learn”.
Computer Simulations/ Modeling	Chemistry	*Journal of Science Education and Technology*	2003	Steiff	Connected chemistry—incorporating interactive simulations into the chemistry classroom
Computer Simulation/ Student Inquiry	Geology	*Journal of Science Education and Technology*	2012	Lin	The Role of Computer Simulation in an Inquiry-Based Learning Environment: Reconstructing Geological Events as Geologists
Cooperative learning	Chemistry	*Research in Science Education*	2008	Acar	Effects of Cooperative Learning on Students' understanding of metallic bonding
Cooperative learning	Biology	*Journal of microbiology & biology education*	2013	Gasper	Engaging Students in Authentic Microbiology Research in an Introductory Biology Laboratory Course is Correlated with Gains in Student Understanding of the Nature of Authentic Research and Critical Thinking
Cooperative learning	Engineering	*Journal of Engineering Education*	2000	Haller	Dynamics of peer education in cooperative learning workgroups
Cooperative learning	Physics	*American Journal of Physics*	1992	Heller	Teaching problem solving through cooperative grouping. Part 1: Group versus individual problem solving
Cooperative learning	Engineering	*Journal of Engineering Education*	2012	Hsiung	The effectiveness of cooperative learning.
Cooperative learning	Biology	*Journal of Research in Science Teaching*	1996	Jensen	Changes in students’ understanding of evolution resulting from different curricular and instructional strategies
Cooperative learning	Biology	*BioScience*	2007	Nehm	Biology majors’ knowledge and misconceptions of natural selection.
Cooperative learning	Biology	*CBE- Life Sciences Education*	2009	Prezler	Replacing lecture with peer-led workshops improves student learning
Cooperative learning	Biology	*CBE- Life Sciences Education*	2008	Walker	A delicate balance: Integrating active learning into a large lecture course
Demonstrations	Chemistry	*Journal of Chemical Education*	1997	Bowen	Demonstration-Based Cooperative Testing in General Chemistry: A Broader Assessment-of-Learning Technique

Demonstrations	Physics	*American Journal of Physics*	2011	Chang	Integrating electrostatics with demonstrations and interactive teaching
Inquiry, Cooperative learning	Biology	*CBE- Life Sciences Education*	2011	Jensen	Effects of collaborative group composition and inquiry instruction on reasoning gains and achievement in undergraduate biology
Instructional Technology	Active Learning	*Journal of Science Education and Technology*	2007	Barak	Transforming an introductory programming course: from lectures to active learning via wireless laptops
Interactive engagement	Physics	Physics Education	2012	Adegoke	Impact of interactive engagement on reducing the gender gap in quantum physics learning outcomes among senior secondary students
Interactive engagement	Geology	Papers in the Earth and Atmospheric Sciences	2009	Arthurs	Coupled collaborative in-class activities and individual follow-up homework promote interactive engagement and improve student learning outcomes in a college level Environmental Geology course
Interactive Lecture	Physics	*Physical Review Special Topics-Physics Education Research*	2014	Cahill	Multi Year, multi-instructor evaluation of a large-class interactive-engagement curriculum
Interactive Lecture	Physics	*American Journal of Physics*	2014	Potter	Sixteen years of collaborative learning through active sense making in physics (CLASP) at UC Davis
Interactive Lecture	Physics	*Physical Review Special Topics-Physics Education Research*	2013	West	Variation of instructor-student interactions in an introductory interactive physics course
Interactive lecture demonstration/ Peer Instruction	Physics	*INTERNATIONAL CONFERENCE ON PHYSICS EDUCATION: ICPE -200*	2010	Sokoloff	Image Formation Interactive Lecture Demonstrations Using Personal Response Systems
Interactive lecture demonstration/Collaborative learning	Physics	*The Physics Teacher*	2002	Steinberg	PER-based reform at a multicultural institution
Interactive Lecture demonstrations	Physics	*American Journal of Physics*	2004	Crouch	Classroom demonstrations: Learning tools or entertainment?

Interactive Lecture demonstrations	Physics	*American Journal of Physics*	1999	Cummings	Evaluating innovation in studio physics
Interactive Lecture demonstrations	Physics	*Canadian Journal of Physics*	2009	Moll	The effect of interactive lecture experiments on student academic achievement and attitudes towards physics
Interactive Lecture/Just-in-Time Teaching	Biology	*CBE- Life Sciences Education*	2004	Marrs	Just-in-Time Teaching in Biology: Creating an active learner classroom using the internet.
Interactive Simulation/ Student Inquiry/Collaborative learning	Biology	*Journal of Computers in Mathematics and science Teaching*	2006	Zumbach	Learning Life Science: Design and development of a virtual molecular biology learning lab
Jigsaw	Chemistry	*Research in Science & Technology Education*	2008	Doymus	Teaching chemical bonding through jigsaw cooperative learning
Jigsaw	Physics	*Learning and Instruction*	2007	Hanze	Cooperative learning, motivational effects, and student characteristics: An experimental study comparing cooperative learning and direct instruction in 12th grade physics class
Jigsaw	Chemistry	*Journal of Science Education and Technology*	2013	Karacop	Effects of jigsaw cooperative learning and animation techniques on students' understanding of chemical bonding and their conceptions of the particulate nature of matter
Jigsaw	Chemistry	*Chemistry Education Research and Practice*	2012	Tarhan	Jigsaw cooperative learning: acid–base theories
Jigsaw	Biology	*Journal of College Science Teaching*	2007	Tessier	Small-Group Peer Teaching in an Introductory Biology Classroom
Jigsaw/Cooperative learning/ Argumentation	Geoscience	*Innovations in Higher Education*	2013	Kim	Effects of active learning on enhancing student critical thinking in an undergraduate general science course

JiTT	Statistics	*Teaching of Psychology*	2004	Benedict	Applying the Just-in-Time Teaching approach to teaching statistics
JiTT	Physics	*Physical Review Special Topics-Physics Education Research*	2010	Formica	Transforming common-sense beliefs into Newtonian thinking through Just-In-Time Teaching
JiTT	General Science	*Journal of Science Education and Technology*	2007	Guertin	Just-in-Time Teaching exercises to engage students in an introductory-level dinosaur course
JiTT	Biology	*CBE- Life Sciences Education*	2010	Moravec	Learn before lecture: a strategy that improves learning outcomes in a large introductory biology class.
Modeling	Biology	CBE- Life Sciences Education	2013	Batiza	The effects of the SUN Project on teacher knowledge and self-efficacy regarding biological energy transfer are significant and long lasting - results of a randomized control trial
Modeling	Physics	Physical Review Special Topics-Physics Education Research	2010	Brewe	Toward equity through participation in modeling instruction in introductory physics
Peer Instruction	Biology	*CBE- Life Sciences Education*	2008	Crossgrove	Using clickers in nonmajors-and majors-level biology courses: student opinion, learning, and long-term retention of course material.
Peer Instruction	Physics	*American Journal of Physics*	2001	Crouch	Peer instruction: Ten years of experience and results.
Peer Instruction		*Journal of Science Education and Technology*	2006	Fies	Classroom response systems: A review of the literature
Peer Instruction	Biology	*Science*	2011	Haak	Increased structure and active learning reduce the achievement gap in introductory biology
Peer Instruction	Biology	*CBE- Life Sciences Education*	2005	Knight	Teaching more by lecturing less
Peer Instruction	Physics	*American Journal of Physics*	2008	Lasry	Peer instruction: From Harvard to the two-year college
Peer Instruction	Biology	*Science*	2009	Smith	Why peer discussion improves student performance on in-class concept questions
Peer Instruction	Biology	*CBE- Life Sciences Education*	2009	Tanner	Talking to learn: why biology students should be talking in classrooms and how to make it happen

Peer Instruction/ Computer simulations	Physics	*Physics Education Research Conference*	2006	Keller	Assessing the effectiveness of a computer simulation in introductory undergraduate environments
Peer Instruction/ Just-in-Time Teaching	Physics	*The Physics Teacher*	2014	Lasry	Just in Time to Flip your Classroom
Peer Instruction/ Lecture demonstrations	Chemistry	*Chemistry Education Research and Practice*	2007	Ashkenazi	Using lecture demonstrations to promote the refinement of concepts: the case of teaching solvent miscibility.
Problem-based learning	Science	CBE- Life Sciences Education	2013	Klegeris	Improvement in generic problem-solving abilities of student by using tutor-less problem-based learning in a large classroom setting
Problem-based learning	Chemistry	*Journal of Chemical Education*	2012	Sandi-Urena	Effect of cooperative problem-based lab instruction on metacognition and problem-solving skills
Problem-based learning	Physics	*Research in Science & Technology Education*	2011	Tatar	The effectiveness of problem-based learning on teaching the first law of thermodynamics
Problem-based learning	Physics	*American Journal of Physics*	2004	van Kampen	Teaching a single physics module through Problem Based Learning in a lecture-based curriculum
Problem-based learning	Engineering	*Journal of Engineering Education*	2011	Yadav	Problem -b Electrical Engineering Course
Problem-based learning, think-pair-share, Clickers	Biology	*CBE-Life Sciences Education*	2009	Armbruster	Active Learning and Student-centered Pedagogy Improve Student Attitudes and Performance in Introductory Biology
Project-based Learning	Chemistry	*Science Education*	2005	Barak	Enhancing undergraduate students' chemistry understanding through project-based learning in an IT environment
Project-based Learning	Engineering	*Science*	2007	Fortenberry	Engineering Education research aids instruction
Project-based Learning	Engineering	*Journal of Engineering Education*	2004	Hersam	Implementation of interdisciplinary group learning and peer assessment in a nanotechnology engineering course

Project-based Learning		*Educational Research and Evaluation*	2004	Lou	Enhancing Project-Based Learning through online between-group collaboration
Project-based Learning	Specific Teaching Strategies	*Journal of Educational Research*	2008	Wilhelm	Project-Based Learning Environments: Challenging Preservice teachers to Act in the moment
Representations	Chemistry	*Journal of Chemical Education*	2009	Mocerino	Emphasizing multiple levels of representation to enhance students' understandings of the changes occurring during chemical reactions
Representations	Biology	CBE- Life Sciences Education	2013	Host	Student learning about biomolecular self-assembly using two different external resources
Science Writing Heuristic	Science	*Research in Science Education*	2011	Cavagnetto	Negotiating the inquiry question - A comparison of whole class and small group strategies in grade five science classrooms
Science Writing Heuristic	Biology	*International Journal of Science Education*	2013	Cronje	Using the SWH to improve undergraduate writing in biology
Science Writing Heuristic	Chemistry	*Chemistry Education Research and Practice*	2012	Kingir	How does the science writing heuristic approach affect students' performances of different academic achievement levels? A case for high school chemistry.
Science Writing Heuristic	Chemistry	*Journal of Chemical Education*	2007	Rudd	Using the Science Writing Heuristic To Improve Students' Understanding of General Equilibrium
Science Writing Heuristic	Chemistry	*Chemistry Education Research and Practice*	2008	Schroeder	Implementing POGIL in the lecture and the Science Writing Heuristic in the laboratory—student perceptions and performance in undergraduate organic chemistry.
Science Writing Heuristic/Cooperative Learning		*Journal of Research in Science Teaching*	1999	Keys	Using the Science Writing Heuristic as a tool for learning from laboratory investigations in secondary science
Socratic dialogue, Peer instruction	Biology	*CBE- Life Sciences Education*	2007	Freeman	Prescribed active learning increases performance in introductory biology
Student inquiry		*Journal of Science Teacher Education*	2002	Anderson	Reforming science teaching: What research says about inquiry

Student inquiry	Chemistry	*Analysis*	2007	Farrell	A Guided-Inquiry General Chemistry Course
Student inquiry	Biology	*The American Biology Teacher*	2006	Lord	Moving from didactic to inquiry-based instruction in a science laboratory
Student inquiry	Biology	*Advances in physiology education*	2012	Luckie	Less teaching, more learning: 10-yr study supports increasing student learning through less coverage and more inquiry
Student inquiry	Geology	*Journal of Geoscience Education*	2003	McConnell	Assessment and active learning strategies for introductory geology courses
Student inquiry		*Journal of Research in Science Teaching*	2010	Minner	Inquiry – based science instruction – what is it and does it matter? Results from a research synthesis years 1984 to 2002.
Student inquiry	Biology	*The American Biology Teacher*	2006	Orkwiszewski	Didactic to Inquiry-Based Instruction
Student inquiry	Biology	*BioScience*	2002	Udovic	Workshop biology: demonstrating the effectiveness of active learning in an introductory biology course
Studio course	Physics	*Research-based reform of university physics*	2007	Beichner	The student-centered activities for large enrollment undergraduate programs (SCALE-UP) project
Studio course	Physics	*American Journal of Physics*	2011	Hoellwarth	The implications of a robust curriculum in introductory mechanics
Studio course	Physics	*American Journal of Physics*	2005	Hoellwarth	A direct comparison of conceptual learning and problem solving ability in traditional and studio style classrooms
Studio course	Physics	*American Journal of Physics*	2006	Sorensen	The new studio format for instruction of introductory physics
Think-Pair-share	Chemistry	*Journal of Chemical Education*	2000	Hagen	Cooperative learning in Organic II. Increased retention on a commuter campus.
Think-Pair-share	Biology	*CBE- Life Sciences Education*	2013	Hester	Integrating quantitative thinking into an introductory biology course improves students' mathematica reasoning in biological contexts
Think-Pair-share, peer instruction, tutorials	Physics	*Physical Review Special Topics-Physics Education Research*	2014	Rudolph	Introduction of interactive learning into French university physics classrooms

Wait time	Special Education	*Teacher Education and Special Education*	1987	Ruhl	Using the pause procedure to enhance lecture recall