Recommended Readings – Many of these books and other resources are available at the STEM Station or the Center For Teaching and Learning. Most of the provided descriptions were prepared by the various publishers.

Website Articles and White Papers

Engage! Increasing Faculty-Student Interactions
Becky Wai-Ling Packard and Susan Staffin Metz.
This must-read guide shows how micro moments of interaction lead to mega results with its easy-to-use tips for enhancing spoken and written communication with students.
http://www.engageengineering.org/

Framework for Evaluating Impacts of Informal Science Education Projects
National Science Foundation

The Intellectual Development of Science and Engineering Students, Part 2: Teaching to Promote Growth
Richard M. Felder and Rebecca Brent.
This article is a good resource for those who want to dig a little deeper and connect educational theory to classroom practice, while still focusing on understandable and practical course strategies.

Linking Evidence and Promising Practices in Science, Technology, Engineering, and Mathematics Undergraduate Education: A Status Report for the National Academies National Research Council Board of Science Education
James Fairweather

Teaching for Retention in Science, Engineering, and Math Disciplines: A Guide for Faculty
Marie Kendall Brown, Chad Hershock, Cynthia J. Finelli and Chris O'Neal.
From creating a classroom climate supportive of learning to increasing inquiry learning, the strategies in this paper from the Center for Research on Learning and Teaching at University of Michigan offer practical advice to increase STEM retention.
http://www.crlt.umich.edu/gsis/P3_3.php

White Paper on Promising Practices in Undergraduate STEM Education
Jeffrey E. Froyd.
Eight, evidence-based promising practices for lower division STEM courses and programs have high standards for adaptability and student learning.
Books

Achieving High Educational Standards for All: Conference Summary
This volume summarizes a range of scientific perspectives on the important goal of achieving high educational standards for all students. Based on a conference held at the request of the U.S. Department of Education, it addresses three questions: What progress has been made in advancing the education of minority and disadvantaged students since the historic Brown v. Board of Education decision nearly 50 years ago? What does research say about the reasons of successes and failures? What are some of the strategies and practices that hold the promise of producing continued improvements?

Assessing Science Learning: Perspectives from Research and Practice
The National Science Foundation-funded research projects described here show the strong link between assessment and improved student learning; the essays invite science teachers to reflect on their practices and priorities and to consider a variety of productive assessment strategies and frameworks. The central ideas around which the chapters are based and which provide compelling data to fuel conversations about assessment purposes and opportunities include the: Roles of assessment in teaching and learning, Characteristics of meaningful assessment items, Need for research to validate assessment practices, Significance of assessing both student knowledge and their misconceptions, Value of assessing students.

Classroom Assessment and the National Science Education Standards
This accompanying volume to the Standards focuses on a key kind of assessment: the evaluation that occurs regularly in the classroom, by the teacher and his or her students as interacting participants. As students conduct experiments, for example, the teacher circulates around the room and asks individuals about their findings, using the feedback to adjust lessons plans and take other actions to boost learning.

Classroom Research
K. Patricia Cross and Mimi Harris Steadman
Classroom Research is designed for use in faculty discussion groups, workshops, and seminars to prepare discipline-oriented faculty for the Scholarship of Teaching and Learning. The book’s real-life case studies illustrate basic principles of learning and provide provocative materials for discussion along with practical suggestions for research that can be conducted by faculty from all disciplines in their own classrooms.

Educating Engineers: Designing for the Future of the Field
Sheri D. Sheppard, Kelly Macatangay, Anne Colby and William M. Sullivan
Educating Engineers: Designing for the Future of the Field is the third of a series of reports on professional education issued by The Carnegie Foundation for the Advancement of Teaching's Preparation for the Professions Program. Informed by the findings of the Foundation's concurrent studies of professional education, Educating Engineers is also, like the other studies, grounded in direct observation of education in process. Initial study focused on forty schools of engineering and examination of one hundred accreditation self-study reports. Over several academic semesters, a research team visited eleven electrical and mechanical engineering programs at six colleges and universities in the United States. Public and private, part of technical institutes or situated within universities, geographically diverse and serving different populations, these 11 programs represented a cross section of U.S. undergraduate engineering education.

Educating Teachers of Science, Mathematics, and Technology: Practices for the New Millennium
This book synthesizes what we know about the quality of math and science teaching, draws conclusions about why teacher preparation needs reform, and then outlines recommendations for accomplishing the most important goals before us. Professional Development Schools are reviewed and vignettes presented that describe exemplary teacher development practices.
**Evaluating and Improving Undergraduate Teaching in Science, Technology, Engineering, and Mathematics**
This book offers a vision for systematic evaluation of teaching practices and academic programs, with recommendations to the various stakeholders in higher education about how to achieve change. What is good undergraduate teaching? This book discusses how to evaluate undergraduate teaching of science, mathematics, engineering, and technology and what characterizes effective teaching in these fields.

**How Learning Works**
Susan A. Ambrose, Michael W. Bridges, Michele DiPietro, Marsha C. Lovett, Marie K. Norma, and Richard E. Mayor
Distilling the research literature and translating the scientific approach into language relevant to a college or university teacher, this book introduces seven general principles of how students learn. The authors have drawn on research from a breadth of perspectives (cognitive, developmental, and social psychology; educational research; anthropology; demographics; organizational behavior) to identify a set of key principles underlying learning, from how effective organization enhances retrieval and use of information to what impacts motivation. Integrating theory with real-classroom examples in practice, this book helps faculty to apply cognitive science advances to improve their own teaching.

**How People Learn: Brain, Mind, Experience, and School**
National Research Council
This book offers exciting new research about the mind and the brain that provides answers to a number of compelling questions. When do infants begin to learn? How do experts learn and how is this different from non-experts? What can teachers and schools do—with curricula, classroom settings, and teaching methods—to help children learn most effectively? New evidence from many branches of science has significantly added to our understanding of what it means to know, from the neural processes that occur during learning to the influence of culture on what people see and absorb. How People Learn examines these findings and their implications for what we teach, how we teach it, and how we assess what our children learn. The book uses exemplary teaching to illustrate how approaches based on what we now know result in in-depth learning. This new knowledge calls into question concepts and practices firmly entrenched in our current education system.

**How People Learn: Bridging Research and Practice**
In synthesizing a broad body of research, How People Learn provides an opportunity to provide research-based messages that are clear and directly relevant to classroom practice. Three of the findings are highlighted in this report because they have both a solid research base to support them and strong implications for how the enterprise of education is conducted.

**How Students Learn: Science in the Classroom**
Organized for utility, the book explores how the principles of learning can be applied in science at three levels: elementary, middle, and high school. Leading educators explain in detail how they developed successful curricula and teaching approaches, presenting strategies that serve as models for curriculum development and classroom instruction. This book discusses how to build straightforward science experiments into true understanding of scientific principles. It also features illustrated suggestions for classroom activities.

**Improving Student Learning: A Strategic Plan for Education Research and Its Utilization**
This book offers suggestions for designing, organizing, and managing an effective strategic education research program by building a structure of interrelated networks. The book highlights such issues as how teachers can help students overcome their conceptions about how the world works, the effect of expectations on school performance, and the particular challenges of teaching children from diverse and disadvantaged backgrounds.

**Inquiry into the College Classroom: A Journey toward Scholarly Teaching**
Paul Savory, Amy Nelson Burnett and Amy Goodburn
An essential companion for university faculty interested in conducting scholarly inquiry into their classroom teaching, this practical guide presents a formal model for making visible the careful, difficult, and intentional scholarly work entailed in exploring a teaching question. As a how-to guide, this is an invaluable resource for planning and conducting classroom research—formulating questions and hypotheses, defining a data collection methodology, collecting data, measuring the impact, and documenting the results.
Methods in Educational Research: From Theory to Practice
Katherine H. Voegtle
Written for students, educators, and researchers, Methods in Educational Research offers a refreshing introduction to the principles of educational research. Designed for the real world of educational research, the book’s approach focuses on the types of problems likely to be encountered in professional experiences. Reflecting the importance of The No Child Left Behind Act, “scientifically based” educational research, school accountability, and the professional demands of the twenty-first century, Methods in Educational Research empowers educational researchers to take an active role in conducting research in their classrooms, districts, and the greater educational community—activities that are now not only expected but required of all teachers.

National Science Education Standards
Americans agree that our students urgently need better science education. The Standards offers a coherent vision of what it means to be scientifically literate, describing what all students should understand and be able to do in science. The volume reflects the principles that learning science is an inquiry-based process, that science in schools should reflect the intellectual traditions of contemporary science, and that all Americans have a role in science education reform.

Physics by Inquiry, Vol. I &II
Physics by Inquiry is a set of laboratory-based modules that provide a step-by-step introduction to physics and the physical sciences. Through in-depth study of simple physical systems and their interactions, students gain direct experience with the process of science. Starting from their own observations, students develop basic physical concepts, use and interpret different forms of scientific representations, and construct explanatory models with predictive capability. All the modules have been explicitly designed to develop scientific reasoning skills and to provide practice in relating scientific concepts, representations, and models to real world phenomena.

Scientific Research in Education
This book describes the similarities and differences between scientific inquiry in education and scientific inquiry in other fields and disciplines and provides a number of examples to illustrate these ideas. Its main argument is that all scientific endeavors share a common set of principles, and that each field including education research develops a specialization that accounts for the particulars of what is being studied. The book also provides suggestions for how the federal government can best support high-quality scientific research in education.

Strategic Education Research Partnership
The Strategic Education Research Partnership (SERP) proposes a large-scale, coherent program of research and development that would put the problems of educational practice at its center, and focus on all stages necessary to influence practice. These include theory testing, the development and evaluation of instructional programs, the study of practice in context, and attention to taking innovations to scale.

Transforming Undergraduate Education in Science, Mathematics, Engineering, and Technology
The book addresses pre-college preparation for students in SME&T and the joint roles and responsibilities of faculty and administrators in arts and sciences and in schools of education to better educate teachers of K-12 mathematics, science, and technology. It suggests how colleges can improve and evaluate lower-division undergraduate courses for all students, strengthen institutional infrastructures to encourage quality teaching, and better prepare graduate students who will become future SME&T faculty.

The Unified Learning Model: How Motivational, Cognitive, and Neurobiological Sciences Inform Best Teaching Practices
Duane F. Shell, David W. Brooks, Guy Trainin, Kathleen M. Wilson, et al.
This cutting-edge synthesis of ideas and concepts from the cognitive, motivation, and neurobiological sciences sets out a unique theory of learning that should be of interest to everyone from education practitioners to neuroscientists. The authors base their Unified Learning Model, or ULM, on three core principles. Firstly, that learning requires working memory allocation (attention). Second, that working memory’s capacity for allocation is affected by prior knowledge. And finally, that working memory allocation is directed by motivation. These three principles guide a complete model of learning that synthesizes what is known from research in brain function, cognition, and motivation.