Book Series

Science & Engineering Education Sources

Series Editors
Calvin S. Kalman, Concordia University

This book series provides volumes that are of general significance to theory development and research in Science & Engineering education. The series provides an opportunity to publish monographs, reviews, and collections of papers, which are at the forefront of the field. It publishes work from leading practitioners in the field, and cutting edge researchers.

Call for Monographs

This series is looking for monographs, reviews, and collections of papers that would be the basis for future research on the development of student understanding in science education.

Sample issues include:
What is the stage of the students’ intellectual development?

How can the instructor enable the student to resolve cognitive dissonance in the difficulties students have in transcending their misconceptions toward target ideas?

Students can have great difficulty reading scientific texts and trying to cope with the professor in the classroom. Part of the reason for student’s difficulties is that for a student taking a science gateway course the language and epistemology of science are akin to a foreign culture. For many students in the introductory gateway course, although individual words are understandable, the sentences appear to take the form of an unknown language.

What is the students’ world view; knowledge-in-pieces as described by diSessa, a coherent theory as described for example by Posner, Strike, Hewson, and Gertzog or and an ontological view as described by Chi.

What instructional supports are necessary for students to examine their own ideas and compare them to the ideas presented by peers, the textbook, and the instructor? Feyerabend (1993, p.33) has pointed out that evaluation of a theoretical framework doesn’t occur until there is an alternative (principle of counter induction.)

Relating epistemic change to conceptual change in students.

All inquiries and papers may be directed to Series Editor Calvin S. Kalman:
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Books in this series:
- Using and Developing Measurement Instruments in Science Education
- Developing Science Literacy in the 21st Century
- Successful Science and Engineering Teaching in Colleges and Universities, 2nd Edition
- Deep Learning in Introductory Physics
- Rethinking Science Education
- Using and Developing Measurement Instruments in Science Education
- College Teaching and the Development of Reasoning

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IAP - Information Age Publishing, PO Box 79049, Charlotte, NC 28271
tel: 704-752-9125 fax: 704-752-9113 URL: www.infoagepub.com
This book meets a demand in the science education community for a comprehensive and introductory measurement book in science education. It describes measurement instruments reported in refereed science education research journals, and introduces the Rasch modeling approach to developing measurement instruments in common science assessment domains, i.e. conceptual understanding, affective variables, science inquiry, learning progression, and learning environments. This book can help readers develop a sound understanding of measurement theories and approaches, particularly Rasch modeling, to using and developing measurement instruments for science education research.

This book is for anyone who is interested in knowing what measurement instruments are available and how to develop measurement instruments for science education research. For example, this book can be a textbook for a graduate course in science education research methods; it helps graduate students develop competence in using and developing standardized measurement instruments for science education research. Science education researchers, both beginning and experienced, may use this book as a reference for locating available and developing new measurement instruments when conducting a research study.


The development of science literacy has the potential to have an enormous impact on real world outcomes. Specifically, developing science literacy may persuade individuals to act. We hope that this book will influence scientists, science journalists, sociologists, anthropologists, communication specialists, political leaders, media outlets, educational institutions, and individual science content consumers.

The chapters in this book describe a definition of science literacy that draws on the emotional, cognitive, and social. The authors strive to help prepare individuals to read, write, and speak science in a continuously evolving information landscape. In order to meet these objectives, the chapters examine both qualitative and quantitative research. It is within these frameworks that we can begin to address science literacy in the 21st century.

Successful Science and Engineering Teaching in Colleges and Universities, 2nd Edition
Calvin S. Kalman, Concordia University

Based on the author’s work in science and engineering educational research, this book offers broad, practical strategies for teaching science and engineering courses and describes how faculty can provide a learning environment that helps students comprehend the nature of science, understand science concepts, and solve problems in science courses.

This book’s student-centered approach focuses on two main themes: writing to learn (especially Reflective Writing) and interactive activities (collaborative groups and labatorials). When faculty incorporate these methods into their courses, students gain a better understanding of science as a connected structure of concepts rather than as a toolkit of assorted practices.


Deep Learning in Introductory Physics: Exploratory Studies of Model-Based Reasoning
Mark J. Lattery, University of Wisconsin Oshkosh

Deep Learning in Introductory Physics: Exploratory Studies of Model-Based Reasoning is concerned with the broad question of how students learn physics in a model-centered classroom. The diverse, creative, and sometimes unexpected ways students construct models, and deal with intellectual conflict, provide valuable insights into student learning and cast a new vision for physics teaching. This book is the first publication in several years to thoroughly address the “coherence
versus fragmentation” debate in science education, and the first to advance and explore the hypothesis that deep science learning is regressive and revolutionary. Deep Learning in Introductory Physics also contributes to a growing literature on the use of history and philosophy of science to confront difficult theoretical and practical issues in science teaching, and addresses current international concern over the state of science education and appropriate standards for science teaching and learning.

The book is divided into three parts. Part I introduces the framework, agenda, and educational context of the book. An initial study of student modeling raises a number of questions about the nature and goals of physics education. Part II presents the results of four exploratory case studies. These studies reproduce the results of Part I with a more diverse sample of students; under new conditions (a public debate, peer discussions, and group interviews); and with new research prompts (model-building software, bridging tasks, and elicitation strategies). Part III significantly advances the emergent themes of Parts I and II through historical analysis and a review of physics education research.

ENDORSEMENTS:
“In Deep Learning in Introductory Physics, Lattery describes his extremely innovative course in which students’ ideas about motion are elicited, evaluated with peers, and revised through experiment and discussion. The reader can see the students’ deep engagement in constructive scientific modeling, while students deal with counter-intuitive ideas about motion that challenged Galileo in many of the same ways. Lattery captures students engaging in scientific thinking skills, and building difficult conceptual understandings at the same time. This is the ‘double outcome’ that many science educators have been searching for. The case studies provide inspiring examples of innovative course design, student sensemaking and reasoning, and deep conceptual change.”

~ John Clement, University of Massachusetts—Amherst, Scientific Reasoning Research Institute

“Deep Learning in Introductory Physics is an extraordinary book and an important intellectual achievement in many senses. It offers new perspectives on science education that will be of interest to practitioners, to education researchers, as well as to philosophers and historians of science. Lattery combines insights into model-based thinking with instructive examples from the history of science, such as Galileo’s struggles with understanding accelerated motion, to introduce new ways of teaching science. The book is based on first-hand experiences with innovative teaching methods, reporting student’s ideas and discussions about motion as an illustration of how modeling and model-building can help understanding science. Its lively descriptions of these experiences and its concise presentations of insights backed by a rich literature on education, cognitive science, and the history and philosophy of science make it a great read for everybody interested in how models shape thinking processes.”

~ Dr. Jürgen Renn, Director, Max Planck Institute for the History of Science

why and how a philosophy of science education contributes to science education reform. It seeks to contribute in general
to the improvement of curriculum design and science teacher education. The perspective to be taken on board is that to
teach science is to have a philosophical frame of mind—about the subject, about education, about one’s personal teacher
identity.

Chapter 1: Defining the Identity of the Philosophy of Science Education: Surveying the Terrain. Chapter 2: Science
Education Reform and the Need for Philosophy of Science: Education and Educational Theory. Chapter 3: Philosophy of
Science Education and Kieran Egan’s Educational Metatheory. Chapter 4: Philosophy of Science Education, Epistemology,
References. About the Author.

Using and Developing Measurement Instruments in Science
Education
A Rasch Modeling Approach
Xiufeng Liu, State University of New York, Buffalo
9781617350054 $65.

This book meets a demand in the science education community for a comprehensive and introductory measurement book
in science education. It describes measurement instruments reported in refereed science education research journals, and
introduces the Rasch modeling approach to developing measurement instruments in common science assessment domains,
i.e. conceptual understanding, affective variables, science inquiry, learning progression, and learning environments. This
book can help readers develop a sound understanding of measurement theories and approaches, particularly Rasch
modeling, to using and developing measurement instruments for science education research.

This book is for anyone who is interested in knowing what measurement instruments are available and how to develop
measurement instruments for science education research. For example, this book can be a textbook for a graduate course
in science education research methods; it helps graduate students develop competence in using and developing
standardized measurement instruments for science education research. For use as a textbook there are summaries and
exercises at the end of each chapter. Science education researchers, both beginning and experienced, may use this book as
a reference for locating available and developing new measurement instruments when conducting a research study.

Using and Developing Instruments for Measuring Affective Variables. 5. Using and Developing Instruments for Measuring
Science Inquiry. 6. Using and Developing Instruments for Measuring Learning Progression. 7. Using and Developing
Instruments for Measuring Science Learning Environments. Exercises. References. Subject Index. Author Index. About the
Authors.

College Teaching and the Development of Reasoning
Robert G. Fuller, University of Nebraska Lincoln; Thomas C. Campbell, Illinois Central College; Dewey I. Dykstra, Boise State University; Scott M. Stevens, Carnegie Mellon University
9781617352461 $65.

This book is intended to offer college faculty members the insights of the development of reasoning movement that
enlighten physics educators in the late 1970s and led to a variety of college programs directed at improving the reasoning
patterns used by college students. While the original materials were directed at physics concepts, they quickly expanded to
include other sciences and the humanities and social sciences. On-going developments in the field will be included.

The editors have introduced new topics, including discussions of Vygotsky’s ideas in relation to those of Piaget, of science
education research progress since 1978, of constructivist learning theory applied to educational computer games and of applications from anthropology to zoology. These materials are especially relevant for consideration by current university faculty in all subjects.

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