

Reform in Undergraduate

# Science Teaching

for the 21st Century



edited by

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A VOLUME IN  
RESEARCH IN SCIENCE EDUCATION



# Reform In Undergraduate Science Teaching For The 21st Century Research In Science Education

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## **Reform In Undergraduate Science Teaching For The 21st Century Research In Science Education:**

*Reform in Undergraduate Science Teaching for the 21st Century* Dennis W. Sunal, Emmett L. Wright, Jeanelle Bland, 2006-05-01 The mission of the book series Research in Science Education is to provide a comprehensive view of current and emerging knowledge research strategies and policy in specific professional fields of science education This series would present currently unavailable or difficult to gather materials from a variety of viewpoints and sources in a usable and organized format Each volume in the series would present a juried scholarly and accessible review of research theory and or policy in a specific field of science education K 16 Topics covered in each volume would be determined by present issues and trends as well as generative themes related to current research and theory Published volumes will include empirical studies policy analysis literature reviews and positing of theoretical and conceptual bases

**Research Based Undergraduate Science Teaching** Dennis W. Sunal, Cynthia S Sunal, Emmett L. Wright, Cheryl L. Mason, Dean Zollman, 2014-07-01 Research in Science Education RISE Volume 6 Research Based Undergraduate Science Teaching examines research theory and practice concerning issues of teaching science with undergraduates This RISE volume addresses higher education faculty and all who teach entry level science The focus is on helping undergraduates develop a basic science literacy leading to scientific expertise RISE Volume 6 focuses on research based reforms leading to best practices in teaching undergraduates in science and engineering The goal of this volume is to provide a research foundation for the professional development of faculty teaching undergraduate science Such science instruction should have short and longterm impacts on student outcomes The goal was carried out through a series of events over several years The website at <http://nseus.org> documents materials from these events The international call for manuscripts for this volume requested the inclusion of major priorities and critical research areas methodological concerns and results of implementation of faculty professional development programs and reform in teaching in undergraduate science classrooms In developing research manuscripts to be reviewed for RISE Volume 6 researchers were asked to consider the status and effectiveness of current and experimental practices for reforming undergraduate science courses involving all undergraduates including groups of students who are not always well represented in STEM education To influence practice it is important to understand how researchbased practice is made and how it is implemented The volume should be considered as a first step in thinking through what reform in undergraduate science teaching might look like and how we help faculty to implement such reform

**Transforming University Biochemistry Teaching Using Collaborative Learning and Technology** Penny J. Gilmer, 2010-03-10 One aim of Gilmer's captivating text on university pedagogy is to show that biochemistry or any science does not consist solely of facts to be learned but is a way of thinking about the world Her purpose both in this book and in her classroom is to make her students into critical thinkers rather than passive learners The chapters cast a critical eye over research into enhanced education techniques such as collaborative learning Gilmer describes the action research she

conducted in her own biochemistry undergraduate classroom into ways of improving the learning environment She offers various perspectives on the make up of her classroom including an analysis of ethnographic data The tools Gilmer employs as she hones her teaching skills include collaborative learning and technology She views the classroom through various theoretical perspectives social constructivism cultural historical activity theory and a theory that involves the dialectic between the structure of the learning environment and the agency of the learners a group among whom she includes herself She provides a wealth of autobiographical detail as well as the results of her action research which followed up on its original subjects after an interval of 11 years to see what impact her course had on their professional growth Above all this volume is proof of what can be achieved in education when teachers are as interested in the process of learning as they are in their subject itself *Innovative Methods of Teaching and Learning Chemistry in Higher Education* Ingo Eilks,Bill

Byers,2015-11-06 Two recent initiatives from the EU namely the Bologna Process and the Lisbon Agenda are likely to have a major influence on European Higher Education It seems unlikely that traditional teaching approaches which supported the elitist system of the past will promote the mobility widened participation and culture of life long learning that will provide the foundations for a future knowledge based economy There is therefore a clear need to seek new approaches to support the changes which will inevitably occur The European Chemistry Thematic Network ECTN is a network of some 160 university chemistry departments from throughout the EU as well as a number of National Chemical Societies including the RSC which provides a discussion forum for all aspects of higher education in chemistry This handbook is a result of one of their working groups who identified and collated good practice with respect to innovative methods in Higher Level Chemistry Education It provides a comprehensive overview of innovations in university chemistry teaching from a broad European perspective The generation of this book through a European Network with major national chemical societies and a large number of chemistry departments as members make the book unique The wide variety of scholars who have contributed to the book make it interesting and invaluable reading for both new and experienced chemistry lecturers throughout the EU and beyond The book is aimed at chemistry education at universities and other higher level institutions and at all academic staff and anyone interested in the teaching of chemistry at the tertiary level Although newly appointed teaching staff are a clear target for the book the innovative aspects of the topics covered are likely to prove interesting to all committed chemistry lecturers *The Impact of State and National Standards on K-12 Science Teaching* Dennis W. Sunal,Emmett L. Wright,2006-06-01 This book addresses the expectations toward the science standards of various stakeholders including students parents teachers administrators higher education science and science education faculty members politicians governmental and professional agencies and the business community This book also investigates how the science standards have been translated into practice at the K 12 school district level addressing issues around professional development curriculum assessment evaluation and accountability The fundamental questions to be addressed are 1 What is the response in terms of trends and

patterns of the educational system to the introduction of the national and state science standards since the late 1980s and 2000s. What is the impact of the introduction of the science standards on teachers' classrooms and students?

**The Impact of the Laboratory and Technology on Learning and Teaching Science K-16** Dennis W. Sunal, Emmett L. Wright, Cheryl Sundberg, 2008-02-01

The Impact of the Laboratory and Technology on K-12 Science Learning and Teaching examines the development, use, and influence of active laboratory experiences and the integration of technology in science teaching. This examination involves the viewpoints of policymakers, researchers, and teachers that are expressed through research involving original documents, interviews, analysis, and synthesis of the literature, case studies, narrative studies, observations of teachers and students, and assessment of student learning outcomes. Volume 3 of the series Research in Science Education addresses the needs of various constituencies including teachers, administrators, higher education science and science education faculty, policymakers, governmental and professional agencies, and the business community. The guiding theme of this volume is the role of practical laboratory work and the use of technology in science learning and teaching K-16. The volume investigates issues and concerns related to this theme through various perspectives addressing design, research, professional practice, and evaluation. Beginning with definitions, the historical evolution and policy guiding these learning experiences are explored from several viewpoints. Effective design and implementation of laboratory work and technology experiences is examined for elementary and high school classrooms as well as for undergraduate science laboratories, informal settings, and science education courses and programs. In general, recent research provides evidence that students do benefit from inquiry-based laboratory and technology experiences that are integrated with classroom science curricula. The impact and status of laboratory and technology experiences is addressed by exploring specific strategies in a variety of scientific fields and courses. The chapters outline and describe in detail research-based best practices for a variety of settings.

**Physics Teaching and Learning: Challenging the Paradigm** RISE Volume 8 focuses on research contributions challenging the basic assumptions, ways of thinking, and practices commonly accepted in physics education. Teaching physics involves multifaceted research-based value-added strategies designed to improve academic engagement and depth of learning. In this volume, researchers, teaching and curriculum reformers, and reform implementers discuss a range of important issues. The volume should be considered as a first step in thinking through what physics teaching and physics learning might address in teacher preparation programs, in-service professional development programs, and in classrooms. To facilitate thinking about research-based physics teaching and learning, each chapter in the volume was organized around five common elements:

1. A significant review of research in the issue or problem area.
2. Themes addressed are relevant for the teaching and learning of K-16 science.
3. Discussion of original research by the author(s) addressing the major theme of the chapter.
4. Bridge gaps between theory and practice and/or research and practice.
5. Concerns and needs are addressed of school community context.

stakeholders including students teachers parents administrators and community members      **Handbook of Learning from Multiple Representations and Perspectives** Peggy Van Meter,Alexandra List,Doug Lombardi,Panayiota Kendeou,2020-03-10 In and out of formal schooling online and off today s learners must consume and integrate a level of information that is exponentially larger and delivered through a wider range of formats and viewpoints than ever before The Handbook of Learning from Multiple Representations and Perspectives provides a path for understanding the cognitive motivational and socioemotional processes and skills necessary for learners across educational contexts to make sense of and use information sourced from varying inputs Uniting research and theory from education psychology literacy library sciences media and technology and more this forward thinking volume explores the common concerns shared challenges and thematic patterns in our capacity to make meaning in an information rich society Chapter 16 of this book is freely available as a downloadable Open Access PDF under a Creative Commons Attribution Non Commercial No Derivatives 4 0 license available at <http://www.taylorfrancis.com/books/e/9780429443961>      **The University in the Age of Globalization** W. Bienkowski,J. Brada,G. Stanley,2012-07-06 An informed discussion of the global education market analysing the rankings system and the determinants which help universities to advance The authors examine possible improvements in the promotion and commercialization of university research and the role of universities in the social and economic development of transition economies      *The Role of the National Science Foundation in K-12 Science and Math Education* United States. Congress. House. Committee on Science,2006      Resources in Education ,2001      Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations for 2000: National Science Foundation United States. Congress. House. Committee on Appropriations. Subcommittee on VA, HUD, and Independent Agencies,1999      Excellence in Science Teaching United States. Congress. House. Committee on Science, Space, and Technology. Subcommittee on Science,1992      **Integrative Learning** Daniel Blackshields,James Cronin,Bettie Higgs,Shane Kilcommins,Marian McCarthy,Anthony Ryan,2014-11-13 Current teaching learning and assessment practices can lead students to believe that courses within a programme are self sufficient and separate Integrative Learning explores this issue and considers how intentional learning helps students become integrative thinkers who can see connections in seemingly disparate information and draw on a wide range of knowledge to make decisions Written by international contributors who engaged reflectively with their teaching and their students learning the book seeks to develop a shared language of integrative learning encouraging students to adapt skills learned in one situation to problems encountered in another and make autonomous connections across courses between experiences and throughout their lives More informed teachers can help students develop the necessary attributes for intentional learning which include having a sense of purpose fitting fragmentary information into a learning framework understanding something of their own learning processes asking probing questions reflecting on their own choices and knowing when to ask for help Integrative Learning draws on international research and

vast studies to provide the reader with the resources to ensure access to a unified learning experience The book discusses conceptual and technical tools necessary for facilitating integrative learning across a range of disciplines as well as providing learning pedagogies and considers integrative learning in the context of the relevance of higher education in the complexity and uncertainty of the 21st century It will appeal to academics and researchers in the field of higher education as well as those generating higher education curriculums Ethnographies of Science Education Carol Brandt, Heidi B

Carlone, 2015-09-25 Researchers who conduct ethnography in science education tend to have a deep commitment for transforming science to improve the lives of people in underserved communities This edited volume explores how contemporary ethnographers in science education bring to light the local production of scientific knowledge and the ways it is implicated in larger social and political struggles Ethnographies in science education contribute to understanding the experiences of linguistically racially and economically diverse populations who have been historically excluded from participation in science An anthropological approach has also been instrumental in explicating the situated practices by which students enact science in the classroom and in their lives beyond schools This edited volume brings together ethnographers in science education to contribute a global perspective on science teaching and learning in school and university classrooms at home and after school programs Included are examples of ethnography in science education from the UK Argentina Canada and the USA in which contributors point to promising directions for theorizing the culture of science education as we undertake educational reform The authors in this volume argue that ethnography is not only a valid approach for the study of science education but also they contend that it is essential to the development of more equitable practices for instruction and learning This book was originally published as a special issue of *Ethnography and Education*

*Handbook of Research on Science Learning Progressions* Hui Jin, Duanli Yan, Joseph Krajcik, 2024-07-30 Gathering contributions from leading scholars around the world this handbook offers a comprehensive resource on the most recent advances in research surrounding the theories methodologies and applications of science learning progressions Researchers and educators have used learning progressions to guide the design and alignment of curriculum instruction and assessment and to help students learn scientific knowledge and practices in a coherent and connected way across multiple years This handbook lays out the development and current state of research in this field across four sections learning progression theories and methodologies learning progressions to promote student learning teachers learning and use of learning progressions and new technology in learning progression research Featuring internationally recognized experts in learning progression research as well as up and coming voices the *Handbook of Research on Science Learning Progressions* offers a defining new resource for researchers teachers and teacher educators and curriculum and assessment developers in science education **Improving K-12 STEM Education Outcomes through Technological Integration** Urban, Michael

J., Falvo, David A., 2015-11-12 The application of technology in classroom settings has equipped educators with innovative

tools and techniques for effective teaching practice Integrating digital technologies at the elementary and secondary levels helps to enrich the students learning experience and maximize competency in the areas of science technology engineering and mathematics Improving K 12 STEM Education Outcomes through Technological Integration focuses on current research surrounding the effectiveness performance and benefits of incorporating various technological tools within science technology engineering and mathematics classrooms Focusing on evidence based approaches and current educational innovations this book is an essential reference source for teachers teacher educators and professionals interested in how emerging technologies are benefiting teaching and or learning efficacy *Challenges and Opportunities for Education About Dual Use Issues in the Life Sciences* National Research Council, Division on Earth and Life Studies, Board on Life Sciences, Committee on Education on Dual Use Issues in the Life Sciences, 2011-01-16 The Challenges and Opportunities for Education About Dual Use Issues in the Life Sciences workshop was held to engage the life sciences community on the particular security issues related to research with dual use potential More than 60 participants from almost 30 countries took part and included practicing life scientists bioethics and biosecurity practitioners and experts in the design of educational programs The workshop sought to identify a baseline about 1 the extent to which dual use issues are currently being included in postsecondary education undergraduate and postgraduate in the life sciences 2 in what contexts that education is occurring e g in formal coursework informal settings as stand alone subjects or part of more general training and in what fields and 3 what online educational materials addressing research in the life sciences with dual use potential already exist

**The Guidebook of Federal Resources for K-12 Mathematics and Science** ,1998 Contains directories of federal agencies that promote mathematics and science education at elementary and secondary levels organized in sections by agency name national program name and state highlights by region **American Educational Research Association Annual Meeting Program** American Educational Research Association, 2005

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