



Teaching And Learning Of Energy In K 12 Education

Kostas Kampourakis, Michael Reiss



Teaching And Learning Of Energy In K 12 Education:

Teaching and Learning of Energy in K - 12 Education Robert F. Chen, Arthur Eisenkraft, David Fortus, Joseph Krajcik, Knut Neumann, Jeffrey Nordine, Allison Scheff, 2014-04-09 This volume presents current thoughts research and findings that were presented at a summit focusing on energy as a cross cutting concept in education involving scientists science education researchers and science educators from across the world The chapters cover four key questions what should students know about energy what can we learn from research on teaching and learning about energy what are the challenges we are currently facing in teaching students this knowledge and what needs be done to meet these challenges in the future Energy is one of the most important ideas in all of science and it is useful for predicting and explaining phenomena within every scientific discipline The challenge for teachers is to respond to recent policies requiring them to teach not only about energy as a disciplinary idea but also about energy as an analytical framework that cuts across disciplines Teaching energy as a crosscutting concept can equip a new generation of scientists and engineers to think about the latest cross disciplinary problems and it requires a new approach to the idea of energy This book examines the latest challenges of K 12 teaching about energy including how a comprehensive understanding of energy can be developed The authors present innovative strategies for learning and teaching about energy revealing overlapping and diverging views from scientists and science educators The reader will discover investigations into the learning progression of energy how understanding of energy can be examined and proposals for future directions for work in this arena Science teachers and educators science education researchers and scientists themselves will all find the discussions and research presented in this book engaging and informative

Teaching and Learning of Energy in K - 12 Education Robert F. Chen, Arthur Eisenkraft, David Fortus, 2014-04-30 *Lehr- und Lernforschung in der Biologiedidaktik* Ulrich Gebhard, Markus Hammann, 2016-12-07 Die Fachdidaktik ist ein Kernbereich der LehrerInnenausbildung in allen Bereichen Eine fundierte Ausbildung kann dabei nur auf einer fundierten wissenschaftlichen Grundlage erfolgen weshalb der vorliegende Band eine Auswahl theoretischer und empirischer Originalarbeiten aus aktuellen Forschungsprojekten prsentierte die 2015 auf der Internationalen Tagung der Fachsektion Didaktik der Biologie an der Universit t Hamburg prsentierte wurden Das Tagungsthema Bildung durch Biologieunterricht wurde dabei in vielfacher Weise auf und angenommen Die hier versammelten Beitr ge spannen einen weiten Bogen von bildungstheoretischen berlegungen bis hin zu empirischen Untersuchungen im Rahmen fachdidaktischer Lehr und Lernforschung Sie beziehen sich auf die Vermittlung biologischer Themen und Fragestellungen in der Grundschule und in weiterfhrenden Schulen sowie auf die Lehramtsausbildung im Fach Biologie Die Beitr ge lassen sich thematisch den folgenden Schwerpunkten zuordnen Biologie und Bildung Wissenschaftsverständnis Nature of Science Verstehen von zentralen biologischen Zusammenhngen Moralvorstellungen im Biologieunterricht Experimentieren im Biologieunterricht und im Lehramtsstudium Kompetenzmessung und Testaufgaben Abbildungsmerkmale und Bildverstehen F cherverbindendes

Arbeiten Forschendes Lernen im Schlerlabor und in der Lehramtsausbildung **Biologie verstehen: Energie in anthropogenen Ökosystemen** Mathias Trauschke, 2016-11-09 Die Sicherstellung der Ernährung der Menschheit stellt eine globale Herausforderung dar. Nach wie vor ist Unterernährung ein Problem vieler Entwicklungsländer. In Industrienationen ist die Ernährungsweise wiederum nicht nachhaltig ausgerichtet. Dort beruht die Nahrungsmittelproduktion auf dem Einsatz begrenzter fossiler Ressourcen. Ohne Fleischherzeugung würden die Ackerflächen jedoch für die Welternährung reichen. Energetische Analysen von Lebensmittelketten belegen die Ineffizienz von Fleischproduktion. Eine vermehrt vegetarisch ausgerichtete Nahrungsmittelproduktion könnte daher eine ausreichende und nachhaltige Ernährung der Menschheit gewährleisten. Das gesellschaftlich relevante Thema ist auch für den Biologieunterricht interessant. Dazu ist es notwendig, den Energiebegriff für biologische Kontexte neu zu denken. Energie ist als mengenartige Bilanzierungsgröße zu verstehen, mithilfe derer Prozesse in Systemen quantitativ betrachtet und auf Effizienz untersucht werden können. **Lehr- und Lernforschung in der Biologiedidaktik** Marcus Hammann, Martin Lindner, 2018-12-07 Dieser Band vereint theoretische und empirische Originalarbeiten über aktuelle Forschungsprojekte, die 2017 auf der 21. Internationalen Tagung der Fachsektion Didaktik der Biologie an der Universität Halle präsentiert wurden. Mit dem Tagungsthema Biologiedidaktik als Wissenschaft wird das fachdidaktische Selbstverständnis einer theoretischen, empirischen und praxisbezogenen Fachdidaktik Biologie verdeutlicht. Die in diesem Jahr 40 Jahre alt wurde Biologiedidaktische Forschung stützt sich auf Theorien, strebt empirische Evidenzen zur Verbesserung des Biologieunterrichts und der Ausbildung von Lehrkräften an und ist als eine anwendungsbezogene Wissenschaft der Optimierung des fachbezogenen Lernens und Lehrens verpflichtet. Die Palette unterschiedlicher Themen in diesem Band ist breit: Vorstellungen zu Konzepten und Erkenntnismethoden, Wissenschaftsreflexion, Modellieren und Modellkompetenz, Vermittlungsexperimente und Interventionen, Aufgaben und Assessment, Professionalisierung von Lehramtsstudierenden der Biologie, Einstellungen von Schlerinnen und Biologielehrkräften, Biodiversität und regionale Lernorte. Die Herausgeber dieses Bandes hoffen im Namen der Fachsektion Didaktik der Biologie im VBIO, die inzwischen fast 500 Mitglieder zählt, einen Beitrag zur Diskussion über das Lehren und Lernen im Fach und zur Verbesserung der Ausbildung angehender Lehrkräfte zu leisten. **AUS DEM INHALT** Vorstellungen zu Konzepten und Erkenntnismethoden Irene Lampert Kai Niebert Alltagsvorstellungen zu den planetaren Belastungsgrenzen Dennis Messig Ulrich Kattmann Jorge Gro Fotosynthese verstehen didaktische Rekonstruktion der Pflanzenernährung Bianca Reinisch Dirk Krüger Vorstellungen von Lehramtsstudierenden zu fiktiven Szenarien zum Beobachten und Experimentieren Wissenschaftsreflexion Mario Kötter Marcus Hammann Epistemische Kompetenz Wissenschaftsreflexion im naturwissenschaftlichen Unterricht Modellieren und Modellkompetenz Johannes Meister Annette Upmeyer zu Belzen Biologische Phänomene mit Liniendiagrammen naturwissenschaftlich mathematisch modellieren *Vernetztes Lernen im fächerdifferenzierten und integrierten naturwissenschaftlichen Unterricht aufgezeigt am Basiskonzept Energie* Dennis

Dietz,2023-07-26 In erfolgreichen Lernprozessen müssen die zahlreichen zunächst noch unbekannten und ungeordneten Begriffselemente miteinander verknüpft und in bereits bestehende Begriffsnetze sinnstiftend integriert werden. Lerntheoretisch ist anzunehmen, dass das vernetzte Lernen des fächerbergreifenden Energiekonzepts im integrierten naturwissenschaftlichen Unterricht besser gelingt als dies im fächerdifferenzierten naturwissenschaftlichen Unterricht der Fall sein dürfte, da die Begriffselemente des Energiebegriffs räumlich und zeitlich stärker zusammenhängend unterrichtet werden. Im Rahmen dieser Forschungsarbeit wurde untersucht, welchen Einfluss integrierter bzw. fächerdifferenzierter naturwissenschaftlicher Unterricht auf die Vernetzungsleistungen von Schülerinnen hat. Im Zuge einer Feldstudie im Kontroll- und Interventionsgruppendesign wurden am Ende einer jeweils zweijährigen Intervention insgesamt N 410 Schülerinnen Essays zum Energiekonzept mit dem eigens entwickelten Modell zur Analyse der Vernetzung von Begriffselementen MAVerBE qualitativ inhaltsanalytisch untersucht. Die Ergebnisse zeigen, dass die Schülerinnen nach dem integrierten naturwissenschaftlichen Unterricht Begriffselemente des Energiekonzepts signifikant häufiger fachlich korrekt verwendet und qualitativ hochwertiger vernetzt haben. Damit konnte empirisch nachgewiesen werden, dass integrierter naturwissenschaftlicher Unterricht den Aufbau vernetzten Wissens in besonderem Maße zu fördern vermag.

Pädagogik der Naturwissenschaften Ulrich Gebhard, Dietmar Höttecke, Markus Rehm, 2017-02-20 Eine Pädagogik der Naturwissenschaften fragt einerseits nach gelingendem Lernen und andererseits nach gelingender Bildung mit und durch die Naturwissenschaften. Wenn Lernen und Bildung gelingen sollen, dann wird sich die fachdidaktische Aufmerksamkeit sowohl auf das Subjekt als auch auf das Objekt von Lernen und Bildung im naturwissenschaftlichen Fachunterricht richten müssen. In der Verschränkung von Subjektivierung und Objektivierung sehen wir den fruchtbaren Moment naturwissenschaftlicher Bildungsprozesse, die damit eine gleichermaßen pädagogische wie politische Dimension erhalten. In diesem Buch werden die wesentlichen theoretisch gehaltvollen Elemente einer kritischen wie modernen Naturwissenschaftsdidaktik diskutiert. Die Lektüre des Buches soll die pädagogisch didaktische Haltung von Fachdidaktikerinnen und Fachdidaktikern Studierenden und Lehrkräften inspirieren und theoretisch unterfüttern. Daher akzentuieren wir wesentliche Prämissen, theoretische Grundlegungen und Ziele des naturwissenschaftlichen Unterrichts. Zentrale Problemstellungen einer Pädagogik der Naturwissenschaften werden aus einer integrativen Perspektive bearbeitet. Dabei werden sowohl Bezüge zum disziplinären Physik-, Chemie- und Biologieunterricht als auch zu einem integrierten Fach Naturwissenschaft hergestellt. Ein klarer Theoriebezug steht dabei in einem ausgewogenen Verhältnis zu empirischen Forschungsbefunden und zu Praxisempfehlungen.

The Role of Laboratory Work in Improving Physics Teaching and Learning Dagmara Sokołowska, Marisa Michelini, 2018-11-03 This book explores in detail the role of laboratory work in physics teaching and learning. Compelling recent research work is presented on the value of experimentation in the learning process with description of important research-based proposals on how to achieve improvements in both teaching and

learning The book comprises a rigorously chosen selection of papers from a conference organized by the International Research Group on Physics Teaching GIREP an organization that promotes enhancement of the quality of physics teaching and learning at all educational levels and in all contexts The topics covered are wide ranging Examples include the roles of open inquiry experiments and advanced lab experiments the value of computer modeling in physics teaching the use of web based interactive video activities and smartphones in the lab the effectiveness of low cost experiments and assessment for learning through experimentation The presented research based proposals will be of interest to all who seek to improve physics teaching and learning

Schüler besser verstehen Ulrich Kattmann, 2022-12-15 Der Leitfaden für einen schülerorientierten Biologieunterricht Dieser Band behandelt die Gefahren und Chancen von Alltagsvorstellungen die Schülerinnen und Schüler von biologischen Sachverhalten haben Es wird gezeigt wie man zu einer fachlich akkuraten Erklärung des Sachverhalts gelangt und darüber hinaus das gelernte Konzept auf neue Beispiele übertragen und die anfänglichen Vorstellungen reflektieren kann Lernhindernisse und Lernchancen erkennen Ergebnisse aus fachdidaktischer Forschung und langjähriger Unterrichtspraxis Alltagsvorstellungen von Schülerinnen von A wie Abstammung bis Z wie Zufall

Biologiedidaktische Vorstellungsforschung: Zukunftsweisende Praxis Bianca Reinisch, Kristin Helbig, Dirk Krüger, 2020-07-07 Das Werk basiert auf den Beiträgen zu der Tagung Biologiedidaktische Vorstellungsforschung Zukunftsweisende Praxis die im März 2019 in Berlin stattfand Hier wurden innovative Forschungsansätze im Bereich Vorstellung und Theorie Kompetenz Diagnose sowie Intervention präsentiert und diskutiert Die Herausgeber möchten mit dem Werk eine weiterführende Debatte über theoretische und methodische Ansätze in der Vorstellungsforschung anstoßen auch mit dem Ziel Implikationen für die Praxis abzuleiten

Science Curriculum for the Anthropocene, Volume 2 Xavier Fazio, 2023-12-27 This edited volume the second of a two volume set presents science curriculum exemplars based on existing and future curriculum models Drawing upon complexity and systems theories this book will provide a framework for science curriculum that tackles and transforms the interrelated and socio ecological causes of our ecological crises The result is a refreshing and hopeful look at K 12 science curriculum in light of our current global trajectory in the twenty first century Chapter Future oriented Science Education Building Sustainability Competences An Approach to the European GreenComp Framework is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com

Competence Assessment in Education Detlev Leutner, Jens Fleischer, Juliane Grünkorn, Eckhard Klieme, 2017-03-27 This book addresses challenges in the theoretically and empirically adequate assessment of competencies in educational settings It presents the scientific projects of the priority program Competence Models for Assessing Individual Learning Outcomes and Evaluating Educational Processes which focused on competence assessment across disciplines in Germany The six year program coordinated 30 research projects involving experts from the fields of psychology educational science and subject specific didactics The main reference point for all projects is the concept of competencies which are

defined as context specific cognitive dispositions that are acquired and needed to successfully cope with certain situations or tasks in specific domains Koeppen et al 2008 p 62 The projects investigate different aspects of competence assessment The primary focus lies on the development of cognitive models of competencies complemented by the construction of psychometric models based on these theoretical models In turn the psychometric models constitute the basis for the construction of instruments for effectively measuring competencies The assessment of competencies plays a key role in optimizing educational processes and improving the effectiveness of educational systems This book contributes to this challenging endeavor by meeting the need for more integrative interdisciplinary research on the structure levels and development of competencies

Classroom Assessment and Educational Measurement Susan M. Brookhart, James H. McMillan, 2019-07-04 Classroom Assessment and Educational Measurement explores the ways in which the theory and practice of both educational measurement and the assessment of student learning in classroom settings mutually inform one another Chapters by assessment and measurement experts consider the nature of classroom assessment information from student achievement to affective and socio emotional attributes how teachers interpret and work with assessment results and emerging issues in assessment such as digital technologies and diversity inclusion This book uniquely considers the limitations of applying large scale educational measurement theory to classroom assessment and the adaptations necessary to make this transfer useful Researchers graduate students industry professionals and policymakers will come away with an essential understanding of how the classroom assessment context is essential to broadening contemporary educational measurement perspectives The Open Access version of this book available at <http://www.taylorfrancis.com> has been made available under a Creative Commons Attribution Non Commercial No Derivatives 4.0 license

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

Theorien in der naturwissenschaftsdidaktischen Forschung Dirk Krüger, Ilka Parchmann, Horst Schecker, 2018-07-11 Das Buch stellt wichtige theoretische Konzepte für die naturwissenschaftsdidaktische Forschung vor Diese bilden die Grundlage für die

Herleitung naturwissenschaftsdidaktischer Fragen und Hypothesen und die Entwicklung eines Forschungsdesigns Das Buch liefert eine Basis um im Rahmen von Bachelor Master oder Promotionsarbeiten den aktuellen Forschungsstand weiter zu entwickeln Ziel ist es Nachwuchsforschern ein begriffliches Gerüst für das eigene Vorgehen zu geben Ergebniserwartungen begründbar zu machen und Ergebnisse in der Auswertung zu erklären Dem interdisziplinären Autorenteam gelingt es durch ihre Forschungserfahrung den aktuellen Wissensstand von der Theorie bis zur Anwendung profund darzulegen Durch die interdisziplinäre Herangehensweise wird der fachbergreifende Nutzen der beschriebenen Theorien besonders deutlich Das Buch ergänzt den Band Theorien in der biologiedidaktischen Forschung und steht in einer Reihe mit dem Band Methoden in der naturwissenschaftsdidaktischen Forschung

Thermal Cameras in Science Education Jesper Haglund,Fredrik Jeppsson,Konrad J. Schönborn,2022-03-15 This book presents a collection of educational research and developmental efforts on the rapidly emerging use of infrared cameras and thermal imaging in science education It provides an overview of infrared cameras in science education to date and of the physics and technology of infrared imaging and thermography It discusses different areas of application of infrared cameras in physics chemistry and biology education as well as empirical research on students interaction with the technology It ends with conclusions drawn from the contributions as a whole and a formulation of forward looking comments

Teaching Biology in Schools Kostas Kampourakis,Michael Reiss,2018-05-23 An indispensable tool for biology teacher educators researchers graduate students and practising teachers this book presents up to date research addresses common misconceptions and discusses the pedagogical content knowledge necessary for effective teaching of key topics in biology Chapters cover core subjects such as molecular biology genetics ecology and biotechnology and tackle broader issues that cut across topics such as learning environments worldviews and the nature of scientific inquiry and explanation Written by leading experts on their respective topics from a range of countries across the world this international book transcends national curricula and highlights global issues problems and trends in biology literacy

Handbook of Research on Science Education Norman G. Lederman,Dana L. Zeidler,Judith S. Lederman,2023-03-17 Volume III of this landmark synthesis of research offers a comprehensive state of the art survey highlighting new and emerging research perspectives in science education Building on the foundations set in Volumes I and II Volume III provides a globally minded up to the minute survey of the science education research community and represents the diversity of the field Each chapter has been updated with new research and new content and Volume III has been further developed to include new and expanded coverage on astronomy and space education epistemic practices related to socioscientific issues design based research interdisciplinary and STEM education inclusive science education and the global impact of nature of science and scientific inquiry literacy As with the previous volumes Volume III is organized around six themes theory and methods of science education research science learning diversity and equity science teaching curriculum and assessment and science teacher education Each chapter presents an integrative review of the research on the topic it addresses pulling

together the existing research working to understand historical trends and patterns in that body of scholarship describing how the issue is conceptualized within the literature how methods and theories have shaped the outcomes of the research and where the strengths weaknesses and gaps are in the literature Providing guidance to science education faculty scholars and graduate students and pointing towards future directions of the field Handbook of Research on Science Education Research Volume III offers an essential resource to all members of the science education community **Teaching Primary Science Constructively** Keith Skamp,Christine Preston,2017-09-05 Teaching Primary Science Constructively helps readers to create effective science learning experiences for primary students by using a constructivist approach to learning This best selling text explains the principles of constructivism and their implications for learning and teaching and discusses core strategies for developing science understanding and science inquiry processes and skills Chapters also provide research based ideas for implementing a constructivist approach within a number of content strands Throughout there are strong links to the key ideas themes and terminology of the revised Australian Curriculum Science This sixth edition includes a new introductory chapter addressing readers preconceptions and concerns about teaching primary science Teaching Primary Science Constructively Keith Skamp,Christine Preston,Contributing Authors,2020-09-16 Teaching Primary Science Constructively helps readers to create effective science learning experiences for primary students by using a constructivist approach to learning This bestselling text explains the principles of constructivism and their implications for learning and teaching It also discusses core strategies for developing science understanding and science inquiry processes and skills Chapters provide research based ideas for implementing a constructivist approach within a number of content strands Throughout there are strong links to the key ideas themes and terminology of the revised Australian Curriculum Science

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