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METAPHOR AND ANALOGY IN SCIENCE EDUCATION

Edited by
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Metaphor And Analogy In Science Education

**John K. Gilbert, Miriam Reiner, Mary
Nakhleh**



Metaphor And Analogy In Science Education:

Metaphor and Analogy in Science Education Peter J. Aubusson, Peter Aubusson, Allan G. Harrison, Steve Ritchie, 2006 This book brings together powerful ideas and new developments from internationally recognised scholars and classroom practitioners to provide theoretical and practical knowledge to inform progress in science education This is achieved through a series of related chapters reporting research on analogy and metaphor in science education Throughout the book contributors not only highlight successful applications of analogies and metaphors but also foreshadow exciting developments for research and practice Themes include metaphor and analogy best practice as reasoning for learning applications in teacher development in science education research philosophical and theoretical foundations Accordingly the book is likely to appeal to a wide audience of science educators classroom practitioners student teachers teacher educators and researchers

Conceptual metaphor and embodied cognition in science learning Tamer Amin, Fredrik Jeppsson, Jesper Haglund, 2018-10-03 Scientific concepts are abstract human constructions invented to make sense of complex natural phenomena Scientists use specialised languages diagrams and mathematical representations of various kinds to convey these abstract constructions This book uses the perspectives of embodied cognition and conceptual metaphor to explore how learners make sense of these concepts That is it is assumed that human cognition including scientific cognition is grounded in the body and in the material and social contexts in which it is embedded Understanding abstract concepts is therefore grounded via metaphor in knowledge derived from sensory and motor experiences arising from interaction with the physical world The volume consists of nine chapters that examine a number of intertwined themes how systematic metaphorical mappings are implicit in scientific language diagrams mathematical representations and the gestures used by scientists how scientific modelling relies fundamentally on metaphor and can be seen as a form of narrative cognition how implicit metaphors can be the sources of learner misconceptions how conceptual change and the acquisition of scientific expertise involve learning to coordinate the use of multiple implicit metaphors and how effective instruction can build on recognising the embodied nature of scientific cognition and the role of metaphor in scientific thought and learning The volume also includes three extended commentaries from leading researchers in the fields of cognitive linguistics the learning sciences and science education in which they reflect on theoretical methodological and pedagogical issues raised in the book This book was originally published as a special issue of the International Journal of Science Education

The World of Science Education, 2009-01-01 Each volume in the 7 volume series The World of Science Education reviews research in a key region of the world These regions include North America South and Latin America Asia Australia and New Zealand Europe and Israel North Africa and the Middle East and Sub Saharan Africa The focus of this Handbook is on Australasia a region loosely recognized as that which includes Australia and New Zealand plus nearby Pacific nations such as Papua New Guinea Solomon Islands Fiji Tonga Vanuatu and the Samoan islands science education and the scholarship that

most closely supports this program The reviews of the research situate what has been accomplished within a given field in Australasian rather than international context The purpose therefore is to articulate and exhibit regional networks and trends that produced specific forms of science education The thrust lies in identifying the roots of research programs and sketching trajectories focusing the changing face of problems and solutions within regional contexts The approach allows readers review what has been done and accomplished what is missing and what might be done next

Visualization: Theory and Practice in Science Education John K. Gilbert, Miriam Reiner, Mary Nakhleh, 2007-12-05 External representations pictures diagrams graphs concrete models have always been valuable tools for the science teacher This book brings together the insights of practicing scientists science education researchers computer specialists and cognitive scientists to produce a coherent overview It links presentations about cognitive theory its implications for science curriculum design and for learning and teaching in classrooms and laboratories

Science Education at the Nexus of Theory and Practice, 2008-01-01 This book is a compilation of papers from the inaugural International Science Education Conference held at the National Institute of Education Singapore The title Science Education at the Nexus of Theory and Practice reflects a pressing yet ongoing concern worldwide to integrate theory and practice in science education and the reader will find something of interest to both science education practitioners and researchers The editors have decided to engage in written dialogue before each of the three sections to enrich the experience Divided into three key sections A Concepts conceptual change and science learning B science teacher development and learning and C access to science accessible science the 19 chapters will engender food for thought and in all likelihood transform classroom practices All the contributors here provide important insights into the diverse education systems cultural backgrounds and societal norms through which science education can be realized

How Metaphors Guide, Teach and Popularize Science Anke Beger, Thomas H. Smith, 2020-04-22 Metaphors are essential to scientists themselves and strongly influence science communication Through careful analyses of metaphors actually used in science texts recordings and videos this book explores the essential functions of conceptual metaphor in the conduct of science teaching of science and how scientific ideas are promoted and popularized With an accessible introduction to theory and method this book prepares scientists science teachers and science writers to take advantage of recent shifts in metaphor theories and methods Metaphor specialists will find theoretical issues explored in studies of bacteriology cell reproduction marine biology physics brain function and social psychology We see the degree of conscious or intentional use of metaphor in shaping our conceptual systems and constraining inferences Metaphor sources include social structure embodied experience abstract or mathematical formulations The results are sometimes innovative hypotheses and robust conclusions other times pedagogically useful if inaccurate stepping stones or at worst misleading fictions As of January 2023 this e book is freely available thanks to the support of libraries working with Knowledge Unlatched

Concepts of Matter in Science Education Georgios Tsaparlis, Hannah Sevan, 2013-07-09 Bringing together a wide collection of ideas reviews

analyses and new research on particulate and structural concepts of matter Concepts of Matter in Science Education informs practice from pre school through graduate school learning and teaching and aims to inspire progress in science education The expert contributors offer a range of reviews and critical analyses of related literature and in depth analysis of specific issues as well as new research Among the themes covered are learning progressions for teaching a particle model of matter the mental models of both students and teachers of the particulate nature of matter educational technology chemical reactions and chemical phenomena chemical structure and bonding quantum chemistry and the history and philosophy of science relating to the particulate nature of matter The book will benefit a wide audience including classroom practitioners and student teachers at every educational level teacher educators and researchers in science education If gaining the precise meaning in particulate terms of what is solid what is liquid and that air is a gas were that simple we would not be confronted with another book which while suggesting new approaches to teaching these topics confirms they are still very difficult for students to learn Peter Fensham Emeritus Professor Monash University Adjunct Professor QUT from the foreword to this book

Science and Religion in Education Berry Billingsley, Keith Chappell, Michael J. Reiss, 2019-11-06 This book brings together the latest research in education in relation to science and religion Leading international scholars and practitioners provide vital insights into the underlying debates and present a range of practical approaches for teaching Key themes include the origin of the universe the theory of evolution the nature of the human person the nature of science and Artificial Intelligence These are explored in a range of international contexts The book provides a valuable resource for teachers students and researchers in the fields of education science religious education and the growing specialist field of science and religion Science and Religion in Education is a compelling read for current and future generations of academic researchers and teachers who wish to explore the fascinating intersect between science education and religious studies The research findings and insights presented by these international scholars offer new dimensions on contemporary practice Vaille Dawson Professor of Science Education University of Western Australia Science and Religion in Education offers a fascinating and diverse collection of chapters surveying the current state of thinking about how science and religion can be understood in education The book offers a wealth of thought provoking material for anyone interested in the natures of science and religion their relationships or their representation within the curriculum Professor Keith Taber University of Cambridge Science education and religious education are uncomfortable bedfellows This book written in part as a response to the perhaps too clear accounts of Ian Barbour provides suitably nuanced pictures of how science and religion are dealt with in schools Whatever the views of specialists young people receive an education in both science and religion hearing their voices is refreshing in such a serious academic account Julian Stern Professor of Education and Religion York St John University Humans have long endeavored to make sense of the world often using science and religion Yet these two great traditions are frequently seen as incompatible This useful volume features thoughtful contributions from experts whose work

straddles the divide and provides educators with arguments engaging strategies and historical perspectives to help build a bridge and allow a fruitful discussion in schools William F McComas Distinguished Professor of Science Education University of Arkansas Equal parts critical examination of existing models for the relationship between science and religion scholarly exposition of newer models and insights toward practical application in classrooms this book is an invaluable resource for science and religion educators If you have been thinking it is time we looked beyond Barbour s taxonomy you will want to read this book If you have not I implore you to read this book Jason Wiles Associate Professor of Biology and Science Education Syracuse University

Modelling-based Teaching in Science Education John K. Gilbert, Rosária Justi, 2016-05-30 This book argues that modelling should be a component of all school curricula that aspire to provide authentic science education for all The literature on modelling is reviewed and a model of modelling is proposed The conditions for the successful implementation of the model of modelling in classrooms are explored and illustrated from practical experience The roles of argumentation visualisation and analogical reasoning in successful modelling based teaching are reviewed The contribution of such teaching to both the learning of key scientific concepts and an understanding of the nature of science are established Approaches to the design of curricula that facilitate the progressive grasp of the knowledge and skills entailed in modelling are outlined Recognising that the approach will both represent a substantial change from the content transmission approach to science teaching and be in accordance with current best practice in science education the design of suitable approaches to teacher education are discussed Finally the challenges that modelling based education pose to science education researchers advanced students of science education and curriculum design teacher educators public examiners and textbook designers are all outlined

Studies in Science Education in the Asia-Pacific Region May May Hung Cheng, Alister Jones, Cathy Bunting, 2017-09-13 Consistent with international trends there is an active pursuit of more engaging science education in the Asia Pacific region The aim of this book is to bring together some examples of research being undertaken at a range of levels from studies of curriculum and assessment tools to classroom case studies and investigations into models of teacher professional learning and development While neither a comprehensive nor definitive representation of the work that is being carried out in the region the contributions from China Hong Kong Taiwan Korea Japan Singapore Australia and New Zealand give a taste of some of the issues being explored and the hopes that researchers have of positively influencing the types of science education experienced by school students The purpose of this book is therefore to share contextual information related to science education in the Asia Pacific region as well as offering insights for conducting studies in this region and outlining possible questions for further investigation In addition we anticipate that the specific resources and strategies introduced in this book will provide a useful reference for curriculum developers and science educators when they design school science curricula and science both pre service and in service teacher education programmes The first section of the book examines features of science learners and learning and

includes studies investigating the processes associated with science conceptual learning scientific inquiry model construction and students attitudes towards science The second section focuses on teachers and teaching It discusses some more innovative teaching approaches adopted in the region including the use of group work inquiry based instruction developing scientific literacy and the use of questions and analogies The third section reports on initiatives related to assessments and curriculum reform including initiatives associated with school based assessment formative assessment strategies and teacher support accompanying curriculum reform Using Analogies in Middle and Secondary Science Classrooms Allan G.

Harrison, Richard K. Coll, 2008 Makes a distinct contribution to science instruction Many teachers attempt to use analogies and metaphors to introduce abstract concepts however little is available on how to do this with specific examples The authors definitely address a need Douglas Llewellyn Professor of Science Education St John Fisher College Helps preservice and novice teachers use analogies and allows teachers to bridge the gap that sometimes occurs when students are learning abstract concepts The examples cover a wide variety of subjects and are written in a concise easy to understand voice John D Ophus Assistant Professor of Science Education University of Northern Iowa Use the power of analogies to enliven your science classroom and meet national standards When analogies are effective they readily engage students interest and clarify difficult and abstract ideas But not all analogies are created equal and developing them is not always intuitive Drawing from an extensive research base on the use of analogies in the classroom Allan Harrison Richard Coll and a team of science experts come to the rescue with more than 40 teacher friendly ready to use analogies for biology earth and space studies chemistry and physics The authors show teachers how and when to select analogies for instruction why certain analogies work or break down how to gauge their effectiveness and how to improve them Designed to enhance teachers presentation and interpretation of analogies through focus action and reflection FAR this guidebook includes Key science concepts explained through effective models and analogies Research findings on the use of analogies and their motivational impact Guidelines that allow teachers and students to develop their own analogies Numerous visual aids science vignettes and anecdotes to support the use of analogies Linked to NSTA standards Using Analogies in Middle Secondary Science Classrooms will become a much used text by teachers who want to enrich inquiry based science instruction **Narrative**

and Metaphor in Education Michael Hanne, Anna A. Kaal, 2018-12-07 Human beings rely equally on narrative or storytelling and metaphor or analogy for making sense of the world Narrative and Metaphor in Education integrates the two perspectives of narrative and metaphor in educational theory and practice at every level from pre school to lifelong civic education Bringing together outstanding educational researchers the book interweaves for the first time the rich strand of current research about how narrative may be used productively in education with more fragmentary research on the role of metaphor in education and invites readers to look both ways The book consists of research by 40 academics from many countries and disciplines describing and analysing the intricate connections between narrative and metaphor as they

manifest themselves in many fields of education including concepts of education teacher identity and reflective practice teaching across cultures teaching science and history using digital and visual media in teaching fostering reconciliation in a postcolonial context special needs education civic and social education and educational policy making It is unique in combining study of the narrative perspective and the metaphor perspective and in exploring such a comprehensive range of topics in education Narrative and Metaphor in Education will be of great interest to academics and researchers in the fields of education and educational policy as well as teacher educators practising and future teachers It will also appeal to psychologists sociologists applied linguists and communications specialists

Learning from Animations in Science Education Len Unsworth, 2020-11-10 This book examines educational semiotics and the representation of knowledge in school science It discusses the strategic integration of animation in science education It explores how learning through the creation of science animations takes place as well as how animation can be used in assessing student s science learning Science education animations are ubiquitous in a variety of different online sites including perhaps the most popularly accessed YouTube site and are also routinely included as digital augmentations to science textbooks They are popular with students and teachers and are a prominent feature of contemporary science teaching The proliferation of various kinds of science animations and the ready accessibility of sophisticated resources for creating them have emphasized the importance of research into various areas the nature of the semiotic construction of knowledge in the animation design the development of critical interpretation of available animations the strategic selection and use of animations to optimize student learning student creation of science animations and using animation in assessing student science learning This book brings together new developments in these research agendas to further multidisciplinary perspectives on research to enhance the design and pedagogic use of animation in school science education Chapter 1 is available open access under a Creative Commons Attribution 4.0 International License via link [springer.com](https://www.springer.com)

Teaching Science in Out-of-School Settings Junqing Zhai, 2015-09-03 This book explores pedagogical approaches used by informal science educators and botanic garden educators in particular when teaching science to visiting students 7-12 years old More specifically it draws on the sociocultural perspective of learning and highlights the importance of discourse in learning processes It examines the interactions between four botanic garden educators BGEs and their students focusing on how the students contributions to the talk are followed up on by the BGEs Moreover it includes an investigation into which kinds of teaching behaviours on the part of BGEs can best support learning

Time for Science Education Michael Matthews, 2012-12-06 The book s argument depends as do most proposals in education upon certain positions in the philosophy of education I believe that education should be primarily concerned with developing understanding with initiation into worthwhile traditions of intellectual achievement and with developing capacities for clear analytic and critical thought These have been the long accepted goals of liberal education In a liberal education students should come to know and appreciate a variety of disciplines know them at

an appropriate depth see the interconnectedness of the disciplines or the modes of thought and finally have some critical disposition toward what is being learned to be genuinely open minded about intellectual things These liberal goals are contrasted with goals such as professional training job preparation promotion of self esteem social engineering entertainment or countless other putative purposes of schooling that are enunciated by politicians administrators and educators The book s argument might be consistent with other views of education especially ones about the training of specialists sometimes called a professional view of education but the argument fits best with a liberal view of education The liberal hope has always been that if education is done well then other personal and social goods will follow The development of informed critical and moral capacities is the cornerstone for personal and social achievements **Handbook of**

Research on Science Education, Volume II Norman G. Lederman, Sandra K. Abell, 2014-07-11 Building on the foundation set in Volume I a landmark synthesis of research in the field Volume II is a comprehensive state of the art new volume highlighting new and emerging research perspectives The contributors all experts in their research areas represent the international and gender diversity in the science education research community The volume is organized around six themes theory and methods of science education research science learning culture gender and society and science learning science teaching curriculum and assessment in science 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 the 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 and graduate students and leading to new insights and directions for future research the Handbook of Research on Science Education Volume II is an essential resource for the entire science education community **Second International Handbook of Science Education** Barry Fraser, Kenneth Tobin, Campbell J.

McRobbie, 2011-12-14 The International Handbook of Science Education is a two volume edition pertaining to the most significant issues in science education It is a follow up to the first Handbook published in 1998 which is seen as the most authoritative resource ever produced in science education The chapters in this edition are reviews of research in science education and retain the strong international flavor of the project It covers the diverse theories and methods that have been a foundation for science education and continue to characterize this field Each section contains a lead chapter that provides an overview and synthesis of the field and related chapters that provide a narrower focus on research and current thinking on the key issues in that field Leading researchers from around the world have participated as authors and consultants to produce a resource that is comprehensive detailed and up to date The chapters provide the most recent and advanced thinking in science education making the Handbook again the most authoritative resource in science education **Graphic Medicine, Humanizing Healthcare and Novel Approaches in Anatomical Education** Leonard Shapiro, 2023-09-23 This

book contains subjects by authors with a fresh exciting and extensive focus within the medical humanities offering the reader chapters which include the history of medical illustration Graphic Medicine as a vehicle for the expression of humanistic dimensions of healthcare equitable and ethical medical illustrations as well as novel art based approaches in anatomical education Authors consider the role of visual narratives in medical and scientific illustration the unique affordances of the comics medium the history of comics as a form of medical and scientific visualization and the role of comics as didactic tools and as vehicles for the expression of the humanistic dimensions of healthcare A chapter considers ethical and equitable implications in global healthcare practice and highlights the work currently being undertaken to address inappropriate and problematic depictions of people in global health visualizations This will inform the reader of emerging and current thinking about visual communication and the use of images in the public domain as well as in the healthcare and education sectors Novel approaches in anatomical education include the benefits of three dimensional anatomy models made of felt visual analogies as a method to enhance students learning of histology the use of the hands for learning anatomy and visualizing anatomy through art archaeology and medicine This book will appeal to readers who have an interest in the medical humanities Graphic Medicine and ethical medical and anatomical illustrations These include academic and non academic readers medical students medical educators clinicians health care workers as well as policy makers

Research in Science Education — Past, Present, and Future Helga Behrendt, Helmut Dahncke, Reinders Duit, Wolfgang Gräber, Michael Komorek, Angela Kross, Priit Reiska, 2005-12-27 This truly international volume includes a selection of contributions to the Second Conference of the European Science Education Research Association Kiel Sept 1999 It provides a state of the art examination of science education research in Europe discusses views and visions of science education research deals with research on scientific literacy on students and teachers conceptions on conceptual change and on instructional media and lab work

[Drawing for Science Education](#) Phyllis Katz, 2017-03-23 This book argues for the essential use of drawing as a tool for science teaching and learning The authors are working in schools universities and continual science learning CSL settings around the world They have written of their experiences using a variety of prompts to encourage people to take pen to paper and draw their thinking sometimes direct observation and in other instances their memories The result is a collection of research and essays that offer theory techniques outcomes and models for the reader Young children have provided evidence of the perceptions that they have accumulated from families and the media before they reach classrooms Secondary students describe their ideas of chemistry and physics Teacher educators use drawings to consider the progress of their undergraduates understanding of science teaching and even their moral ethical responses to teaching about climate change Museum visitors have drawn their understanding of the physics of how exhibit sounds are transmitted A physician explains how the history of drawing has been a critical tool to medical education and doctor patient communications Each chapter contains samples insights and where applicable analysis techniques The chapters in this book

should be helpful to researchers and teachers alike across the teaching and learning continuum The sections are divided by the kinds of activities for which drawing has historically been used in science education An instance of observation Audubon Linnaeus A process how plants grow over time what happens when chemicals combine Conceptions of what science is and who does it Images of identity development in science teaching and learning

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Metaphor And Analogy In Science Education Introduction

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