

1. Record Nr.	UNINA9910502962503321
Titolo	The oasis
Pubbl/distr/stampa	Arizola, Arizona : , : The Oasis Publishing Company, , 1893-
ISSN	2373-2067
Descrizione fisica	1 online resource
Disciplina	071
Soggetti	Newspapers. Benson (Ariz.) Newspapers Nogales (Ariz.) Newspapers Santa Cruz County (Ariz.) Newspapers Arizona Benson Arizona Nogales Arizona Santa Cruz County
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Periodico
Note generali	Published in Benson, Ariz., May 17, 1894-Nov. 22, 1894; Nogales, Ariz., Dec. 1, 1894-Oct. 9, 1920. "An authority on mines and mining." "Devoted to Southern Arizona and Sonora."

2. Record Nr.	UNINA9910495156803321
Autore	Sokoowski Andrzej
Titolo	Understanding Physics Using Mathematical Reasoning : A Modeling Approach for Practitioners and Researchers // by Andrzej Sokolowski
Pubbl/distr/stampa	Cham : , : Springer International Publishing : , : Imprint : Springer, , 2021
ISBN	9783030802059 3030802051
Edizione	[1st ed. 2021.]
Descrizione fisica	1 online resource (208 pages)
Disciplina	530
Soggetti	Mathematics - Study and teaching Science - Study and teaching Mathematical models Mathematics Education Science Education Mathematical Modeling and Industrial Mathematics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Preface -- The Book Structure -- Contents -- Part I: Conceptual Background -- Chapter 1: Physics Constructs Viewed Through the Prism of Mathematics -- 1.1 Mathematics as an Indispensable Part of Physics Inquiry -- 1.2 Laws of Physics and Their Mathematical Embodiments -- 1.3 Principles and Their Relations to Laws -- 1.4 Theories and Laws -- 1.5 Theories and Theorems -- References -- Chapter 2: The Interface Between the Contents of Physics and Mathematics -- 2.1 Mathematics as a Language in Physics Classroom -- 2.2 Philosophy and the Substance of the Knowledge of Mathematics -- 2.3 Procedural and Conceptual Mathematical Knowledge -- 2.4 Unifying Classification of Math Knowledge Used in Physics Education -- 2.5 Arrays of Applying Mathematics in Physics -- 2.6 Search for Tools and Methods -- 2.7 Mathematical and Scientific Reasoning -- Are These Mental Actions Equivalent? -- 2.8 Synthesis of Students' Challenges with Math Knowledge Transfer -- References -- Part II: Designing Learning

Environments to Promote Math Reasoning in Physics -- Chapter 3: Modeling as an Environment Nurturing Knowledge Transfer -- 3.1 Scientific Modeling and Models -- 3.2 Modeling Cycles in Physics Education -- 3.3 Merging Mathematics and Physics Representations -- References -- Chapter 4: Proposed Empirical-Mathematical Learning Model -- 4.1 Didactical Underpinnings of the Design -- 4.2 Description of the Learning Phases -- 4.3 Hypotheses as Learners' Proposed Theories -- 4.4 Mainstream of the Inquiry and Its Confirmation -- 4.5 Methods of Enacting Mathematical Structures -- 4.6 Concluding Phases of the Learning Process -- References -- Chapter 5: Covariational Reasoning - Theoretical Background -- 5.1 Quantities, Parameters, and Variables -- 5.2 Formulas in Science and Mathematics -- 5.3 Covariational Reasoning in Mathematics Education. 5.4 Covariational Reasoning in Physics Education -- 5.4.1 Viewing Phenomena as Covariations of Their Parameters -- 5.4.2 Proposed Categories of Covariations Embedded in Physics Formulas -- 5.4.3 Discussing Covariations of Parameters in Experiments -- 5.5 Limiting Case Analysis -- 5.5.1 Evaluating Limits when the Variable Parameter Is Getting Very Large -- x -- 5.5.2 Evaluating Limits when the Variable Parameter Is Close to a Specific Value -- x_a -- 5.5.3 Is Limiting Case Analysis Really "Limiting"? -- References -- Part III: From Research to Practice -- Chapter 6: Extending the Inquiry of Newton's Second Law by Using Limiting Case Analysis -- 6.1 Limits - Tools for Extending Scientific Inquiry -- 6.2 Research Methods -- 6.2.1 Research Questions, Logistics, and Participants -- 6.2.2 Criteria for the Study Content Selection -- 6.2.3 Discussion of the Applied Algebraic Tools -- 6.3 Description of the Instructional Unit -- 6.3.1 Analyzing Acceleration of the System in the Function of Mass m_2 -- 6.3.2 Analyzing Acceleration of the System in the Function of Mass m_1 -- 6.4 Data Analysis -- 6.4.1 Analysis of the Pretest Results -- 6.4.2 Analysis of the Posttest Results -- 6.5 Conclusions -- References -- Chapter 7: Reconstructing Newton's Law of Universal Gravity as a Covariate Relation -- 7.1 Prior Research Findings -- 7.2 Theoretical Framework -- 7.2.1 Historical Perspective -- 7.2.2 Contemporary Presentations of the Law of Universal Gravity -- 7.3 Methods -- 7.4 Didactical Underpinnings of the Instructional Unit -- 7.5 The Lecture Component -- 7.5.1 Gravitational Field Intensity and the Effects of Covariate Quantities -- 7.5.2 Reconstructing the Formula to Calculate Mutual Gravitational Force -- 7.6 Analysis of Pretest - Posttest Results -- 7.6.1 Analysis of the Pretest Results -- 7.6.2 Analysis of the Posttest Results. 7.7 Conclusions and Suggestions for Further Research -- References -- Chapter 8: Parametrization of Projectile Motion -- 8.1 Prior Research Findings -- 8.2 Theoretical Framework -- 8.2.1 Categories of Motion Studied in High School and Undergraduate Physics Courses -- 8.2.2 Why Parametric Equations? -- 8.2.3 Foundations of Constructivist Learning Theory -- 8.3 Methods -- 8.3.1 Study Description and the Research Question -- 8.3.2 The Participants -- 8.3.3 Lecture Component Sequencing -- 8.3.4 Topics Embedded within the Curriculum to Enhance the Treatment -- 8.4 General Lab Description -- 8.4.1 Lab Logistics -- 8.4.2 Gathering Data to Construct Positions Functions for a Projected Object -- 8.4.3 Constructing Representations of the Position Functions -- 8.4.4 Finding Velocities and Acceleration Functions -- 8.4.5 Verification Process -- 8.5 Treatment Evaluation -- 8.6 Summary and Conclusions -- References -- Chapter 9: Reimaging Lens Equation as a Dynamic Representation -- 9.1 Introduction -- 9.2 Prompts Used for the Instructional Unit Design -- 9.2.1 Mathematical Background -- 9.2.2 Lab Equipment -- 9.2.3 Conversion of Lens Equation into a Covariational Relation -- 9.2.4

Sketching and Scientifically Interpreting the Graph of the Lens Function -- 9.2.5 Formulating Magnification Function -- 9.2.6 Merging Mathematical and Experimental Representations into One Inquiry -- 9.3 Suggested Independent Student Work -- 9.4 Summary -- References -- Chapter 10: Embracing the Mole Understanding in a Covariate Relation -- 10.1 Introduction and Prior Research Findings -- 10.2 Theoretical Framework -- 10.2.1 Weaknesses of the Mole Understanding -- 10.2.2 Proportional Reasoning, Rates, and Ratios -- 10.3 Methods -- 10.4 The Lecture Component -- 10.4.1 The Mole as a Fundamental Unit of the Substance Amount -- 10.4.2 Converting the Number of Atoms to the Units of Moles. 10.4.3 Converting Mass of Substance to Moles -- 10.4.4 Converting Mass of a Substance to the Number of Atoms -- 10.5 Pretest Posttest Analysis -- 10.5.1 Analysis of the Pretest Results -- 10.5.2 Comparisons of the Pretest and Posttest Results -- 10.6 Summary and Conclusions -- References -- Chapter 11: Enabling Covariational Reasoning in Einstein's Formula for Photoelectric Effect -- 11.1 Prior Research -- 11.2 Theoretical Background -- 11.3 Embracing the PE into the Framework of Covariational Representation -- 11.3.1 Weaknesses of the Graph of K_{MAX} Versus Photons' Frequency Presented in Physics Resources -- 11.3.2 Covariation of Photon's Energy and Frequency as a Linear Function -- 11.3.3 Electrons' Binding Energy as a Function of Photons Threshold Frequency -- 11.3.4 Maintaining a Minimum Number of Covariational Parameters During the Inquiry -- 11.4 Reassembling the PE Formula to Assure a Coherence of Representations -- 11.4.1 Graph Constructing -- 11.4.2 Finding Algebraic Representation of the Graph -- 11.4.3 Linking the Photons Threshold Frequency and the Work Function $h\nu_0 = W_0$ -- 11.5 Summary and Conclusions -- References -- Chapter 12: Are Physics Formulas Aiding Covariational Reasoning? Students' Perspective -- 12.1 Introduction and Prior Research Findings -- 12.2 Theoretical Background and Methods -- 12.2.1 Foundations of Covariation Reasoning -- 12.2.2 Study Description, Participants, Research Questions, and Evaluation Instrument -- 12.3 Data Analysis -- 12.4 Summary and Conclusions -- 12.4.1 Traditional Formula Notation Does Not Aid Covariational Reasoning in Physics -- 12.4.2 Physics Depends on the Mathematical Rules and Notation -- References -- Chapter 13: Adaptivity of Mathematics Representations to Reason Scientifically Students' Perspective -- 13.1 Prior Research Findings. 13.2 Theoretical Framework, Research Questions, and Study Logistics -- 13.3 Study Instrument -- 13.3.1 General Characteristics of the Treatment: How Did Covariational Reasoning Emerge? -- 13.3.2 Actions Taken to Exercise Covariation Model Using Laboratory -- 13.4 Data Analysis -- 13.5 Summary and Conclusions -- References -- Teaching Physics Using Mathematical Reasoning -- Research and Practice -- Index.

Sommario/riassunto

This book speaks about physics discoveries that intertwine mathematical reasoning, modeling, and scientific inquiry. It offers ways of bringing together the structural domain of mathematics and the content of physics in one coherent inquiry. Teaching and learning physics is challenging because students lack the skills to merge these learning paradigms. The purpose of this book is not only to improve access to the understanding of natural phenomena but also to inspire new ways of delivering and understanding the complex concepts of physics. To sustain physics education in college classrooms, authentic training that would help develop high school students' skills of transcending function modeling techniques to reason scientifically is needed and this book aspires to offer such training The book draws on

current research in developing students' mathematical reasoning. It identifies areas for advancements and proposes a conceptual framework that is tested in several case studies designed using that framework. Modeling Newton's laws using limited case analysis, Modeling projectile motion using parametric equations and Enabling covariational reasoning in Einstein formula for the photoelectric effect represent some of these case studies. A wealth of conclusions that accompany these case studies, drawn from the realities of classroom teaching, is to help physics teachers and researchers adopt these ideas in practice.
