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Nota di contenuto	Preface -- Acknowledgements -- The Concept of Invariance and Change: Theoretical Background -- Understanding Phenomena from the Aspect of Invariance and Change -- The Concept of Invariance and Change in the Mathematical Knowledge of Students -- The Basic Interplay between Invariance and Change -- Some Introductory Activities in Invariance and Change -- References -- Invariant Quantities – What Is Invariant and What Changes? -- Introduction: Understanding the Invariance of Quantity as a Basis for Quantitative Thinking -- Activity 2.1: Dividing Dolls between Two Children -- Mathematic and Didactic Analysis of Activity 2.1: Partitioning a Set into Two Subsets: Posing Problems and Partition Methods -- Activity 2.2: How to Split a Fraction. Almost Like Ancient Egypt -- Mathematic and Didactic Analysis of Activity 2.2: Invariance of Quantity and Splitting of Unit Fractions -- Activity 2.3: They Are All Equal, But … -- Mathematic and Didactic Analysis of Activity 2.3: From Equal Addends to

Consecutive Addends -- Activity 2.4: Expressing a Natural Number as Infinite Series -- Suggestions for Further Activities -- References -- The Influence of Change -- Introduction: Changes in Quantity and Comparing Amounts -- Activity 3.1: Less or More? -- Mathematical and Didactic Analysis of Activity 3.1: The influence That a Change in One Operand Has on the Value of an Arithmetical Expression -- Activity 3.2: Plus How Much or Times How Much? -- Mathematical and Didactic Analysis of Activity 3.2: Different Ways of Comparing -- Activity 3.3: Markups, Markdowns and the Order of Operations -- Mathematical and Didactic Analysis of Activity 3.3: Repeated Changes in Percentages -- Activity 3.4: Invariant or Not? -- Mathematical and Didactic Analysis of Activity 3.4: Products and Extremum Problems -- Activity 3.5: What Is the Connection between Mathematical Induction and Invariance and Change? -- Mathematical and Didactic Analysis of Activity 3.5: What Is the Connection between Mathematical Induction and Invarianceand Change? -- Suggestions for Further Activities -- References -- Introducing Change for the Sake of Invariance -- Introduction: Algorithms – Introducing Change for the Sake of Invariance -- Activity 4.1: The “Compensation Rule”: What Is It? -- Mathematical and Didactic Analysis of Activity 4.1: Changes in the Components of Mathematical Operations That Ensure the Invariance of the Result -- Activity 4.2: Divisibility Tests -- Mathematical and Didactic Analysis of Activity 4.2: Invariance of Divisibility and Composing of Divisibility Tests -- Activity 4.3: Basket Configuration Problems -- Mathematical and Didactic Analysis of Activity 4.3: Diophantine Problems and Determining the Change and Invariance -- Activity 4.4: Product = Sum? -- Mathematical and Didactic Analysis for the Activities in 4.4: Invariance as a Constraint -- Suggestions for Further Activities -- References -- Discovering Hidden Invariance -- Introduction: Discovering Hidden Invariance as a Way of Understanding Various Phenomena -- Activity 5.1: How to Add Numerous Consecutive Numbers -- Mathematical and Didactic Analysis of Activity 5.1: The Arithmetic Series: Examples of Use of the Interplay between Change and Invariance in Calculations -- Activity 5.2: Solving Verbal Problems: Age, Speed, and Comparing the Concentrations of Chemical Solutions -- Mathematic and Didactic Analysis of Activity 5.2: Solving Verbal Problems by Discovering the Hidden Invariance -- Activity 5.3: Mathematical Magic – Guessing Numbers -- Mathematical and Didactic Analysis of Activity 5.3: Discovering the Invariant in Mathematical “Tricks”: “Guessing Numbers” -- Activity 5.4: “Why Can’t I Succeed?” -- Mathematical and Didactic Analysis of Activity 5.4: Discovering the Hidden Invariance in “Why Can’t I Succeed?” -- Suggestions for Further Activities -- References -- Change and Invariance in Geometric Shapes -- Introduction: Invariance and Change in the World of Geometry -- Activity 6.1: Halving in Geometry – Splitting Shapes -- Mathematical and DidacticAnalysis of Activity 6.1: Invariance and Change When Dividing Polygons -- Activity 6.2: What Can One Assemble from Two Triangles? -- Mathematical and Didactic Analysis of Activity 6.2: Invariance and Change When Constructing Polygons from Triangles -- Activity 6.3: How Can a Parallelogram Change? -- Mathematical and Didactic Analysis of Activity 6.3: Invariance and Change of Dimensions in the Set of Parallelograms -- Activity 6.4: Identical Perimeters -- Mathematical and Didactic Analysis of Activity 6.4: Preserving the Perimeter -- Summary of the Roles of Invariance and Change in Geometrical Shapes -- Suggestions for Further Activities -- References.

Sommario/riassunto

"What is the connection between finding the amount of acid needed to reach the desired concentration of a chemical solution, checking divisibility by a two-digit prime number, and maintaining the perimeter

of a polygon while reducing its area? The simple answer is the title of this book. The world is an interplay of variation and constancy – a medley of differences and similarities – and this change and invariance is, largely, a language of science and mathematics. This book proposes a unique approach for developing mathematical insight through the perspective of change and invariance as it applies to the properties of numbers and shapes. After a short introductory chapter, each of the following chapters presents a series of evolving activities for students that focus on a specific aspect of interplay between change and invariance. Each activity is accompanied by detailed mathematical explanations and a didactic discussion. The assignments start with tasks familiar from the school curriculum, but progress beyond the menial to lead to sophisticated generalizations. Further activities are suggested to augment the chapter's theme. Some examples: "How to represent all the integers from zero to 1000 using ten fingers?", "How to win at the game of Nim?", "Why do different square lattice polygons with the same area often have the same perimeter?" This book can be used as a textbook for pre-service mathematics teachers and is primarily intended for their academic instructors. Essentially, students, teachers and anyone interested in elementary mathematics will enjoy the elegant solutions provided for the plethora of problems in elementary mathematics through the systematic approach of invariance and change.".