1. Record Nr. UNINA9910483607303321

| | |
|---|---|
| Titolo | Applying bio-measurements methodologies in science education research / / Iztok Devetak, Sasa Aleksij Glazar, editors |
| Pubbl/distr/stampa | Cham, Switzerland : , : Springer, , [2021]<br>©2021 |
| ISBN | 3-030-71535-3 |
| Descrizione fisica | 1 online resource (318 pages) |
| Disciplina | 507.1 |
| Soggetti | Science - Study and teaching - Research<br>Electronic books. |
| Lingua di pubblicazione | Inglese |
| Formato | Materiale a stampa |
| Livello bibliografico | Monografia |
| Nota di contenuto | Intro -- Preface -- Contents -- Editors and Contributors -- 1 Cognitive Processes and Eye-Tracking Methodology -- Introduction -- Use of Authentic Tasks with Different Levels of Science Concept Representation in Teaching -- Cognitive Factors of Problem-Solving Performance in Science -- Methods for Monitoring How Authentic Science Problems Are Solved -- Eye-Tracking Features as Indicators for Cognitive Processes -- Issues in Eye-Tracking Experiments -- A Case Study -- Method -- Sample -- Instruments -- Selection of Participants for the Case Study -- Results and Discussion -- Conclusions and Implications for Education -- References -- 2 The Interplay of Motivation and Cognition: Challenges for Science Education Research and Practice -- Motivation in Learning -- The Relationship Between Motivation and Attention in Learning -- Early Development of Motivation -- Neural System of Motivation -- Self-Determination in Learning -- Challenges in Learning and Teaching Science: Examples of Potential Problems in Learning Motivation -- Learned Helplessness -- Developmental Dyslexia -- The Development of Visual Attention -- Conclusions and Implications -- References -- 3 Predicting Task Difficulty Through Psychophysiology -- Introduction -- Methods -- Participants -- Task -- Measuring Protocol -- Instrumentation -- Signal Processing -- Results -- Self-Reports on Perceived Difficulty -- Choosing Parameter's Best Features -- Choosing the Best Parameter -- |

Discussion -- References -- 4 The Role of the Explanatory Key in Solving Tasks Based on Submicroscopic Representations -- Introduction -- The Context and the Purpose of the Study -- Method -- Sample -- Instruments -- Data Collection and Analysis -- Results and Discussion -- Conclusion -- References.
5 Investigating the Role of Conceptual Understanding on How Students Watch an Experimental Video Using Eye-Tracking -- Introduction -- Method -- Participants -- Procedure and Data Collection -- Data Analysis -- Results -- Discussion and Conclusion -- References -- 6 Using an Eye-Tracker to Study Students' Attention Allocation When Solving a Context-Based Problem on the Sublimation of Water -- Introduction -- Learning the Triple Nature of Chemical Concepts -- Understanding the Particle Representations of Chemical Concepts -- Eye-Tracking Measurements -- Aims and Research Questions -- Method -- Participants -- Instrument and Procedures -- Context-Based Problem of Sublimation of Water -- Eye-Tracking Apparatus -- Data Collection -- Data Analysis -- Results and Discussion -- Differences in Visual Attention on the AOIs -- Average Pupil Size in Relation to Cognitive Load -- Conclusions and Implications -- Differences in Attention Allocation on the AOIs -- Differences in Average Pupil Size and Cognitive Load of Defining the Problem -- Limitations of the Research -- Implications for the Educational Process -- Further Research -- References -- 7 Using an Eye-Tracking Approach to Explain Students' Achievements in Solving a Task About Combustion by Applying the Chemistry Triplet -- Introduction -- Understanding Chemical Reaction in the Context of the Chemistry Triplet -- Eye Movement Measurements in Chemical Education Research -- Research Problem and Research Questions -- Method -- Participants -- Instruments -- Pre-knowledge Achievement Test -- The Context-Based Natural Gas Combustion Exercise -- Test of Logical Thinking -- Science Motivation Questionnaire -- Visualisation Ability Test -- Test of Working Memory Capacity -- Research Design -- Results and Discussion -- Conclusions -- References.
8 Pre-service Teachers' Determination of Butterflies with Identification Key: Studying Their Eye Movements -- Introduction -- Skills of Observation -- Identification Keys -- Eye-Tracking Technique -- Research Problem and Research Questions -- Method -- Participants -- Procedure and Instruments -- Data Analysis -- Results -- Discussion -- Conclusion -- References -- 9 Case Processing in the Development of Expertise in Life Sciences-What Can Eye Movements Reveal? -- Introduction -- Cases in Supporting the Development of Adaptive Expertise in Learning of Life Sciences -- Eye Movements in Investigating Professional Development in Life Sciences -- Study 1: Examining the Effect of the Level of Expertise on Case Processing -- Study 2: Students' Processing of a Non-routine Case and Its Relationship to the Level of Their Basic Biological Knowledge -- Educational and Methodological Implications for Higher Education -- Conclusions -- References -- 10 Analysis of Aspects of Visual Attention When Solving Multiple-Choice Science Problems -- Introduction -- Aim of This Study -- Method -- Participants -- Procedure -- Task -- Results and Discussion -- Remarks on Data Analysis Methodology -- General Results as Per Provided Answers -- General Results for Visual Attention Measured by Dwell Time -- Maximum Average Dwell Time Versus Chosen Answer-A General Tendency -- Maximum Dwell Time Versus Chosen Answer in Groups at Different Levels of Expertise -- Strategy of Eliminating Wrong Answers (Expert P62)-Inverted Maximum -- Strategy of Eliminating Wrong Answers (Expert P21)-Cognitive Load While Making Decision --

Cognitive Load Associated with Need to Indicate Incorrect Answer During Decision-Making Process (Expert P59) -- Strategy of Singling Out Answer A and Then Verifying It (Expert P104) -- Disrupted Tendency Caused by Precariousness.
Singling Out the Correct Answer Without Verification-Strong Conviction of Correctness (P43) -- Answering by Chance (P77) -- Conclusions -- Remarks on General Answers -- General Tendency on Dependence Between Visual Attention and Chosen Option Based on Average Data -- Significant Differences in General Tendency for Participants of Various Scientific Expertise: Experts, University Students, and Secondary School Students -- Highlighting Different Strategies and Approaches for Solving Tasks and Their Impact on Compatibility, Change, or Inversion of Trend Described in Section General Tendency on Dependence Between Visual Attention and Chosen Option Based on Average Data -- Importance of Long Fixations -- References -- 11 The Impact of Students' Educational Background, Formal Reasoning, Visualisation Abilities, and Perception of Difficulty on Eye-Tracking Measures When Solving a Context-Based Problem with Submicroscopic Representation -- Introduction -- Aims and Research Questions -- Method -- Participants -- Instruments -- Context-Based Problem About the Process of Opening a Bottle of Mineral Water -- Test of Logical Thinking -- Visualisation Ability Test -- Eye-Tracking Apparatus -- Data Collection -- Data Analysis -- Results and Discussion -- Eye-Tracker Measures Among Students of Different Levels of Education -- Eye-Tracker Measures Among Students' Perceived Task Difficulty -- Eye-Tracker Measures Among Students of Different Levels of Logical Thinking and Visualisation Abilities -- Conclusions -- Limitations of This Research -- Implications for the Educational Process -- Further Research Guidelines -- References -- 12 Students' Understanding of Diagrams in Different Contexts: Comparison of Eye Movements Between Physicists and Non-physicists Using Eye-Tracking -- Introduction -- Research Questions -- Methods -- Participants -- Materials -- Apparatus.
Procedure -- Results -- Students' Scores -- Physics Vs. Non-physics Students -- Dwell Times -- Attentional Distribution on Quantitative Area Question -- Attentional Distribution of Qualitative Slope Questions -- Discussion -- Discussion of Scores -- Discussion of Students' Visual Attention Using Dwell Time Analysis -- Analysis of Visual Attention Distribution on the Graphs: Success and Failure of Transfer -- Conclusion -- References -- 13 Task-Evoked Pupillary Responses in Context of Exact Science Education -- Introduction -- Short Characteristics of Eye Movements -- Pupillometry -- Pupillometric Hypotheses -- Methodology -- Results -- Discussion -- Conclusions -- References -- 14 An Investigation of Visual and Manual Behaviors Involved in Interactions Between Users and Physics Simulation Interfaces -- Introduction -- Research Questions -- Methodology -- Participants -- Simulation -- Pretest -- Apparatus -- Data Collection Procedure -- Data Analysis -- Eye-Movement Indices -- Log Data Analysis -- Lag Sequential Analysis -- Heat Map Analysis -- Results -- RQ1: How Did Students with Different Learning Performance Distribute Their Visual Attention While Manipulating the Simulation? -- Log Data Analysis -- Heat Map Comparison -- RQ2: Did Students with Different Learning Performance Have Different Visual and Manual Behavioral Patterns? -- Discussion and Conclusion -- References -- 15 Visualizing Student Navigation of Geologic Block Diagrams -- Introduction -- Relevant Work in Geoscience Education Research -- Eye-Tracking in the Geosciences -- Methods -- Participants -- Experimental Design and Instrumentation -- Data Analysis -- Results -- Discussion