# The list of proposed chapters to be included in the
# International Handbook of Physics Education Research

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## Volume 1: Learning Physics

0.0 Introduction (M. Fatih Taşar & Paula Heron)

**Section 1: Subject Matter Learning**
***(Sec. Ed.: Marisa Michelini)***
***Chapters:***

1.1. Force & motion (incl. momentum)
1.2. Electricity and magnetism
1.3. Optics
1.4. Sound & Waves
1.5. Thermal physics
1.6. Energy
1.7. Astronomy
1.8. Quantum physics
1.9. Relativity
1.10. Nuclear physics & Radioactivity
1.11. Fluids in equilibrium and hydrodynamics

**Section 2: Cognitive and Affective Aspects of Physics Learning**
***(Sec. Ed.: Shulamit Kapon)***
***Chapters:***

2.1. Physics Learners: Who are they? (incl. individual differences, dispositions)
2.2. Cognitive learning principles applied to physics: e.g., Implicit learning, Explicit learning, Meaningful learning, Associative learning, Non-associative learning (habituation and sensitization), Cooperative and collaborative learning, Discovery learning, Emotional learning, Experiential learning, Receptive learning, Observation or imitation learning, Rote learning
2.3. Higher order learning: Fostering creative thinking, critical thinking, reasoning skills, education of the gifted, 21st century skills
2.4. Conceptual Learning (Concepts, Preconceptions, Misconceptions, Alternative Conceptions, and Conceptual Change)
2.5. Learning Problem Solving in Physics (incl. expert-novice differences in knowledge use)
2.6. Other theoretical perspectives: Resources, ontological classification, Dual-process theories, mental models, communities of practice, metaphors, framing.
2.7. Metacognition and self-regulation in physics learning
2.8. Student interest, attitudes, motivation, (also values, beliefs, and opinion) towards learning physics
2.9. Self-efficacy beliefs
2.10. Physics Identity

# Volume 2: Teaching Physics

**Section 3: Physics Teaching**
***(Sec. Ed.: Edit Yerushalmi & Bet Sheva Eylon)***
***Chapters:***

3.1. Curriculum Perspectives (incl. order of concept introduction)
3.2. Strategies, Methods, and Techniques (including Constructivism)
3.3. Teaching for Conceptual Change – instructional strategies that foster conceptual change
3.4. Physics Teaching Practices
3.5. Constructivism
3.6. Argumentation
3.7. Instructional Design
3.8. Inquiry teaching
3.9. Physics in Integrated STEM Education
3.10. Implementing Active learning strategies (incl. The Modeling Method, Peer Instruction)
3.11. Physics and other disciplines: Engineering, mathematics, chemistry, biology, astronomy
3.12. Teaching physics to the disabled

**Section 4: Educational Technologies in Physics Teaching**
***(Sec. Ed.: Sarantos Psycharis)***
***Chapters:***

4.1. Educational Technologies (incl. microcomputers, Multimedia & ICT)
4.2. Representations in physics (e.g., pictures, videos, models, analogies, metaphors, simulations, and animations)
4.3. Teaching and Learning in Online/Virtual Environments, Innovative Game-Based Learning Approaches (+Virtual reality, augmented reality), AI, etc.
4.4. TPACK in Physics Teacher Education

**Section 5: Physics Teaching Environments**
***(Sec. Ed.: Eugenia Etkina & Eric Brewe)***
***Chapters:***

5.1. Holistic physics learning environments
5.2. Setting-specific physics learning environments
5.3. Lab-based physics learning environments
5.4. Out-of-school physics learning environments
5.5. Virtual learning environments

**Section 6: Physics Teacher Education**
***(Sec. Ed.: Eilish McLoughlin)***
***Chapters:***

6.1. Pre-service Physics Teacher Education
6.2. Models of Physics Teacher Education: International Perspectives
6.3. Physics Teacher Professional Development
6.4. Characterizing physics teachers – Teacher Competencies
6.5. Development of Pedagogical Physics Knowledge as PCK

**Section 7: Assessment of Student Learning in Physics**
***(Sec. Ed.: Feral Ogan Bekiroğlu & Mehmet Fatih Taşar )***
***Chapters:***

7.1. Conceptual tests
7.2. Multiple choice tests
7.3. High stakes exams
7.4. Formative Assessment
7.5. Summative Assessment
7.6. Assessment of Practical Work
7.7. Alternative Assessment Techniques and Strategies (free writing, portfolios, peer assessment, self-assessment)
7.8. Assessment in Distance/On-line Education and Computer Assisted Assessment
7.9. Assessment of Effectiveness of Teaching, Program Assessment
7.10. Factors in student achievement in physics

**Section 8: Equity: Gender, race, ethnicity**
***(Sec. Ed.: Geraldine Cochran)***
***Chapters:***

8.1. Culture
8.2. Gender
8.3. Race
8.4. Ethnicity
8.5. Immigrants/refugees

## Volume 3: Physics Education Research Special Topics

**Section 9: History and Philosophy of Physics in Physics Teaching**
***(Sec. Ed.: Peter Heering, Cibelle Celestino Silva & Don Metz)***
***Chapters:***

9.1. Foreword (Celestino Silva, Heering and Metz)
9.2. Physics as a Human Endeavour
9.3. The Role of Physic Education for Scientific Literacy
9.4. Physics and Socio-Scientific Issues
9.5. Aims and Values of Physics
9.6. The Nature and Structure of Physics Knowledge
9.7. Methods and Practices in Physics
9.8. Epistemic Beliefs and Physics Teacher Education
9.9. Learning and Teaching About Philosophy of Physics
9.10. Methodological Approaches towards implementing HPS in Physics Education
9.11. Epilogue (Celestino Silva, Heering and Metz)

**Section 10: Physics textbooks**
***(Sec. Ed.: Marika Kapanadze & Gabriela Jonas Ahrend)***
***Chapters:***

10.1. Expectations from Physics Textbooks
10.2. Textbook and Curriculum Alignment
10.3. Physics Textbook Content Analysis (High School, University)
10.4. Evaluation of Physics Textbooks

**Section 11: Mathematics in teaching and learning physics**
***(Sec. Ed.: Gesche Pospiech)***
***Chapters:***
11.1. Role and Importance of Mathematics in Physics Education (Working Title)
11.2. Interplay between Physics Knowledge and Mathematics in Physics Education (working title)
11.3. Graphics
11.4. Visualization and mathematization: The role of digital technologies (working title)

**Section 12: Physics Education Research**
***(Sec. Ed.: David Meltzer)***
***Chapters:***
12.1. Methodologies in PER
12.2. Foci, Issues and Problems in PER
12.3. PER as Part of Science and Mathematics Education
12.4. Qualitative methods, Video analysis, Interviews, Student artifacts
12.5. Quantitative methods
12.6. Learning process/progress studies

**Section 13:**
***Chapter author(s):***
13.1. Past, Present, and Future of Secondary School and University Level Physics Education
*(perhaps in the form of a sort of epilogue, but still a literature review together with insightful comments)*