Syllabus

Course Description

Course Title	Didactics of Physics
Course Code	82047
Course Title Additional	
Scientific-Disciplinary Sector	PHYS-06/B
Language	Italian
Degree Course	University course for initial training of secondary school teachers in the Italian language - 60CP
Other Degree Courses (Loaned)	
Lecturers	Prof. a contratto dr. Leonardo Colletti, Leonardo.Colletti@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/3425
Teaching Assistant	
Semester	Second semester
Course Year/s	1
CP	2
Teaching Hours	18
Lab Hours	0
Individual Study Hours	57
Planned Office Hours	0
Contents Summary	Main physics topics in the curriculum
Course Topics	The course addresses the theoretical, epistemological, and methodological foundations of teaching physics in upper secondary school, with particular reference to academic-track high schools. A central axis of the course is the reflection on the dual nature of physics: on the one hand as a method of inquiry into reality, based on modeling, formalization, and empirical verification; on the other as an essential component of scientific culture, in dialogue with history, philosophy, and other disciplines. This perspective informs

	instructional choices and the design of learning pathways in the different high school tracks. The topics covered include: Foundations of discipline-specific physics education and the main teaching–learning models. Elements of epistemology and history of physics relevant for teaching. Main findings of research in physics education, with particular reference to the study of students' spontaneous conceptions and their development. Established tools and results will be discussed, such as the Force Concept Inventory and other conceptual assessments, as well as relevant contributions from international research (for example, those of Carl Wieman on active learning and the effectiveness of interactive methodologies). Analysis of learning difficulties and of the main student misconceptions across different areas of physics. Didactic transposition of the contents of classical physics (mechanics, thermodynamics, electromagnetism, optics) and modern physics (relativity, quantum mechanics). Comparison of different teaching approaches: transmissive, constructivist, inquiry-based, and problem-based learning. The role of language in physics: conscious use of scientific language, transition from everyday language to formal language, and acquisition of figurative language (models, analogies, metaphors) as cognitive tools. The role of representations (graphs, models, mathematization) in learning processes. Assessment of learning: functions (diagnostic, formative, summative), tools, and criteria. Reflection on the school system and on the role of physics in the different high school tracks: differences in aims, levels of formalization required, and the educational meaning of the discipline in different contexts. Physics as method and physics as culture: implications for teaching, for content selection, and for the design of interdisciplinary pathways.
Keywords	didactic transposition; culture of physics; didactic choice; didactic

	methodology
Recommended Prerequisites	
Propaedeutic Courses	
Teaching Format	The course is carried out through: Interactive lectures, with ample space for discussion. Analysis of case studies and teaching practices. Reading and commentary on research articles in physics education. Individual and group reflection activities on topics such as assessment, the role of the discipline, and curricular choices. Guided discussions on epistemological and cultural issues (for example: what it means to "understand" physics in different school contexts). While maintaining a theoretical framework, the course includes applied components aimed at connecting didactic models with teaching practice and the real school context.
Mandatory Attendance	In accordance with the regulation
Specific Educational Objectives and Learning Outcomes	Developing physics-specific teaching skills Promoting critical reflection on the discipline Integrate innovative technologies and methodologies Promote active learning and scientific enquiry Effectively assess student learning Knowledge Know the main theories and models of physics taught in school. Understand the epistemological foundations of the discipline, including the processes of modelling and experimentation. To be familiar with the results of research in physics education. To be familiar with ministerial and provincial guidelines relating to the teaching of physics in schools. Skills Design effective learning units, consistent with the curricula and based on measurable objectives. Identify and manage conceptual nodes and students' cognitive difficulties. Develop effective formative and summative assessment tools.

	Competences To be able to teach physics in a conceptually sound and didactically effective manner. To be able to critically reflect on one's teaching practice and improve it based on observation and feedback. To promote scientific competences in students, such as critical thinking, argumentation, modelling and experimentation. Adapt one's teaching to different starting levels and cognitive styles of the students.
Specific Educational Objectives and Learning Outcomes (additional info.)	---
Assessment	The examination consists of an oral assessment on the course contents, aimed at evaluating the understanding of the main theoretical frameworks of physics education and the ability to apply them to the analysis of teaching situations. During the interview, case discussions or brief examples of instructional design may be proposed, also in relation to different upper secondary school contexts and to the cultural role of the discipline.
Evaluation Criteria	The assessment will take into account: Mastery of the theoretical content. Knowledge of the main findings of research in physics education. Ability to engage in critical analysis and argumentation. Appropriate use of disciplinary and didactic language. Ability to connect theory and teaching practice. Ability to reflect on the role of physics as a body of knowledge and as a cultural practice. Ability to contextualize instructional choices within different upper secondary school tracks. Clarity of exposition and ability to synthesize.
Required Readings	**Reference texts on physics education and pedagogy.** **National and international research articles in the field of science education (including studies on misconceptions and concept inventories).**

	Selected contributions on the epistemology and history of physics. **Institutional documents (National Guidelines for upper secondary schools).** **Materials provided by the instructor during the course.**
Supplementary Readings	----
Further Information	----
Sustainable Development Goals (SDGs)	Quality education