Syllabus

Course Description

Course Title	Didactics of Mathematics and Natural Sciences 2 - In-depth Analysis of Selected Topics
Course Code	11422
Course Title Additional	
Scientific-Disciplinary Sector	NN
Language	Italian
Degree Course	5 year master degree in Primary Education - Italian section
Other Degree Courses (Loaned)	
Lecturers	Prof. Federico Corni, Federico.Corni@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/800 Prof. a contratto dr. Leonardo Colletti, Leonardo.Colletti@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/3425 dr. Sara Bagossi, Sara.Bagossi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/50774
Teaching Assistant	
Semester	First semester
Course Year/s	4.
CP	10
Teaching Hours	70
Lab Hours	50
Individual Study Hours	130
Planned Office Hours	30
Contents Summary	Knowledge of the main constructs of mathematics didactics

Course Topics	Knowledge of the fundamental elements of planning a teaching activity and the main collections of teaching experiences in mathematics Critical knowledge of the fundamental elements of teaching physical sciences in pre-school and primary school as set out in the Provincial Directions of the Autonomous Province of Bozen/Bolzano, the National Directions for the Curriculum and the PAT Guidelines. Knowledge of the fundamental elements of planning interdisciplinary teaching activities and teaching experiences in the physical sciences. Capacity Ability to design a teaching-learning pathway in mathematics adapting to the context situation Ability to formatively evaluate learning in mathematics Ability to read and interpret everyday life situations in scientific terms Ability to find, criticise, use, modify and develop materials for work in situations involving the physical sciences. Ability to design interdisciplinary teaching/learning paths in physical sciences adapting to the context situation.
Keywords	Systems thinking. Teaching physics to children aged 5-12. Energy and energy sources. Forces of nature. Astronomy.
Recommended Prerequisites	
Propaedeutic Courses	
Teaching Format	Interactive lectures with games, exercises, and simple experiments from the lectern. Group laboratory experiences with final report. Preparation of learning units.
Mandatory Attendance	In accordance with the regulation
Specific Educational Objectives and Learning Outcomes	Disciplinary skills Knowledge and understanding Educational knowledge relating to mathematics and physics in pre-school and primary school, with attention to interdisciplinary links. Knowledge of the main factors of disorder, discomfort and difficulty in learning mathematics (dyscalculia, dysgraphia, ...) Knowledge of the main theoretical constructs of mathematics didactics (didactic contract, epistemological obstacle, cognitive

	unity between arguing and demonstrating, collective discussion, ...) Knowledge of the main characteristics from a disciplinary point of view of the main standardised surveys Knowledge of group dynamics during children's mathematical activity. Knowledge of the main natural conceptualisations in the interpretation of physical reality and their development in the direction of a scientific approach to reality. Ability to apply knowledge and understanding: Design learning paths in mathematics and physics. Analysing teaching situations, pupil protocols, standardised test questions, parts of textbooks. Analysing an artefact for learning-teaching mathematics in pre-school and primary school. Analysing a textbook or teaching proposal made by others. Search for material to construct a didactic path in relation to a learning objective. Set up learning environments appropriate to the age of the learners Prepare inclusive learning environments with respect to pupils with disabilities, specific learning disorders, difficulties. Transversal/soft skills Autonomy of judgement: Recognise the validity of teaching paths in mathematics and physics observed during the placement, in textbooks, manuals and teaching guides Recognise the validity of materials on the Internet Critically analyse and evaluate student protocols (papers, films) and class discussions Communication skills: Presenting a teaching project. Present an analysis of teaching paths or textbooks or tests. Communicate and share resources with colleagues both orally and online. Make appropriate use of digital technologies to communicate in class and with colleagues and to document

	Manage learning situations in multilingual contexts Learning skills: Acquire the ability to learn from one's environment by analysing materials, documentation, protocols and standardised assessment results.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	MATHEMATICS: Written and project teaching Written with verification of the ability to analyse and design teaching situations using materials critically Teaching project carried out in a group with an application paper PHYSICS: Oral with discussion of materials produced individually and in groups and questions on all topics covered in the lecture. The module mark is composed of the marks of the individual parts (lectures and mathematics laboratory, lectures and physics laboratory) weighted against the relevant number of CFUs. The four parts must be passed individually with a mark of no less than 60%. In the event of a failing grade for the entire module, any parts successfully passed will be considered as already passed on the next attempt to take the entire module examination. It should be borne in mind that, even in this case, a negative mark for the entire module will be counted towards the number of attempts available to take an examination. According to the Examinations Regulations, if a student fails an examination in three consecutive attempts, he/she may not register for the same examination in the three sessions following the last attempt (Art. 6, para. 4 of the current Regulations for Proficiency Examinations).
Evaluation Criteria	MATHEMATICS: Written test and laboratory project work: Analysis of protocols and materials. Design of teaching situations. In the written exam, students will be asked to be familiar with the Provincial Indications and the relationship between these and the National Indications for the first cycle of education of the Italian Republic; to critically master their contents in teaching and learning situations; to adequately use theoretical constructs to

	analyse classroom situations, teaching materials, students' protocols, survey and assessment results. In the project work, students are expected to demonstrate their ability to apply the acquired notions and to be able to present and defend their work. Assessment criteria: knowledge of the required content, logical structure, clarity and coherence of argument, formal and linguistic correctness. PHYSICS: Oral examination - discussion of course content and materials produced. In the materials produced and handed in prior to the call, students must show that they are able to apply the acquired notions and that they are able to present and defend their work. Assessment criteria: knowledge of the content covered in class, logical structure, clarity and coherence of argument, formal and linguistic correctness. The written examination in Mathematics counts 4/10 in the final grade; the laboratory project work in Mathematics 2/10; the oral examination in Physics 2/10 and the materials produced in the Physics laboratory 2/10.
Required Readings	Zan, R. (2007). *Difficoltà in matematica. Osservare, interpretare, intervenire*. Milano: Springer Verlag Arzarello, F., Bazzini L., Ferrara F., Sabena C., Andrà C., Merlo D., Savioli K. and Villa B. (2011). *Matematica: non è solo questione di testa. Strumenti per* osservare i processi in classe. Trento: Erickson. Fuchs, HU., Corni, F. (2023). Primary Physical Science Education. An imaginative approach to encounters with nature. Springer, Open Access. Egan, K. (2012). La comprensione multipla. Sviluppare una mente somatica, mitica, romantica, filosofica e ironica. Erickson. .
Supplementary Readings	Other materials including handouts will be made available to students in the Reserve Collection, OLE or Teams.

Further Information	
Sustainable Development Goals (SDGs)	Quality education, Gender equality, Affordable and clean energy, Climate action, Sustainable cities and communities, Responsible consumption and production, Reduced inequalities

Course Module

Course Constituent Title	Didactics of Mathematics: In-depth Analysis of Selected Topics
Course Code	11422A
Scientific-Disciplinary Sector	MATH-01/B
Language	Italian
Lecturers	dr. Sara Bagossi, Sara.Bagossi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/50774
Teaching Assistant	
Semester	First semester
CP	4
Responsible Lecturer	
Teaching Hours	40
Lab Hours	0
Individual Study Hours	60
Planned Office Hours	12
Contents Summary	In Teaching Mathematics Didactics: Thematic Insights, the main constructs of mathematics didactics will be presented in situ, with the aim of learning how to use them when planning and teaching action and interpreting pupils' behaviour.
Course Topics	Vertical curriculum: analysis of the National and Provincial Directions in the light of continuity/discontinuity; content scanning. The mathematics laboratory: the meaning of the mathematics laboratory in the national and provincial indications. The teacher's role in laboratory activities. Examples of teaching activities with artefacts. Problem posing and problem solving: problem solving in mathematics education. Mathematical modelling: the modelling cycle. Didactic constructs: didactic transposition, didactic contract,

	misconceptions, prototypes. Elements of designing teaching activities: definition of objectives; use of artefacts; ways of working in the classroom; mathematical discussion; textbooks and repositories of materials. The impact of technologies: use of digital platforms and tools for learning and design. Assessment: the different forms of assessment (formative and summative). The international standardised assessment tests (TIMSS and PISA). The INVALSI standardised tests. Teaching tools.
Teaching Format	Lectures, case discussions, group analysis of activities, use of and design with digital tools.
Required Readings	Sabena, C., Ferri, F., Martignone, F. & Robotti, E. (2019). *Insegnare e apprendere matematica nella scuola dell'infanzia e primaria.* Milano: Mondadori.
Supplementary Readings	

Course Module

Course Constituent Title	Didactics of Mathematics with an Emphasis on the Age Range 5-12 (Lab.)
Course Code	11422B
Scientific-Disciplinary Sector	MATH-01/B
Language	Italian
Lecturers	dr. Sara Bagossi, Sara.Bagossi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/50774
Teaching Assistant	
Semester	First semester
CP	2
Responsible Lecturer	
Teaching Hours	0
Lab Hours	30 Gruppo 1, 2 e 3: Dr. Bagossi Sara
Individual Study Hours	20

Planned Office Hours	6
Contents Summary	The workshop Teaching mathematics with a focus on the 5-12 age group includes the realisation and group presentation of a mathematics teaching project for primary school, with a focus on vertical continuity with pre-school and secondary school
Course Topics	List of topics: Elaboration of a teaching project with reference to sources, analysis of materials, construction of evaluation tests
Teaching Format	Workshop
Required Readings	Sabena, C., Ferri, F., Martignone, F. & Robotti, E. (2019). *Insegnare e apprendere matematica nella scuola dell'infanzia e primaria.* Milano: Mondadori.
Supplementary Readings	

Course Module

Course Constituent Title	Didactics of Physics: In-depth Analysis of Selected Topics
Course Code	11422C
Scientific-Disciplinary Sector	PHYS-06/B
Language	Italian
Lecturers	Prof. Federico Corni, Federico.Corni@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/800
Teaching Assistant	
Semester	First semester
CP	2
Responsible Lecturer	
Teaching Hours	30
Lab Hours	0
Individual Study Hours	20
Planned Office Hours	6
Contents Summary	In the teaching of Didactics of Physics: Thematic Insights, the main disciplinary contents of physics will be presented and some of the thematic insights that pupils will encounter in kindergarten and primary school will be addressed, with a focus on the didactic

	aspects involved.
Course Topics	Reference to Provincial Indications and National Indications. Narrative and analogical approach to various levels of formalisation of contexts such as fluids, thermal phenomena, electricity and motion. Introduction to the concept of energy. Understanding and cognitive tools. Dynamic modelling, dynamic systems, complexity. Analysis of some complex systems of interest to the school. Systems thinking.
Teaching Format	Lectures, classroom experiences, case discussions
Required Readings	Fuchs, HU., Corni, F. (2023). Primary Physical Science Education. An imaginative approach to encounters with nature. Springer, Open Access. Egan, K. (2012). La comprensione multipla. Sviluppare una mente somatica, mitica, romantica, filosofica e ironica. Erickson.
Supplementary Readings	

Course Module

Course Constituent Title	Didactics of Physics with an Emphasis on the Age Range 5-12 (Lab.)
Course Code	11422D
Scientific-Disciplinary Sector	PHYS-06/B
Language	Italian
Lecturers	Prof. Federico Corni, Federico.Corni@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/800 Prof. a contratto dr. Leonardo Colletti, Leonardo.Colletti@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/3425
Teaching Assistant	
Semester	First semester
CP	2
Responsible Lecturer	
Teaching Hours	0

Lab Hours	20 Gruppo 1 e 2: Prof. Corni Federico Gruppo 3: Dr. Colletti Leonardo
Individual Study Hours	30
Planned Office Hours	6
Contents Summary	Workshop on the production and discussion of teaching-learning activities in the physical sciences for the 5-12 age group with reference to the content covered in the lecture.
Course Topics	Didactic activities for interdisciplinary teaching-learning in the physical sciences (e.g. experiences with fluids, heat and electricity, discussions, creative activities, motor activities, dramatisation, role-playing, games, reading and writing, singing, etc.).
Teaching Format	Workshop with group activities and preparation of materials.
Required Readings	Fuchs, HU., Corni, F. (2023). Primary Physical Science Education. An imaginative approach to encounters with nature. Springer, Open Access. Egan, K. (2012). La comprensione multipla. Sviluppare una mente somatica, mitica, romantica, filosofica e ironica. Erickson.
Supplementary Readings	