Syllabus

Course Description

Course Title	Didactics of Natural Sciences
Course Code	12418
Course Title Additional	
Scientific-Disciplinary Sector	NN
Language	German; Italian
Degree Course	5 year master degree in Primary Education - German section
Other Degree Courses (Loaned)	
Lecturers	Prof. Dr. Angelika Pahl, AnPahl@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/31985 Dr. Franziska Zemmer, Franziska.Zemmer@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/39588 Prof. Dr.Dr. Robert Philipp Wagensommer, RobertPhilipp.Wagensommer@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/40174 Dott. Mag. Michele Marcaccio, Michele.Marcaccio@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/40854
Teaching Assistant	
Semester	First semester
Course Year/s	3.
CP	11
Teaching Hours	60
Lab Hours	40
Individual Study Hours	175

Planned Office Hours	33
Contents Summary	See the individual course modules.
Course Topics	See the individual course modules.
Keywords	Science didactics, Physics, Chemistry, Biology
Recommended Prerequisites	
Propaedeutic Courses	
Teaching Format	Frontal teaching, exercises, laboratory activities, classroom teaching
Mandatory Attendance	In accordance with the regulation
Specific Educational Objectives and Learning Outcomes	Knowledge - the subject-specific and didactic principles, in particular the subject-immanent structures and cross-age developmental lines that must be observed in order to stimulate and support children's learning processes in physics and biology from kindergarten to the transition to secondary school as seamlessly as possible, both in a child- and subject-appropriate manner and in accordance with the children's potential - the role, significance and limits of scientific approaches to solving factual problems - of application tasks that are suitable for thematisation in kindergarten and primary school, combined with current didactic concepts for dealing with them in kindergarten and primary school Skills - to analyse and plan scientific learning in kindergarten and primary school in a technically and didactically sound manner based on the framework guidelines for kindergarten and primary school in South Tyrol and with a view to the interdisciplinarity required in kindergarten and primary school, also beyond the STEM area - for the qualitative, process-oriented recording of learning levels and for dealing with heterogeneity in a way that promotes learning in the content areas covered in the module Expected learning outcomes and competences: Knowledge and understanding Critical knowledge and understanding of the fundamental and

	theoretical principles of physics, biology and chemistry, combined with age-appropriate everyday experiences of children; knowledge of subject-specific research methods, also in a school context. Knowledge and mastery of the disciplinary contents of the natural sciences that are the subject of the kindergarten and primary school; knowledge of the fundamental and transversal concepts of the disciplines necessary for the understanding, knowledge and comprehension of the specific and formal language of the discipline. Knowledge of physical quantities and the main measuring instruments. Application of knowledge and understanding Ability to design didactic interventions on fundamental topics of physics, chemistry and biology, transversal to science, which actively involve children with their specificities; ability to promote children's intrinsic motivation on the problems of physics, chemistry and biology in the context of everyday situations; ability to work in groups for the design, organisation and review of pedagogical-didactic interventions in the chemical-microbiological field. Ability to use basic concepts in different contexts of everyday life; ability to use everyday language to correctly describe phenomena; ability to formalise; ability to distinguish basic concepts. Ability to plan and carry out practical and everyday experiences. Ability to collect, analyse and interpret experimental data. Ability to create diagrams, tables, etc..... for analysing, presenting and interpreting physical, chemical and biological processes. Interdisciplinary competences "soft skills" Judgement Ability to reflect autonomously and critically on the acquired physical-chemical-biological competences and the contents of the subject teaching. Students should be able to interpret natural phenomena autonomously and originally, using the elementary concepts discussed and dealt with in the course. Communication Ability to argue theoretical aspects of the disciplines of physics,

	chemistry and biology and their teaching clearly, effectively and across disciplines. Students should be able to communicate their thinking clearly and critically, to challenge it by identifying developments and improvements from dialogue with other students, the teacher or hypothetically the children; to communicate the content of the discipline in a child-friendly way, to be able to support children's speeches from the perspective of science education. Learning strategies Students have skills that can be used in lifelong learning strategies and have the ability to find sources to update and deepen them. Students demonstrate autonomy in learning and the ability to formulate questions, plan and synthesise actions.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	Written module examination on the topics covered in the two lectures, which are taken in two independent partial examinations (physics part, biology/chemistry part). The module examination involves solving multiple-choice tasks and answering open questions. A written elaboration and reflection on the contents of the two laboratories is required. The assessment is summative.
Evaluation Criteria	In accordance with the examination regulations of the faculty, the assessment for each individual course belonging to the module must also be positive for a positive overall assessment of the module performance. If this condition is met, the overall assessment will take into account the performance achieved in the two laboratories or the two partial examinations of the written examination in accordance with the shares of these partial courses in the total number of credit points awarded for the module. The assessment will be based on correctness of content and language, accuracy and clarity, in particular in the application of the content taught in the module when completing the tasks; correct use of technical language; reference to specialist literature; depth and comprehensibility of the required reflection and

	argumentation. Active participation in the laboratories is required. In the event of a negative assessment of the overall module, any positively assessed parts of the module will be credited the next time you take the module examination. Please note, however, that a negative assessment will also be included in the count of examination attempts in this case. According to the examination regulations, three attempts without passing will result in a suspension for three examination dates (see also Article 6, Paragraph 4 of the current examination regulations).
Required Readings	See the individual course modules.
Supplementary Readings	See the individual course modules.
Further Information	The course materials are provided on OLE.
Sustainable Development Goals (SDGs)	Climate action, Quality education

Course Module

Course Constituent Title	Basics of Physics and its Didactics
Course Code	12418A
Scientific-Disciplinary Sector	PHYS-06/B
Language	German
Lecturers	Prof. Dr. Angelika Pahl, AnPahl@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/31985
Teaching Assistant	
Semester	First semester
CP	3
Responsible Lecturer	
Teaching Hours	30
Lab Hours	0
Individual Study Hours	45

Planned Office Hours	9
Contents Summary	The general point of reference for the choice of topics covered in the lecture are the national framework guidelines and the framework guidelines of the province of South Tyrol for kindergartens and primary schools. The topics are analysed from a subject-specific and didactic point of view, and specific methods are also presented with which children in kindergarten and primary school can experience and explore scientific phenomena and principles.
Course Topics	- Analysis of the framework guidelines for kindergarten and primary school in South Tyrol, the significance and importance of the educational area of physics in the context of STEM promotion and the networking with concepts of chemistry (educational area: inanimate nature); exemplary comparison with educational plans of other German-speaking countries - Introduction to current research findings on science education in kindergarten and primary school in the area of physics education - Introduction to various methods of hands-on-learning for exploring physical phenomena in kindergarten and primary school: possibilities for children's exploration; selection of suitable scientific experiments; phases of the research circle and the accompanying role of the educational specialist or teacher; linking activity-based activities with language and storytelling. - Basic knowledge of the principles, structures, processes and procedures of physics, with particular reference to the areas mentioned in the framework guidelines for kindergarten and primary school of the province of South Tyrol (e.g. sound/acoustics, magnetism, swimming/sinking) - Importance of recording children's learning levels and ideas with regard to phenomena of inanimate nature; planning learning opportunities that take into account the technical and children's perspectives; criteria for good learning tasks for the educational area of inanimate nature; knowledge of how to help children express and discuss experiences with natural and technical phenomena in depth.
Teaching Format	Lecture with media support (including short videos) and interspersed reflection phases
Required Readings	Lück, G. (2022). Handbuch der naturwissenschaftlichen Bildung:

	Theorie und Praxis für die Arbeit in Kindertageseinrichtungen (10. akt. Aufl.). Freiburg im Breisgau: Herder. Kapitel 3, 5, 10 und Teil II (S. 155-165). Labudde, P. & Metzger, S. (2019). Fachdidaktik Naturwissenschaft 1.-9. Schuljahr. Bern: Haupt-Verlag. Kapitel 3, 4, 8 und 9. Kahlert, J. & Demuth, R. (2010). Wir experimentieren in der Grundschule. Einfache Versuche zum Verständnis physikalischer und chemischer Zusammenhänge. Teil 1. Freising: Aulis Verlag. Kapitel 2, 4 und 6.
Supplementary Readings	DK (2022). Visuelles Wissen Physik. München: Dorling Kindersley Verlag. Fthenakis, W. E. (2009) Frühe naturwissenschaftliche Bildung. Bildungsverlag EINS.

Course Module

Course Constituent Title	Didactics of Physics with an Emphasis on the Age Range (0)-2-7 (Lab.)
Course Code	12418B
Scientific-Disciplinary Sector	PHYS-06/B
Language	German
Lecturers	Prof. Dr. Angelika Pahl, AnPahl@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/31985
Teaching Assistant	
Semester	First semester
CP	2
Responsible Lecturer	
Teaching Hours	0
Lab Hours	20

	Gruppe 1, 2, 3 und 4: Prof. Dr. Angelika Pahl
Individual Study Hours	30
Planned Office Hours	6
Contents Summary	The laboratory serves to deepen and practically implement the contents of the lecture.
Course Topics	- Implementation of didactic concepts and models of early science education from the field of experience of physical nature in order to take up and further promote children's interest and ideas. - Acquisition of basic action-orientated methods for exploring physical phenomena and for expressing/communicating experiences with such phenomena - Concrete practical examples of learning environments for kindergarten and early primary school lessons in which physical phenomena are explored and developed in a child-appropriate way - Reflection on the importance of practical work in the natural sciences with a focus on physics and further development of one's own attitude towards exploratory and discovering work
Teaching Format	Laboratory with practical activities. Group work on the topics covered in class.
Required Readings	--
Supplementary Readings	Lück, G. (2015). Handbuch der naturwissenschaftlichen Bildung: Theorie und Praxis für die Arbeit in Kindertageseinrichtungen. Freiburg im Breisgau: Herder. Lück, G. (2007). Forschen mit Fred. Naturwissenschaften im Kindergarten. Oberursel: Finken. Kahlert, J. & Demuth, R. (2010). Wir experimentieren in der Grundschule. Einfache Versuche zum Verständnis physikalischer und chemischer Zusammenhänge. Teil 1. Freising: Aulis Verlag.

Course Module

Course Constituent Title	Didactics of Biology and Chemistry: In-depth Analysis of Selected

	Topics
Course Code	12418C
Scientific-Disciplinary Sector	BIOS-01/A
Language	Italian
Lecturers	Prof. Dr.Dr. Robert Philipp Wagensommer, RobertPhilipp.Wagensommer@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/40174
Teaching Assistant	
Semester	First semester
CP	4
Responsible Lecturer	
Teaching Hours	30
Lab Hours	0
Individual Study Hours	70
Planned Office Hours	12
Contents Summary	The teaching "Didactics of biology and chemistry: in-depth thematic studies" has as its educational objectives the acquisition of fundamental scientific and didactic concepts of the teaching of biological sciences and chemistry in pre-school and primary school, as foreseen in the Provincial Indications of the Autonomous Province of Bolzano, in the National Indications for the Curriculum and in the Guidelines of the Autonomous Province of Trento. The teaching aims to provide the fundamental and necessary tools for planning activities and teaching experiences in the biological and chemical sciences from an interdisciplinary perspective, with an eye also to possible links to the geological and physical sciences, enabling the development of the ability to read, describe and interpret reality and natural processes linked to everyday life.
Course Topics	In connection with the National Guidelines and Provincial Guidelines, the following topics are addressed, in relation to teaching in pre-school and primary school: - environmental, climate and energy crisis, sustainable development and environmental education; - plant blindness; - flora and vegetation;

	- the scientific method; - herbaria and botanical gardens; - main causes of biodiversity loss: habitat destruction, invasive alien species; - nature conservation: endangered species, red lists, protected areas; - ecosystems, biomes, interactions between organisms and their relations with the environment; - altitudinal vegetation belts in the Alps; - ecosystem services; - water cycle, biogeochemical cycles of elements; - food chain, food web; - evolution and adaptation, extinctions, evolutionary history of life on Earth; - relationship between form and function; - the human body; - poisonous and dangerous plants, mushrooms and animals in Trentino-Alto Adige; - indications, suggestions and reflections on the didactic aspects of the biological and chemical sciences with a focus on fundamental and transversal science concepts.
Teaching Format	Lectures with the aid of multimedia tools, invitation to oral reflection, critical discussion of cases, videos.
Required Readings	--
Supplementary Readings	Antonietti, M., & Bertolino, F. (a cura di) (2017) A tutta natura! Nuovi contesti formativi all'aria aperta per l'infanzia di oggi. Parma: Edizioni Junior, 206 pp. Crudeli, F. (a cura di) (2021) L'outdoor education: per la costruzione di una comunità educante. Parma: Edizioni Junior, 127 pp. Longo, C. (2014) Didattica della Biologia. Milano: Ledizioni, 262 pp. Padoa-Schioppa, E. (2018) Metodi e strumenti per l'insegnamento

	e l'apprendimento della biologia. Ed. Edises. The slides that will be uploaded during the course via the digital learning platform set up for the course.

Course Module

Course Constituent Title	Didactics of Biology and Chemistry with an Emphasis on the Age Range 5-12 (Lab.)
Course Code	12418D
Scientific-Disciplinary Sector	BIOS-01/A
Language	Italian
Lecturers	Dr. Franziska Zemmer, Franziska.Zemmer@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/39588 Dott. Mag. Michele Marcaccio, Michele.Marcaccio@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/40854
Teaching Assistant	
Semester	First semester
CP	2
Responsible Lecturer	
Teaching Hours	0
Lab Hours	20 Gruppo 1 e 2: Dr. Franziska Zemmer Gruppo 3 e 4: Dott. Mag. Michele Marcaccio
Individual Study Hours	30
Planned Office Hours	6
Contents Summary	The "LAB Didactics of biology and chemistry with a focus on the 5-12 age group" teaching intends to propose experiences and activities of observation, exploration, manipulation and analysis to stimulate the development of the capacity

	- to find, analyse, use, modify and develop materials and models for work in situations involving the natural, biological and chemical sciences - to design interdisciplinary teaching/learning paths in biological and chemical sciences appropriate to the 5-12 year old context and capable of stimulating the development of specific competences in the scientific disciplines.
Course Topics	Direct laboratory experiences concerning biological and chemical science subjects covered in VL teaching: - experiences of observation, exploration and manipulation of various groups of living organisms (e.g. plants, animals, fungi), useful for stimulating the development of fundamental concepts of biology and transversal to the sciences (e.g. relationship between form and function, system, adaptation and evolution) - Direct experiences with solutions, mixtures, chemical transformations (reactions) to stimulate the development of cross-science topics (e.g. relationship between form and function, etc.); - Use of models with critical analysis of relevance and limitations in the teaching of biology and chemistry; - Subsequent reflections and critical reworking of the observations and data collected in the light of their educational application in specific school contexts in the 5-12 age group.
Teaching Format	Teaching consists of: - practical exercises, using instruments useful for biology and chemistry experiences and materials that are easy to find in schools, such as magnifying glasses, microscopes, beakers, graduated cylinders, thermometers, heating plates, etc; - critical reflection on the observations and results obtained and revisiting them for educational application in specific school contexts (5-12 years); - critical analysis of teaching units implemented in contexts related to the 5-12 year age group; group work and discussions.
Required Readings	--
Supplementary Readings	Scialò, A. T. (2025). Dentro la materia, La chimica nella scuola del primo ciclo - Edizioni Junior

	Labudde, P. (2019). Fachdidaktik Naturwissenschaft 1.-9. Schuljahr. Bern: Haupt-Verlag.