Syllabus

Course Description

Course Title	Didactics of Mathematics and Natural Sciences 1 - Basics
Course Code	12410
Course Title Additional	
Scientific-Disciplinary Sector	NN
Language	German
Degree Course	5 year master degree in Primary Education - German section
Other Degree Courses (Loaned)	
Lecturers	Prof. Dr. Camilla Wellstein, Camilla.Wellstein@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33786 Prof. Dr. Michael Gaidoschik, Michael.Gaidoschik@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/37288 Verena Stragenegg, Verena.Stragenegg@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/38380 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. Irene Köfele, Irene.Koefele@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/47254 Dott. Mag. Sonia Pichler,

	Sonia.Pichler@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/48873 Dott. Mag. Vera Knapp, Vera.Knapp@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/36686
Teaching Assistant	
Semester	Second semester
Course Year/s	2.
CP	11
Teaching Hours	70
Lab Hours	50
Individual Study Hours	155
Planned Office Hours	33
Contents Summary	Knowledge - the subject-specific and subject-didactic principles, in particular the subject-immanent structures and cross-age developmental lines that must be observed in order to be able to stimulate, accompany and promote children's learning processes in mathematics (in the content area of number/arithmetic) as well as chemistry and biology from kindergarten to the transition to secondary school as seamlessly as possible, both in a child-orientated and subject-specific manner and in accordance with the children's potential
Course Topics	See the individual course modules
Keywords	Didactics of arithmetic, didactics of biology, didactics of chemistry, early mathematical education, early science education
Recommended Prerequisites	Willingness to engage with the subject matter of mathematics and natural sciences relevant to early learning in kindergarten and elementary school, even if one feels uncertain about these subjects and/or does not have fond memories of one's own school lessons in these subjects. Interest in children's thought processes and enjoyment when children make intellectual discoveries.
Propaedeutic Courses	

Teaching Format	Lectures and laboratories (see detailed explanations for individual modules)
Mandatory Attendance	In accordance with the regulation
Specific Educational Objectives and Learning Outcomes	Skills - to recognise and use the potential of games and everyday situations in kindergarten for mathematical and scientific learning in the content areas addressed in the module - to observe, analyse, plan and design learning-promoting support for learning processes in kindergarten and school lessons in mathematics (content area number/arithmetic) as well as biology and chemistry (interdisciplinary also physics) based on the framework guidelines for kindergarten and primary school in South Tyrol, always with a view to the interdisciplinarity required in kindergarten and primary school - to promote general, process-related maths and science skills - for the qualitative, process-oriented assessment of competences/learning levels and for dealing with heterogeneity in a way that promotes learning in the content areas addressed in the module Expected learning outcomes and competences: Knowledge and understanding - Knowledge and understanding of the educational objectives of the framework guidelines for kindergarten and primary school related to the mathematical and scientific content areas covered, taking into account the general (process-related) mathematical and scientific competences throughout - Basic mathematical knowledge and fundamental insights into elementary mathematical structures and relationships in the content area "Number" (arithmetic); knowledge and understanding of current development models for the acquisition of arithmetic skills as well as current didactic concepts for promoting and further developing these skills - Knowledge and understanding of basic chemical-physical and biological concepts and their interdisciplinary connection; knowledge and understanding of basic relationships between animate and inanimate nature in the immediate living environment; knowledge and understanding of current concepts

	for the didactic implementation of the learning content addressed in the sense of moderate constructivism. Applying knowledge and understanding - Expertise in solving elementary mathematical tasks relevant to kindergarten and primary school in different ways and in justifying the mathematical correctness of such different solutions - Expertise in planning, implementing and evaluating qualitative, process-oriented learning assessments in the mathematical content areas covered - Expertise in identifying intuitive concepts and theories of children and pupils on scientific topics - Expertise in planning settings that promote learning in the mathematical and scientific content covered, taking into account heterogeneous learning requirements Judgement - Competence in the technically and didactically sound assessment of the potential of everyday and play situations for maths and science education in kindergarten as well as of tasks, exercise forms, learning environments, methods and didactic materials for the further development of maths and science skills in primary school in the content areas covered - Expertise in differentiated reflection on one's own and others' attitudes towards mathematics and science, their significance for learners, school and society, as well as attitudes towards learning mathematics and science Communication - Ability to present the content and contexts covered in a precise and target group-appropriate manner in both specialised and everyday language - Competence to present their own thought processes and solution strategies in an intersubjectively comprehensible way - Knowledge of the importance of language skills for learning arithmetic and science and of suitable forms of promoting these in kindergarten and primary school Learning strategies - (Further) development of cross-content and content-specific

	problem-solving strategies - (Further) development of the ability to independently learn and deepen subject-specific and didactic content
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	Comprehensive final written examination (3 hours total working time) on the content covered in the course. The written examination consists of one part each on the mathematical and scientific topics.
Evaluation Criteria	The content of the lectures in mathematics education and biology and chemistry education is assessed in a written examination. Performance in the laboratories is assessed on the basis of written assignments, which must be completed outside of laboratory sessions by the specified deadlines. Active participation in the laboratories is required. The performance assessment of the written examinations and work assignments takes into account the correctness of content and language, accuracy and clarity, in particular when applying the content taught in the course to the examination tasks (transfer performance); correct use of technical language; reference to specialist literature; depth and comprehensibility of the required reflection and argumentation. In order to successfully complete the course, all four sub-courses must be passed individually. If this condition is met, the overall assessment will take into account the performance in the sub-courses in proportion to the respective course's share of the total credit points for the course. In the event of a negative assessment of the course, any positively assessed partial examinations will be credited the next time the course is taken. Please note, however, that even in this case, a negative assessment will count toward the number of examination attempts. According to the examination regulations, failing the course three times will result in a three-term suspension from taking the examination.

Required Readings	See the required reading listed for each module.
Supplementary Readings	See the further reading listed for each module.
Further Information	
Sustainable Development Goals (SDGs)	Reduced inequalities, Quality education

Course Module

Course Constituent Title	Basics of Mathematics and its Didactics
Course Code	12410A
Scientific-Disciplinary Sector	MATH-01/B
Language	German
Lecturers	Prof. Dr. Michael Gaidoschik, Michael.Gaidoschik@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/37288
Teaching Assistant	
Semester	Second semester
CP	4
Responsible Lecturer	
Teaching Hours	40
Lab Hours	0
Individual Study Hours	60
Planned Office Hours	12
Contents Summary	The aim of the lecture is to impart the basic subject-related and didactic knowledge necessary to stimulate and support learning processes in the content area of number (arithmetic) from kindergarten to the end of primary school, with an orientation towards both the child and the subject, and to be able to promote the individual potential of the children.
Course Topics	- Mathematics as an activity of discovering, describing, creating and explaining patterns and structures - Development of maths-related interests, abilities and skills in

	early childhood - Concepts of early mathematical education in line with the framework guidelines for kindergarten in South Tyrol and current specialised didactics of mathematics - Subject-specific and subject-didactic basic knowledge for the learning-promoting treatment of the content area of number (arithmetic), upstream of classifying and sorting by characteristics and dealing with quantities, from kindergarten to the transition to secondary school (development of the concept of number; elements of number theory, number aspects; place value systems; addition, subtraction, multiplication, division), with continuous attention to the promotion of general, process-related mathematical skills (problem solving, communication, representation, argumentation and modelling) - The role of acting with material as well as of working with visualisations for the development of arithmetic operations and concepts - Substantive learning environments for the content that is covered in the lecture; natural differentiation to promote the learning of children of all levels of talent and inclination - Qualitative assessments and process-orientated learning progression on key content covered
Teaching Format	Lecture with media support, interspersed work phases (from individual work to small groups), repeated invitation to written interim reflections and differentiated feedback on the course
Required Readings	Benz, Ch., Peter-Koop, A., & Grüßing, M. (2015). Frühe mathematische Bildung. Mathematiklernen der Drei- bis Achtjährigen. Springer. Gaidoschik, M. (2025). Das dezimale Stellenwertsystem verstehen, verinnerlichen, flexibel anwenden: Ein Leitfaden für den Unterricht in der Grundschule. Klett-Kallmeyer. Gaidoschik, M. (2022). Rechenschwäche verstehen – Kinder gezielt fördern. Ein Leitfaden für die Unterrichtspraxis (12. Auflage). Persen.

	Gaidoschik, M. (2019). Einmaleins verstehen, vernetzen, merken. Strategien gegen Lernschwierigkeiten (5. Auflage). Kallmeyer. Padberg, F. & Benz, Ch. (2020). Didaktik der Arithmetik. Springer.
Supplementary Readings	Schipper, W., Dröge, A., & Ebeling, R. (2015-2018). Handbuch für den Mathematikunterricht, 1./2./3./4. Schuljahr. Bildungshaus Schulbuchverlage. Wittmann, E.Ch. & Müller, G. (2017/2018). Handbuch produktiver Rechenübungen. Neufassung. Kallmeyer.

Course Module

Course Constituent Title	Basics of Mathematics and its Didactics with an Emphasis on the Age Range (0)-2-7 (Lab.)
Course Code	12410B
Scientific-Disciplinary Sector	MATH-01/B
Language	German
Lecturers	Dott. Mag. Irene Köfele, Irene.Koefele@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/47254 Dott. Mag. Sonia Pichler, Sonia.Pichler@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/48873 Dott. Mag. Vera Knapp, Vera.Knapp@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/36686 Verena Stragenegg, Verena.Stragenegg@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/38380
Teaching Assistant	

Semester	Second semester
CP	2
Responsible Lecturer	
Teaching Hours	0
Lab Hours	30 Gruppe 1: Verena Stragenegg Gruppe 2: Dott. Mag. Irene Köfele Gruppe 3: Dott. Mag. Sonia Pichler Gruppe 4: Dott. Mag. Vera Knapp
Individual Study Hours	20
Planned Office Hours	6
Contents Summary	The aim of the laboratory is, on the one hand, to support students in acquiring the content of the lecture "Fundamentals of Mathematics and its Didactics" through practical exercises in small groups. On the other hand, it is about the practical testing of substantial tasks, materials, media... for early mathematical education, with a special focus on the age group (0-)2-7 (kindergarten and first/second grade). The essential content of arithmetic is continued until the end of primary school and, conversely, the content covered there is dealt with in the laboratory in the 4th year of study (focus on ages 5-12), starting from kindergarten. Reflecting on the experiences made in the exercises and relating them back to the theory covered in the lecture is essential for the laboratory.
Course Topics	- Reflection and further development of own attitudes and behaviour towards mathematics and learning mathematics - Discovering, exploring, describing, continuing and explaining patterns and structures as the guiding principle of mathematical activity from kindergarten onwards - Games, everyday situations, substantial tasks and learning environments that stimulate and promote the (further) development of competences in the content areas addressed - Practical exercises for their own professional penetration as well as analysis and testing of current didactic concepts and related methods and didactic materials on the content areas "Counting and the development of number concepts", "Place value systems", "Arithmetic laws, arithmetic methods and arithmetic strategies in the four basic arithmetic operations", with continuous

	consideration of the general mathematical competences of problem solving, communication, representation, argumentation and modelling.
Teaching Format	Laboratory with theoretical input; individual, partner and group work, discussions; small written assignments serve first and foremost as preparation for the laboratory sessions; discussion of the assignments is an important part of the sessions. Performance assessment for the laboratory is based on work assignments, which must be completed outside of class by the specified deadlines.
Required Readings	See required readings of the related lecture.
Supplementary Readings	

Course Module

Course Constituent Title	Basics of Biology and Chemistry and their Didactics
Course Code	12410C
Scientific-Disciplinary Sector	BIOS-01/A
Language	German
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	Second semester
CP	3
Responsible Lecturer	
Teaching Hours	30
Lab Hours	0
Individual Study Hours	45
Planned Office Hours	9
Contents Summary	The aim of the lecture is to impart the basic subject-related and didactic knowledge required to stimulate and support learning processes in the field of science education, especially in the areas of biology and chemistry, from kindergarten to the end of primary

	school, orientated towards both the child and the subject, and to promote the individual potential of the children.
Course Topics	- Early science education in kindergarten and basic science education in primary school and its anchoring in the framework guidelines for kindergarten and primary school in South Tyrol. - Didactic principles of sustainable science education in kindergarten and primary school: science as an activity of observing, comparing, describing, classifying, asking questions, formulating hypotheses, drawing conclusions. - Development of science-related interests, abilities and skills in early childhood. - Current didactic concepts, principles and objectives of science education, particularly in the fields of biology and chemistry. - To be able to answer children's questions scientifically correctly. - Cells, living beings. - Atoms, molecules. - Photosynthesis. - Biodiversity, classification of living beings. - Structure of a plant: root, stem, leaf. - Flowers, fruits. - The most important animal groups. - Plant and animal species native to Trentino-South Tyrol.
Teaching Format	Lecture with media support, invitation to oral reflection, critical case discussion, videos.
Required Readings	None
Supplementary Readings	Fthenakis, W. E. (2009). Natur-Wissen schaffen - Band 3: Frühe naturwissenschaftliche Bildung. Bildungsverlag Eins. Hamman, M. & Asshoff, R. (2013) Schülervorstellungen im Biologieunterricht: Ursachen für Lernschwierigkeiten. Seelze-Velber: Klett-Kallmeyer. Labudde P. (2010). Fachdidaktik Naturwissenschaften. Haupt.

	Lück, G. (2018). Handbuch naturwissenschaftliche Bildung in der Kita. Herder Schmiemann, P. & Mayer, G. (Hrsg.) (2013). Experimentieren Sie! Biologieunterricht mit Aha-Effekt. Cornelsen Verlag. Stäudel L., Werber B., & Wodzinski R. (2006). Forschen wie ein Naturwissenschaftler: Das Arbeits- und Methodenbuch. Friedrich. The slides that will be uploaded during the course via the digital learning platform set up for the course.

Course Module

Course Constituent Title	Basics of Biology and Chemistry and their Didactics with an Emphasis on the Age Range (0)-2-7 (Lab.)
Course Code	12410D
Scientific-Disciplinary Sector	BIOS-01/A
Language	German
Lecturers	Prof. Dr. Camilla Wellstein, Camilla.Wellstein@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33786 Dr. Franziska Zemmer, Franziska.Zemmer@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/39588
Teaching Assistant	
Semester	Second semester
CP	2
Responsible Lecturer	
Teaching Hours	0
Lab Hours	20 Gruppe 1, 3 und 4: Dr. Franziska Zemmer Gruppe 2: Prof. Dr. Camilla Wellstein

Individual Study Hours	30
Planned Office Hours	6
Contents Summary	The aim of the laboratory is, on the one hand, to support students in acquiring the content of the lecture "Fundamentals of Biology and Chemistry and their Didactics" through practical exercises in small groups. On the other hand, it is about the practical testing of substantial tasks, materials, media... for early science education in the age group (0-)2-7 (focus) as well as for their continuation in primary school, as well as the reflection of the experiences made and their reference back to the theory dealt with in the lecture.
Course Topics	- Implementation of didactic concepts and models for early science education in the fields of biology and chemistry - Acquisition of basic experimentation skills in order to facilitate scientific processes in the educational and learning area of chemistry/biology and to pick up on, stimulate and further develop children's and pupils' interest in processes in nature in a technically and didactically competent manner. - Practical examples to promote and initiate scientific thinking and working methods such as asking questions, making assumptions (hypotheses), trying out/experimenting, observing, comparing, organising, documenting, drawing conclusions/discussing. - Practical examples of learning experiences and learning environments with a focus on "exploration" and "investigation" to promote and develop early scientific skills in accordance with the content areas of the lecture - Planning, implementation, reflection and evaluation of experimental educational activities and learning environments in biology and chemistry - Reflection on the importance of practical work in the natural sciences and further development of one's own attitude towards working and learning through research and discovery
Teaching Format	Laboratory with theoretical inputs; individual, partner and group work, discussions; small written and/or practical assignments.
Required Readings	• Deutsches Schulamt der Autonomen Provinz Bozen – Südtirol (2008). Rahmenrichtlinien für den Kindergarten in Südtirol • Deutsches Schulamt der Autonomen Provinz Bozen– Südtirol (2021). Rahmenrichtlinien für die Grund- und Mittelschule in Südtirol

Supplementary Readings	• Fthenakis, W. E. (2009). Natur-Wissen schaffen - Band 3: Frühe naturwissenschaftliche Bildung. Bildungsverlag Eins. • Labudde, P. (2019). Fachdidaktik Naturwissenschaft 1.-9. Schuljahr. Bern: Haupt-Verlag. • Lück, G. (2018). Handbuch naturwissenschaftliche Bildung in der Kita. Herder • Weitere Leseempfehlungen werden über die für die Lehrveranstaltung eingerichtete digitale Lernplattform zur Verfügung gestellt.