Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Didaktik der Mathematik und frühkindliche Konzeptbildung
Code der Lehrveranstaltung	500004
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	NN
Sprache	Italienisch
Studiengang	Einstufiger Master in Bildungswissenschaften für den Primarbereich - Abteilung in italienischer Sprache
Andere Studiengänge (gem. Lehrveranstaltung)	LM-85 bis Education Ladin section - 2026
Dozenten/Dozentinnen	Prof. Federico Corni, Federico.Corni@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/800 Prof. Antonella Brighi, Antonella.Brighi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/39352 dr. Sara Bagossi, Sara.Bagossi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/50774 Prof. George Richard Paul Santi, GeorgeRichardPaul.Santi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/39717
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
Studienjahr/e	1
KP	12

Vorlesungsstunden	92
Laboratoriumsstunden	32
Stunden für individuelles Studium	176
Vorgesehene Sprechzeiten	36
Inhaltsangabe	This course provides foundational theoretical knowledge and pedagogical skills essential for early childhood and primary education, linking children's cognitive and conceptual development with the teaching of mathematics and physics. On one side (Seminar), the course delves into how categories and scientific/mathematical concepts are structured in early childhood, analyzing Core Knowledge systems, executive functions, embodied cognition, and children's spontaneous generation of scientific explanations anchored in sensory and bodily experiences. On the other side (Lectures and Workshop), the course focuses on the core mathematical domain of "Numbers and Operations" (natural, integer, and rational numbers, mental calculation, early algebra, problem-solving, and mathematical reasoning), combining theoretical frameworks from mathematics education research with the design and critical analysis of laboratory practices using physical and digital artifacts.
Themen der Lehrveranstaltung	- Cognitive and Conceptual Development in Early Childhood: Core Knowledge systems (number, space, objects, causality); conceptual development; Embodied Cognition, gesture, movement, and image schemas in constructing physical and mathematical concepts; phases of understanding; executive functions and self-regulation in inquiry-based science learning; the child as a theory-builder and intuitive explanations of physical/mathematical phenomena. - Numbers and Operations in Mathematics Education: Number sense, counting, enumeration, and calculation processes; natural numbers (operations, properties, number line, multiples/divisors); integers, rational numbers (fractions, decimals, percentages), and introduction to real numbers; mental calculation and standard algorithms; early algebra, pattern recognition, and generalization; exploring, conjecturing, and arguing in numerical contexts. - Theoretical and Pedagogical Frameworks in Mathematics Didactics: Laboratory-based teaching and Activity Theory; mathematical modeling and problem-solving; semiotic registers of

	representation, multimodality, and mediating tools; didactic transposition, didactic contract, mathematical discussion, and assessment; historical/cultural perspectives on numbers (positional systems, ancient cultures, symbol acquisition).
Stichwörter	Core Knowledge, Embodied Cognition, Imaginative Education, Early Algebra, Problem solving, Semiotic mediation
Empfohlene Voraussetzungen	No prerequisites
Propädeutische Lehrveranstaltungen	
Unterrichtsform	The course employs a diverse and highly interactive pedagogical approach, combining lectures (face-to-face and synchronous online) with hands-on workshop sessions. Teaching methods include interactive and expository lectures, laboratory work, micro-teaching design, cooperative learning activities (in small groups and breakout rooms), and plenary mathematical discussions. The methodology also features collaborative analysis of learning scenarios (using video observations of children during play/exploration), direct simulations, embodied activities, the hands-on use of physical artifacts and digital collaborative tools, and the application of Activity Theory principles.
Anwesenheitspflicht	According to the Academic Regulations
Spezifische Bildungsziele und erwartete Lernergebnisse	1. Knowledge and understanding By the end of the course, students will be able to: - Demonstrate knowledge of key theories regarding cognitive and conceptual development in early childhood, with particular focus on Core Knowledge systems, executive functions, and Embodied Cognition. - Understand how young children build spontaneous explanations and construct physical and mathematical concepts through action, movement, gestures, and sensory experiences. - Master fundamental content within the "Numbers and Operations" conceptual domain (number systems, computation, early algebra, properties, and algorithms). 2. Applying knowledge and understanding By the end of the course, students will be able to: - Design learning units and educational activities for preschool and

	primary school, integrating mathematics, physics, science education, and developmental psychology. - Utilize physical artifacts, digital tools, and mediating instruments to foster exploration, modeling, and problem-solving in young learners. - Analyze and interpret educational situations and children's outputs (verbal, gestural, and graphical) related to mathematical and physical phenomena. - Implement laboratory-based teaching strategies and cooperative learning to promote hypothesis generation, reasoning, and active concept formation. - Comprehend theoretical and pedagogical frameworks in mathematics education (laboratory-based learning, Activity Theory, didactic transposition, didactic contract, semiotic registers of representation, and multimodality). 3. Making judgements By the end of the course, students will be able to: - Critically evaluate instructional materials, laboratory experiences, and pedagogical proposals concerning early childhood mathematics and science education. - Reflect critically on teaching practices, recognizing the teacher's role, the influence of the didactic contract, and the value of children's intuitive ideas. - Select and adapt mathematical and scientific tasks appropriately based on children's cognitive development levels and classroom needs. 4. Communication skills By the end of the course, students will be able to: - Use appropriate, precise disciplinary terminology across mathematics, science education, and developmental psychology. - Facilitate and orchestrate mathematical and scientific discussions in the classroom, encouraging peer reasoning, debate, and collaborative meaning-making. - Present, justify, and discuss instructional designs clearly with peers and instructors using digital tools and multimodal representations. 5. Learning skills

	By the end of the course, students will be able to: - Independently access and analyze research literature, bibliographic sources, and educational materials in early childhood mathematics and science education. - Cultivate a reflective attitude toward self-assessment and continuous professional development. - Apply acquired theoretical frameworks to analyze real educational settings and address future teaching challenges.
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	
Art der Prüfung	Written exam
Bewertungskriterien	- Content knowledge from an interdisciplinary perspective - Translating theoretical knowledge into learning activities, also with cultural artefacts, consistent with the Learning Unit's objective??? - Language proficiency and clarity of presentation
Pflichtliteratur	See the bibliography for each module
Weiterführende Literatur	
Weitere Informationen	
Ziele für nachhaltige Entwicklung (SDGs)	Hochwertige Bildung, Bezahlbare und saubere Energie, Leben an Land, Maßnahmen zum Klimaschutz, Leben unter Wasser, Nachhaltige Städte und Gemeinden

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Didaktik der Mathematik für Kindergarten und Grundschule 1: Zahlen und Operationen
Code der Lehrveranstaltung	500004A
Wissenschaftlich-disziplinärer Bereich	MATH-01/B
Sprache	Italienisch
Dozenten/Dozentinnen	Prof. George Richard Paul Santi, GeorgeRichardPaul.Santi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/39717

Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
KP	7
Verantwortliche/r Dozent/in	
Vorlesungsstunden	56
Laboratoriumsstunden	0
Stunden für individuelles Studium	119
Vorgesehene Sprechzeiten	21
Inhaltsangabe	The course aims to provide students with a solid background in mathematics and mathematics education, which is essential for teaching in kindergarten and primary schools. The course aims to provide students with the tools to: consolidate and acquire mathematical knowledge and skills relating in particular to the 'Numbers' core concept of the National Guidelines, with a focus on problem-solving and problem-formulation processes, exploration, hypothesis formulation, and argumentation; acquire teaching knowledge and skills related to the topics covered; carry out practical activities and engage in critical pedagogical reflection on the topics covered.
Themen der Lehrveranstaltung	Numbers and their meanings; processes of enumeration, counting, and calculation. Natural numbers: operations, meanings, and properties; the number line; the meaning of multiples, divisors, and prime numbers. Integers. Rational numbers: definition, properties, and various forms of representation (decimals, fractions, percentages); an introduction to irrational and real numbers. Mental arithmetcalculationorithwritten ms for the four operations. Early algebra and processes of generalisation. Identifying and describing patterns. Exploring, conjecturing, and reasoning in a numerical context. Theoretical elements from research in mathematics education: laboratory methodology and problem-solving; mathematical modelling; registers of representation and multimodality; didactic transposition, didactic contract, mathematical discussion. Examples of teaching activities related to the topics covered. Assessment in mathematics.
Unterrichtsform	Laboratory activities and cooperative learning. Class discussions to

	introduce activities and consolidate learning. Lesson planning
Pflichtliteratur	D'Amore, B., & Sbaragli, S. (2011). Principi di base di didattica della matematica. Pitagora. Sabena, C, Ferri, F, Martignone, F., & Robotti E. (2019). Insegnare e apprendere matematica nella scuola dell'infanzia e primaria. Mondadori
Weiterführende Literatur	Baccaglini-Frank, A., Di Martino, P., Natalini, R., Rolini, G. (2017). Didattica della matematica. Mondadori

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Didaktik der Mathematik für Kindergarten und Grundschule 1: Zahlen und Operationen (Lab.)
Code der Lehrveranstaltung	500004B
Wissenschaftlich-disziplinärer Bereich	MATH-01/B
Sprache	Italienisch
Dozenten/Dozentinnen	Prof. George Richard Paul Santi, GeorgeRichardPaul.Santi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/39717
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
KP	2
Verantwortliche/r Dozent/in	
Vorlesungsstunden	0
Laboratoriumsstunden	32 Gruppi 1,2,3+4: Prof. George Richard Paul Santi
Stunden für individuelles	18

Studium	
Vorgesehene Sprechzeiten	6
Inhaltsangabe	The laboratory aims to provide students with practical experience of mathematics laboratories. The sessions will not only offer ideas and teaching materials, but will also encourage students to reflect on teaching practices, the use of tools, the importance of visual representations, and the role of the teacher.
Themen der Lehrveranstaltung	Working groups will analyze situations, materials, teaching tools, and educational experiences related to key concepts, such as the introduction to the concept of numbers, positional number systems, numbers in ancient cultures, teaching models for fractions, and the understanding of symbols.
Unterrichtsform	Laboratory activities utilizing material and digital artifacts, cooperative learning, and an activity theory approach
Pflichtliteratur	Sabena, C, Ferri, F, Martignone, F., & Robotti E. (2019). Insegnare e apprendere matematica nella scuola dell'infanzia e primaria. Mondadori
Weiterführende Literatur	Course materials provided by the teacher

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Aufbau wissenschaftlicher Konzepte in der frühen Kindheit (Sem.)
Code der Lehrveranstaltung	500004C
Wissenschaftlich-disziplinärer Bereich	PSIC-02/A
Sprache	Italienisch
Dozenten/Dozentinnen	Prof. Antonella Brighi, Antonella.Brighi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/39352
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
KP	1

Verantwortliche/r Dozent/in	
Vorlesungsstunden	12 Gruppo 1+2: Prof. Antonella Brighi
Laboratoriumsstunden	0
Stunden für individuelles Studium	13
Vorgesehene Sprechzeiten	3
Inhaltsangabe	This seminar focuses on the structuring of knowledge in early childhood. Central to this are the terms category and concept. The course explores how categories and concepts change throughout the process of cognitive development.
Themen der Lehrveranstaltung	Unit 1 — Early Cognitive Foundations (3 hours) Topics: - Early Knowledge Systems (Core Knowledge): Objects, Number, Space, Causality - Conceptual Change as a Theoretical Reorganization, Not Just the Accumulation of Experience - Overcoming the "Pre-logical" View of Infancy: The Child as a Competent Thinker Unit 2 — Body, Action, and Concept: Embodied Cognition Topics: - Embodied Cognition: The Role of Movement and Action in Concept Construction - Gesture and Mathematical Learning: From Concrete Action to Abstract Representation - Physical Action as a Facilitator for Understanding Physical Concepts (e.g., Strength, Balance) Unit 3 — Executive Functions and Scientific Learning (3 hours) Topics: - Executive Functions: Inhibition, Working Memory, Cognitive Flexibility - The Link Between Self-Regulation and the Capacity for Exploration and Inquiry Learning - Implications for Designing Science Activities in Preschool Unit 4 — The Child as a Theory Builder: The Scientific Thinking as a Process (3 hours) Topics: - "Theory-theory": children form and revise intuitive theories like

	scientists - Causal reasoning, hypothesis formulation, comparison of explanations - Curiosity and emotion as cognitive and motivational variables of learning - Interdisciplinary synthesis and connection with the final integrated design workshop (math, physics, science)
Unterrichtsform	The module is delivered online in synchronous mode, but is designed to maintain a highly interactive and laboratory-based approach, consistent with the very purpose of the teaching (the active construction of concepts): Lectures conducted via videoconference, with brief moments of theoretical presentation (max 20-25 minutes) alternating with guided discussions Work in small groups in a breakout room, with plenary feedback at the end of each activity Collaborative analysis of videos of children in exploration, play, and scientific activities Use of collaborative digital tools (shared whiteboards, real-time documents) for micro-planning of teaching Remote simulations and embodied activities: students experience firsthand activities that they will then design for preschool (e.g., the walked number line, performed individually and then compared in groups) Critical discussion of cases and readings, with a request for motivated personal placement Concluding feedback in Unit 4, in conjunction with the final interdisciplinary workshop of the Seminar Supporting materials: pre-assigned readings, summary slides, shared video repository, and sample teaching activities
Pflichtliteratur	- Carey, S. (2009). The Origin of Concepts. Oxford University Press. - Diamond, A. (2013). Executive functions. Annual Review of Psychology, 64, 135–168. - Gopnik, A., & Schulz, L. (2004). Mechanisms of theory formation in young children. Trends in Cognitive Sciences, 8(8), 371–377.

Weiterführende Literatur	further references will be communicated during the seminar

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Aufbau wissenschaftlicher Konzepte in der frühen Kindheit (Sem.)
Code der Lehrveranstaltung	500004D
Wissenschaftlich-disziplinärer Bereich	MATH-01/B
Sprache	Italienisch
Dozenten/Dozentinnen	Prof. George Richard Paul Santi, GeorgeRichardPaul.Santi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/39717 dr. Sara Bagossi, Sara.Bagossi@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/50774
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
KP	1
Verantwortliche/r Dozent/in	
Vorlesungsstunden	12 Gruppo 1: Dr. Sara Bagossi 12 Gruppo 2: Prof. George Richard Paul Santi
Laboratoriumsstunden	0
Stunden für individuelles Studium	13
Vorgesehene Sprechzeiten	3
Inhaltsangabe	The seminar aims to provide future kindergarten teachers with an opportunity to link the theoretical knowledge acquired in the "Developmental and Educational Psychology" course with the observation and practical understanding of how pre-school children think and reason about their experiences with physical phenomena

	and mathematical concepts. Building on basic knowledge of cognitive development processes in early childhood, the course will explore the ways in which children construct spontaneous explanations of the world around them. Through examples, discussion of educational situations, and analysis of teaching activities, children's intuitive ideas will be explored. Particular attention will be paid to the ways in which children formulate hypotheses through experimentation and action, use language and expressive gestures to explain what they observe and feel, and progressively construct representations of phenomena, always deeply rooted in bodily and sensory experience.
Themen der Lehrveranstaltung	Phases of understanding in early childhood. Basic image schemas for interpreting experience. Development of key concepts according to the theory of the embodied mind.
Unterrichtsform	Laboratory-based teaching with material and digital artifacts, cooperative learning, and whole-group discussions.
Pflichtliteratur	Bartolini Bussi, M. G. (2008). *Matematica. I numeri e lo spazio*. Edizioni Junior.
Weiterführende Literatur	

Kursmodul

Titel des Bestandteils der Lehrveranstaltung	Aufbau wissenschaftlicher Konzepte in der frühen Kindheit (Sem.)
Code der Lehrveranstaltung	500004E
Wissenschaftlich-disziplinärer Bereich	PHYS-06/B
Sprache	Italienisch
Dozenten/Dozentinnen	Prof. Federico Corni, Federico.Corni@unibz.it https://www.unibz.it/en/faculties/education/academic-staff/person/800
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
KP	1
Verantwortliche/r Dozent/in	

Vorlesungsstunden	12 Gruppo 1+2: Prof. Federico Corni
Laboratoriumsstunden	0
Stunden für individuelles Studium	13
Vorgesehene Sprechzeiten	3
Inhaltsangabe	The seminar aims to provide future kindergarten teachers with an opportunity to link the theoretical knowledge acquired in the "Developmental and Educational Psychology" course with the observation and practical understanding of how pre-school children think and reason about their experiences with physical phenomena and mathematical concepts. Building on basic knowledge of cognitive development processes in early childhood, the course will explore the ways in which children construct spontaneous explanations of the world around them. Through examples, discussion of educational situations, and analysis of teaching activities, children's intuitive ideas will be explored. Particular attention will be paid to the ways in which children formulate hypotheses through experimentation and action, use language and expressive gestures to explain what they observe and feel, and progressively construct representations of phenomena, always deeply rooted in bodily and sensory experience.
Themen der Lehrveranstaltung	Phases of understanding in early childhood. Basic image schemas for interpreting experience. Development of key concepts according to the theory of the embodied mind.
Unterrichtsform	Online classes with assignments for small groups
Pflichtliteratur	Handouts and bibliography provided by the lecturer
Weiterführende Literatur	Handouts and bibliography provided by the lecturer