UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics Teaching (with Workshop)

2627-4-G8501R023

Course title

G8501R023 - Didactics of mathematics with laboratory

Topics and course structure

The lecture course aims to provide skills and tools practical for the development of teaching activities for the teaching of mathematics and related disciplines through:

- The analysis of teaching units structured according to the principle of discovery followed by consolidation;
- The learning and consolidation of programming principles applicable to creating teaching experiences to support the teaching of the discipline;
- The study of examples of the application of educational robots to teach mathematics in an interactive and laboratory context.

The lecture course aims to provide examples and opportunities for practical trials in various forms in which teaching can be articulated, starting from the early experiences in preschool to didactic pathways for primary school.

Objectives

With this lecture course, with constant and active attendance in the lessons and the laboratory connected to the course, the following learning outcomes will be achieved:

- curriculum design and didactic activities for teaching mathematics in preschool and primary school
- introduction and consolidation of programming principles helpful in supporting the learning of the discipline

- use and coding of educational robots as an aid for teaching mathematics.

At the end of the course, students:
- Understand models of educational design and the role of technologies in teaching practices
- Are familiar with foundational scientific concepts, formalized language, and mathematical structures
- Are able to design and implement educational pathways using a variety of methods and creating connections with other disciplines
- Can use mathematical language to tackle problems
- Develop autonomy in analyzing, implementing, and evaluating educational needs
- Gain perspective on research in mathematics education

Methodologies

Lectures (40 percent, frontal teaching), interactive workshops (60 percent, interactive teaching), pedagogical-didactic laboratory (30 percent, interactive teaching).

Teaching is conducted in Italian. Students wishing to use English in writing the portfolio and during the oral exam are welcome to do so.

Online and offline teaching materials

All information related to the lecture course (lectures, laboratory, and exams) and educational and supplementary materials will be available exclusively in the dedicated space on the website http://elearning.unimib.it/. Therefore, all students who intend to attend the laboratory associated with the course and/or take the exam are required to register and use this platform.

The instructor provides recordings of the lessons on the e-learning page to support students in studying and preparing for the exam.

Programme and references

The teaching program includes:

- The analysis of educational activities for teaching mathematics in preschool and primary school, developed according to the principle of discovery of concepts, techniques of formalization, and consolidation of the newly learned concepts in various areas of mathematics (algebra, geometry, probability).

- Learning the most common programming languages (Scratch, Python) that are functional for developing coding activities to support the learning of the discipline.

- Studying examples of using educational robots for creating laboratory activities that reinforce concepts related to logic, mathematics, and related disciplines.

Reference Texts

For theaching mathematics:
Materials provided by the instructor will be available on the course's e-learning page.
Peter Liljedahl, "Building Thinking Classrooms in Mathematics.", Corwin, 2020

To self-evaluate the knowledge of mathematical concepts:
Silvia Tabarelli, "Astuccio delle regole di matematica", Erickson, 2016

Educational materials useful for portfolio development and in-depth study

Peter Liljedahl & Maegan Giroux, "Mathematics Tasks for the Thinking Classroom, Grades K-5", Corwin, 2024
Daniele Gouthier, "Matematica fuori dalle regole - Guida di sopravvivenza per genitori e insegnanti", Feltrinelli, 2024
Hans Magnus Enzensberger, "Il mago dei numeri", Einaudi, 2014
Emma Castelnuovo, "Didattica della matematica", UTET, 2025
AAVV, "EnigMath: Quaderni delle sfide matematiche", Innovamat Education, 2024
Elena Rinaldi, "Facciamo Che Eravamo Matematici", Scienza Express, 2019
Laura Montagnoli, "Matematica con SCRATCH", Editrice Morcelliana, 2023
Fondazione Mondo Digitale, "Tinkering Coding Making", Erikson, 2019
Linda Liukas, "HELLO RUBY - Avventure nel mondo del coding", Erikson, 2017
Linda Liukas, "Nel mondo dell'intelligenza artificiale con Hello Ruby", Erikson, 2024
Kiki Prottsman, "My First Coding Book", DK, 2017
Carol Vorderman, "Computer Coding Games in Scratch for Kids", DK, 2024
Carol Vorderman, "Computer Coding Python Games for Kids", DK, 2018
Michele Fumagalli & Silvia Colombo, "Facciamo che eravamo astrofisici", Scienza Express, 2026

Students who intend to spread the exam over two years must agree with the instructor on the bibliography to prepare for the exam.

Assessment methods

Passing the exam requires the submission of a portfolio consisting of two written assignments, followed by an oral examination. There are no midterm exams.

The written portfolio comprises two lesson plans accompanied by a commentary, developed from a list of topics assigned at the beginning of the course.

The oral examination is divided into two parts.

Part One. This section assesses the mathematical knowledge expected at the end of fifth grade in primary school, in accordance with current national guidelines. This will be evaluated through a short mathematical problem modeled after the INVALSI tests. Students must pass this section to proceed to the second part.

Part Two. This section consists of a discussion of the portfolio. Evaluation criteria include the ability to critically elaborate on the course topics and laboratory experience, as well as the capacity to independently explore a specific mathematical teaching topic, analyze its content, and identify its most significant aspects to build effective educational activities. Furthermore, candidates will be assessed on their knowledge of the mathematical topics under analysis and their ability to connect the mathematically significant aspects of these topics with the pedagogical approaches used to design relevant learning activities.

The final grade reflects a comprehensive evaluation of all components contributing to the learning objectives described above. Specifically, the assessment will be based on the following criteria:

- Completeness, originality, and accuracy of conceptual elaboration
- Coherence and rigor in the logical structure of the portfolio and its presentation
- Analytical and synthesis skills
- Accurate and rigorous use of mathematical language

Office hours

By appointment (via email).

Programme validity

According to the rules of the degree programme.

Course tutors and assistants

Prof. Matteo Fossati
Dr. Lorenzo Pizzuti

Sustainable Development Goals

QUALITY EDUCATION