Pedagogic case and specific course in which designed tasks and units are used

Name of university: Masaryk University

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Pedagogic case:	• Inquiry-based activities for selected topics of the course Mathematical Analysis 1 and its seminars
Description (including temporal scheme for design, development and implementation)	• Using inquiry-based teaching units to help students to comprehend key terms of the course • Planning of the 1st round of developmental process: - design in January 2019, - development in February – March 2019, - 1st implementation in March – April 2019, - evaluation in May – June 2019.

Aim of pedagogic case	• Students are introduced with topics during lectures given by our colleague Karel Lepka on more theoretical level. We should continue in seminars, add more practical information and guide students to understand these topics. • The aim of IBE units we plan to design is to enable students better and deeper understanding of key theoretical terms of Differential calculus – limit of a function, derivative of a function. • We have another particular motivation to use IBE units – to demonstrate participants different types of teaching activities than they are used to; our students should teach mathematics in secondary schools after they finish their studies, therefore they can try IBE activities themselves and think about pros and cons of this type of teaching/learning process.
Mathematical concepts	• Real functions of a real variable 1. Limit of a function 2. Derivative of a function 3. Applications: Monotonicity and local extrema, Convexity/concavity and points of inflection
Addressed practice	• Seminars
Place in specific course Course name Place of units	• Mathematical Analysis 1 • 3rd week (limit of a function), 4th week (derivative of a function and its geometrical interpretation), 6th week (Monotonicity and local extrema, Convexity/concavity and points of inflection)
Learners profile orientation, year, age, prior knowledge, other such as math anxiety, special needs, ..	• 1st year, 2nd semestre students in Bachelor programme of Mathematics for Education, • Prior knowledge of basic curriculum of secondary school mathematics • Prior knowledge of Propositional calculus, First-order logic, Set theory, Binary relations and its properties, Elelementary real functions of one variable, and key terms of discrete mathematics • No prior experience with Geogebra or any other application for plotting graphs
Organisation of specific course study credits/hours, location, group size	• 5 ECTS credits • 2x50 min lectures and 2x50 seminars each week (13 weeks in total) • 70 students divided into three groups for seminars

Expected learning outcomes	• Deeper understanding of key theoretical terms such as the limit and the derivative of a real function of a real variable • Geometrical interpretation of these terms • Awareness of applications for plotting graphs of 2D and 3D functions (Geogebra, Wolfram Alpha, etc.) • Ability to analyze the function of one variable and to understand the relationship between the first derivative and monotonicity, and the second derivative and convexity/concavity.
Envisioned use of digital technology	• Geogebra Online
Planning of tasks	• Discussions (teachers involved in the course) • Design of inquiry-based activities • Monitoring the process of their usage (peer-observing and the following discussion) • Feedback from the students (students' opinion poll)
Names of persons involved	• Lenka Pavlíčková • Lukáš Másilko
Course:	Mathematical Analysis 1

Learning objectives	• We focus to develop our students' ability to
	  ○ find a limit of some function or sequence,
	  ○ compute a (partial) derivative of some function of one or more variables,
	  ○ analyze the graph of some function,
	  ○ approximately compute the value of the function at some point,
	  ○ use digital tools when computing or plotting the graph of the function

Learning contents	• Sequences
	  ○ Limit of a sequence and accumulation (cluster) points
	• Real functions of a real variable
	  ○ Limit of a function and its continuity
	  ○ Derivative of a function
	  ○ Applications: L'Hospital's rule to find a limit of a function, approximation of a function by its differential and Taylor polynomial, Analysis of the function and its curve sketching
	• Real functions of two and more variables
	  ○ Limit of a function and its continuity
	  ○ Partial derivative of a function
	  ○ Searching for local extrema

teaching /learning activities	• Lectures and seminars include
	  ○ Teachers' explanation of the key terms and proving the most important statements,
	  ○ discussion to verify students' understanding,
	  ○ demonstrating methods of computation by teachers or students themselves in front of the others

Media	• We prepare one document for each seminar including the most important facts, examples to compute during instruction or at home and the recommended sources to read – these files will be uploaded to the folder with study materials (in the Masaryk University Information System) before seminars start.
Evaluation	• Two credit tests (mid-term and final) and an oral exam if students pass both credit tests

Instructor role	• As seminars' leaders we are closely linked with Karel Lepka who gives lectures, therefore we
	  ○ discuss the key terms and try to activate students to come with their answers, comments, questions;
	  ○ guide them during practical solution of examples and give them feedback;
	  ○ encourage them to work in teams to find out the solution of the given problem

Student roles	• Students should
	  ○ actively participate in the seminars – put questions, comments;
	  ○ try to solve the problems by themselves or in groups, not only wait for explanation of an instructor.

Other aspects	•