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

Name of university: University of Agder

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Pedagogic case:	• Inquiry based Multivariable Calculus
Description (including temporal scheme for design, development and implementation)	• We are interested in transforming traditional Multivariable Calculus into an Inquiry Based (or Active) Multivariable Calculus. • The ambitious goal is to have small inquiry-based tasks in every lecture and inquiry-based problems in (non-obligatory) assignments and in seminars. • To encourage students' active engagement with the non-obligatory tasks and attendance during seminars, several inquiry-based problems from the assignments (chosen from textbooks other than the main textbook) will be selected for the final written exam. Students who seriously engage in solution of assignments will be provided feedback on their work.

Aim of pedagogic case	• Facilitate understanding of the main concepts in Multivariable Calculus and improve retention of the basic notions and ideas
Mathematical concepts	• Graphs of curves in two and three dimensions • Parametric curves • Planes, curves and surfaces in 3D • Polar, spherical and cylindrical coordinates • Vectors in 3D and operations on vectors • Numerical and functional series, convergence and divergence of series • Multiple integrals and applications • Line integrals • Divergence, gradient and curl • Green's, Stokes and Gauss' theorems
Addressed practice	• Bachelor's Programme in Mathematics • Bachelor's Programme in Mathematics and Physics • Advanced teacher Education level 8-13, 5-year master Programme • Master's Programme in Mathematics Education • Mathematics, 1-year Programme
Place in specific course Course name Place of units	• The course MA-216 Calculus 2 taught yearly during Spring term
Learners profile orientation, year, age, prior knowledge, other such as math anxiety, special needs, …	• Undergraduate students in Mathematics and Physics, master student in mathematics education and advanced teacher education for senior students
Organisation of specific course study credits/hours, location, group size	• 15 credits course • 13 teaching weeks • 78 academic hours of lectures • 26 academic hours of seminars • One compulsory assignment • Four non-compulsory assignments • Compulsory practice for students at the Advanced Teacher Education • An expected workload of about 400 hours

Expected learning outcomes	The student should be able to • decide whether a numerical series converges or diverges and to find the convergence interval for power series • explain and apply the concepts of gradient, conic section, parametrized curve and surface • perform line-, double-, triple- and surface integration and apply integrals to find the arc length, area, volume and work • use digital tools to visualize surfaces and curves in 3D space and to describe fundamental results • use polar-, cylindric- and spherical coordinates for evaluation of multiple integrals • apply Green's theorem, Stokes' theorem and the divergence theorem
Envisioned use of digital technology	• CAS may be used for visualization of curves, surfaces and regions in 2D and 3D as well as to illustrate/facilitate some computations
Planning of tasks	• Discussion of the course and preliminary planning by the course team (Yuriy Rogovchenko – the lecturer, Simon Goodchild, Svitlana Rogovchenko) • Analysis of available materials on "IBL Calculus" and "Active Calculus", mainly in the US • Weekly selection/design of inquiry-based tasks by the course team • Regular observation of lecturers and seminars by Simon Goodchild with the consequent discussions within the course team and eventual strategy/materials adjustments • Keeping the record of all course developments including observations of mathematics educator and lecturer's reflections • Analysis of the overall students' performance and its comparison to that in "traditionally taught" course
Names of persons involved	• Yuriy Rogovchenko (lecturer) • Simon Goodchild (mathematics education lead) • Svitlana Rogovchenko (mathematics and educational support, mediation between Simon and Yuriy)
Course:	
Learning objectives	• Students are expected to learn the fundamental results and techniques related to sequences and series, curves, surfaces, vector valued functions,

	multiple integrals, Green's theorem, Stokes theorem, the divergence theorem and to apply the knowledge for solving problems, including real-life applications.
Learning contents	• See above
teaching /learning activities	• Lecture, seminars, obligatory and non-obligatory assignments
Media	• Canvas • Personal computers • Mobile phones for classroom engagement during the lectures • Appropriate software for computing and lecturer-class interaction (Kahoot!, Socrative, Menti, Padlet)
Evaluation	• Written six hour exam
Instructor role	• Preparation of lectures, selection and development of IBL tasks, teaching and advising students and teaching assistants
Student roles	• Active engagement in learning during the lectures, seminars and independent studies
Other aspects	•