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

Name of university: Loughborough University
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Pedagogic case:	• Teaching Complex Numbers (C. N.) within a mathematics course for first year Aero/Auto Engineering Students
Description (including temporal scheme for design, development and implementation)	• I am keen to explore developments in teaching for this group of students. Ideally, I want to introduce some inquiry-based activity in teaching-learning. This can include design of types of questions, inquiry-based tasks, engagement with students, students own engagement …

Aim	• To think about the teaching of C.N.: what mathematical concepts are included and how they can be approached. To try out some of these ideas with the current cohort, collect data in some forms, and make suggestions for future cohorts.
Mathematical concepts	• The nature of C.N; arithmetic of C. N; representations of C.N. and how they are related; graphical and algebraic forms; …
Addressed practice	• 1st year in the Aernautical/Automotive Engineering Bachelor programme; an introduction to mathematics in the programme building on expectations of what students have learned in their pre-university courses.
Place in specific course Course name Place of units	• A one-semester module in a modular programme. • Title is: Engineering Mathematics 1 • The module will be a basis for further mathematics modules in the programme
Learners profile orientation, year, age, prior knowledge, other such as math anxiety, special needs, ..	• First year engineering students in Aero/Auto – approx. 200 students.. • Higher secondary/college education in mathematics • Students come from a diversity of backgrounds – some will have studied more of the content than others. • Students with S.N. are included in the cohort as a whole, with special provision as relevant.
Organisation of specific course study credits/hours, location, group size	• They should all have covered the same mathematical concepts by the end of the module. • Module is taught each week throughout a 12-week semester • Each week provides two lectures (50 mins each) and two tutorials (one for each half of the cohort). Tutorials allow students to work on set tasks and discuss them with the lecturer and a graduate student supporting the module.
Expected learning outcomes	• Students are expected to real a common standard in a range of topics – including calculus, matrices, vectors and complex numbers. • Where C.N is concerned, a good understanding is expected of the concepts to be addressed which are stated above.
Envisioned use of digital technology	• We have designed tasks in Autograph from a research project compleredd with Foundation students (Catalyst). These tasks will be available for use in demonstration mode but not for students' own use since we do not have the necessary software licence for the cohort.

Planning of tasks	- Performing an a priori analysis of the mathematics in the C.N topic - Discussion with colleagues who are mathematicians and mathematics educators - Design of inquiry-based tasks and teaching approaches - Fitting new forms of activity into the teaching schedule developed in the previous year of the module (time does not allow a complete revision of this teaching) - Keeping a record of new tasks/approaches for the current cohort – to include specific details of tasks and approaches, and teacher reflections on the teaching and learning that takes place. - Student scores from a computer-based task on this material - Introduction of an inquiry-based section in the exam question for C. N. - Details of how students tackle the C.N. question in the exam.
Names of persons involved	- Barbara Jaworski - Stefanie Thomas - Paola Ianone
Course:	**First module in mathematics for engineering students (Aero/Auto)/**
Learning objectives	On completion of this module, students should be able to: **Knowledge and Understanding** Solve mathematical problems in the areas listed in the contents. **Subject-specific Skills** - calculate with vectors; - differentiate and optimise functions of a single variable; - apply matrix algebra to solve systems of linear equations; **Transferable Skills** - manage time effectively in the preparation of coursework; - work independently; - organising the material of the module to support own learning; - construct clear, logical arguments.
Learning contents	Functions of a single variable. Simple use of limits. Differentiation. Matrices. Use of determinants. Inverse matrix. Solving systems of linear equations. Vectors, dot and cross products. Complex numbers, Argand diagram, Polar and exponential forms, taking complex roots. Simple sequences and series. Binomial series, Power series, Maclaurin and Taylor series. Integration, Method of

	substitution, partial fractions and Integration by parts. Ordinary differential equations. Applications of all previously listed topics.
teaching /learning activities	• Each week provides two lectures (50 mins each) and two tutorials (one for each half of the cohort). Tutorials allow students to work on set tasks and discuss them with the lecturer and a graduate student supporting the module.
Media	• As above
Evaluation	• Three computer-based test, one in C. N.
Instructor role	• Development of module content and delivery; Lecturer, presenting course material is lectures; tutor – working with students in tutorials encouraging their own activity and thinking and providing support.
Student roles	• Engaging with the mathematics in both lectures and tutorials. More overt engagment in lectures will be encouraged. More inquiry-based activity in tutorials will be encouraged.