Teaching Philosophy

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Teaching has always been central to my academic identity, complementing my research and deepening my understanding. Effective mathematics education goes beyond knowledge transfer; it nurtures critical thinking, curiosity, independent learning, and invites new generations into scholarly debates. I view teaching as a dynamic process where students actively engage with mathematical concepts.

My approach is based on three key principles: building strong theoretical foundations, fostering problem-solving skills, and preparing students to apply their learning beyond the programme. Through my experience across various institutions and countries, I have learned that effective teaching requires adaptability. Recognizing the diverse ways students think and learn, I strive to foster an environment where they feel engaged and supported. I aim to build an inclusive academic community where students collaborate meaningfully and develop rigorous solutions. Ultimately, I seek to cultivate the confidence and skills necessary for students to contribute to scholarly debates and positively impact society.

My personal journey

Early in my career, particularly while studying and working at research-intensive institutions, the prevailing expectation was that most students would pursue academic careers in mathematics. Over time, I realized this was not the case. This shift in perspective has been pivotal in shaping my approach, prompting me to adapt my teaching methods to better align with my students' diverse aspirations.

Teaching at Hull has further accelerated my understanding of the distinct needs of different cohorts. As I teach three undergraduate modules and supervise master's students, I have seen firsthand how students mature over time. This progression has reinforced my belief that the level of the module greatly influences teaching strategy.

Effective teaching today also requires sensitivity to how students access and engage with knowledge. While traditional lectures remain valuable, integrating digital tools can enhance learning [6]. To support this transition, I have developed mobile-friendly digital lecture notes using Quarto [10], ensuring they can interact with high-quality materials in a format that suits their needs. My familiarity with platforms such as Canvas and Teams has also allowed me to create an inclusive, flexible learning environment for both in-person and online students [7].

Building strong foundations

Transitioning from A-level to university mathematics involves a shift in both pace and approach. As a student, and now as a teacher of Year 1 students, I have learned that university mathematics requires a move beyond memorization. With the volume of information, students must focus on mastering key concepts and their application rather than memorizing everything [11]. To support this, I provide a *Revision Guide* that outlines essential concepts and worked examples, which has greatly boosted students' confidence in exam preparation.

A key part of this transition is developing a strong foundation in mathematical proof, an area where many students struggle. I focus on essential proofs, breaking them into manageable steps and explaining the reasoning clearly. To help students understand the necessity of proofs, I incorporate counterexamples and historical context, demonstrating how proof naturally emerges as a fundamental part of mathematics [2].

Equally important is helping students gain confidence in applying mathematical theory. Many struggle with a fear of failure, feeling unsure of where to begin. To address this, I use two approaches: guided exercises in class and structured assignments. In class, I lead students through

exercises reinforcing core ideas, while assignments are progressively structured, with initial steps mirroring guided exercises. Later steps encourage deeper thinking, helping students transition from understanding concepts to applying them independently.

These methods reflect my belief that mathematical theory is not just a set of problem-solving techniques, but a framework for reasoning. The step-by-step approach mirrors mathematical research, where progress is made incrementally. Students are often surprised by how simple steps can lead to powerful results, sparking their curiosity and helping them see the creative side of mathematics.

Becoming a problem-solver

In mathematics, true understanding comes not just from knowing theorems and formulas, but from learning how to apply them to solve real-world problems. Mathematics is often perceived as a rigid subject, but I believe that learning it should involve exploration and adaptability. A well-structured problem should encourage students to think beyond immediate calculations and see the underlying structure of an argument. In my teaching, I aim to help students develop this problem-solving mindset, particularly in Years 2 and 3, when they have acquired a solid mathematical foundation and can begin exploring more open-ended questions.

To support this, I incorporate practical examples in class, using real-world datasets and project work that encourages students to develop their own modelling solutions. This is a key feature of my *Statistical Models* module at Hull, where students analyze data and build predictive models informed by recent research. The challenge lies in choosing an appropriate approach, as different methods offer varying levels of creativity, complexity, and accuracy. Rather than dictating a single solution, I guide students toward viable strategies, directing them to relevant readings and encouraging them to justify their choices while weighing the strengths and limitations of their approach. Encouraging students to consider multiple solution strategies also helps them build flexibility in their thinking.

Collaboration is key to this learning process. I employ *flipped classroom* [1], and *informal group work* [9] during sessions, giving students the chance to master core concepts and practice problem-solving in small groups . Tutorials further support this by providing a space for discussion and deeper understanding. While collaboration is encouraged, I emphasize academic integrity, ensuring students independently write up assignments and develop their own arguments.

Going Beyond the Standard Curriculum

As a Lecturer, I support students' transition *from learners to practitioners* of mathematics, encouraging the application of mathematics in both academia and industry. Mathematics' beauty and interdisciplinarity can be applied across sectors, and I help students recognize the versatility of their skills. Student project supervision provides an excellent opportunity to support this transition. At Hull, I have had the privilege of supervising exceptional students, watching them grow into independent researchers as they align their final year projects with personal interests. This is one of the most fulfilling aspects of teaching.

Throughout this process, I offer continuous support through weekly meetings and extra office hours [5]. To facilitate this, I ask students to share their projects on Overleaf, a collaborative platform for writing documents in LaTeX. This approach allows me to monitor their progress in real-time, providing immediate feedback and eliminating the need for draft exchanges via email. Additionally, Overleaf enables me to assist with any LaTeX issues, ensuring that technical challenges do not distract from the content of their work. This approach helps to focus on improving students' technical writing skills, which are essential for effective scientific dissemination [8].

The modules I teach in Year 2 and 3 at Hull also guide students toward specific career interests. In my *Differential Geometry* module, I often work with students who are inclined towards academia and are considering pursuing a PhD. For these students, I offer mentorship in applying to programs

and scholarships, while focusing on projects that align with their passion for topics like geometry, mathematical analysis, or algebra. One of my recent supervisees, whose project played a central role in their application, was awarded a prestigious UK master's scholarship. In contrast, students in my *Statistical Models* module often aim for industry careers. These students engage with projects in areas like resource allocation or sports modelling, leading to exciting outcomes. I am particularly proud of two publications I have achieved with project students in the modelling of sports such as Formula 1 and curling [4, 3]. It is rewarding to see students combine their passion for sports with their love for analytics, and achieving a publication in the process is a gratifying achievement.

Beyond technical proficiency, I see my role as a mentor who helps students navigate the university system and develop their academic identity. I guide students in formulating their own research questions and critically assessing mathematical models, balancing support with independence to equip them for success in both academia and industry.

Conclusion

As I continue to evolve as a teacher, I am committed to creating an inclusive and supportive learning environment. I believe that every student, regardless of background or prior knowledge, should have the opportunity to succeed in mathematics. To achieve this, I design my modules to accommodate diverse learning styles, using a variety of teaching methods such as visual aids, step-by-step exercises, and discussions. I also make myself available outside of class through office hours and one-on-one video calls to offer additional support.

My approach to teaching is centered around clarity, structured problem-solving, and fostering independent thinking. I want students to view mathematics not just as a set of rules but as a way of reasoning. I am passionate about continuously developing my teaching practices. These experiences have shaped my approach to module design and student interaction, allowing me to balance theoretical depth with practical application, and adapt my teaching style to meet the needs of diverse learners. Ultimately, I strive to help students build confidence, whether in applied or pure mathematics. My goal is to empower them to ask their own questions, explore problems independently, and appreciate the depth of the discipline. By bridging the gap between theory and application, I prepare students not only for coursework and exams but also for successful careers in academia and industry.

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