CAREER VIEW

MATHEMATICS AND STATISTICS

Mathematics and statistics have a long history and an exciting future. In fact mathematical and statistical ways of thinking and operating are becoming more and more the way of the world. Mathematics and statistics are at the cutting edge of modern developments such as data science, which enables governments and businesses to manage and utilise the vast amounts of information generated by the global knowledge economy.

Mathematics and statistics open the doors to a huge variety of rewarding and well-paid careers. Career pathways include roles such as actuary, data scientist, statistician, ecological modeller, computer graphics designer, computer programmer, software engineer, share-broker, communication and signals analyst, bioinformatics scientist and many more.

A 'language' with its own vocabulary and system of symbols, mathematics is a tool for communication that crosses international and disciplinary boundaries and interconnects with numerous other subjects and occupations. As well as being essential for many jobs in public and private sectors, mathematics and statistics are vital to the study of science subjects and a prerequisite for the study of many others.

WHY STUDY MATHEMATICS AND STATISTICS?

Mathematics and Statistics graduates are among the most employable of university graduates because the skills they learn at university are needed in so many areas of work. Businesses and governments, local authorities, educational organisations and non-government agencies are continually gathering, sorting, measuring, calculating and interpreting data, translating it into meaningful numbers, weighing trade-offs, predicting the consequences of actions, uncertainty and risk, and using complex quantitative approaches to make decisions.

At managerial levels mathematical and statistical skills will help you to think logically and precisely, to problem solve and to make decisions based on the analysis of numerical data. Your career prospects are definitely enhanced if you include these subjects in your degree.

Mathematics and statistics provide a critical knowledge base for the study of subjects such as physics, chemistry, economics, commerce and engineering, and complement and support many others. Employers consider it a plus if one or more Mathematics and Statistics courses are included in a degree as this indicates a good level of numerical ability.

Topical coverage of career related issues brought to you by Victoria University Careers and Employment.

Areas covered include how degrees and courses relate to employment opportunities, to life/work planning, graduate destination information and current issues or material relevant to the employment scene. Your comments and suggestions always welcomed.

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA UNIVERSITY OF WELLINGTON

WHAT SKILLS DO MATHEMATICS AND STATISTICS GRADUATES HAVE?

Numerical confidence means you are comfortable with numbers, their relative size and what they express. This includes not just a mechanical approach but an ability to see when numbers make sense and are within the bounds of possibility. You will be able to understand and work with numerical and graphical information, to apply, interpret, critique and communicate mathematical concepts in a range of academic and life situations, to draw conclusions, explain findings, make deductions and spot unsound deductions made by others. This also involves critical thinking and independent reasoning; skills that are sought by many employers.

Decision-making skills: At the foundation of complex, modern decision-making, mathematics has developed ways to predict the best possible outcomes when faced with conflicting options. The many different mathematical decision-making techniques include quantitative skills - the ability to identify and measure quantities of data and develop or use relationships between the variables that the quantities represent. The application of quantitative methods helps businesses, government agencies, investors, scientific researchers, and problem solvers of all kinds make better decisions.

Problem solving and creativity: Mathematicians enjoy the challenge of wrestling with and solving problems, and of applying lateral thinking to finding solutions. Asking 'what if?' they often use intuition and creativity to identify possible solutions to a problem. They will then apply their skills in logical thinking and analysis to systematically evaluate the relative merits of each solution.

Computer literacy: Computers are used extensively in all statistical and most other mathematical work, so early familiarity with appropriate and current software is advantageous. But more important is a thorough grasp of the underlying principles that will enable you to quickly learn new technology and applications. You should include computer science courses in your degree if you intend to do advanced courses involving statistical or mathematical modelling.

Teamwork: Mathematicians are often employed as part of a multi-disciplinary team in which specialists are required to contribute their skills and knowledge. Being able to work well with people with different skill sets and from different backgrounds is a definite advantage.

Communication and interpersonal skills: In employment situations Mathematics and Statistics graduates may have to communicate complex information or ideas to their non-specialist managers, colleagues and clients. It is important to be able to listen and to communicate (both verbally and in writing) in clear, jargon-free English.

WHERE DO MATHEMATICS AND STATISTICS GRADUATES WORK?

Mathematicians and statisticians are employed in a wide variety of organisations, often as part of a multi-disciplinary team in which their particular expertise complements that of others. Specialist applied areas need people with high-level mathematical and statistical skills (including Master's and PhD degrees). Examples are data science, actuarial science, statistics, operations research, astronomy, biometrics (statistics for the study of biology), econometrics (statistics for the study of economics) and in disciplines which are highly mathematical in nature such as meteorology (the study of weather and climate), geophysics (the physics of the earth), seismology (the scientific study of earthquakes), and computer science.

Public Sector: Government ministries, departments and local and regional authorities have an increasing need for staff such as policy analysts who are skilled in mathematics and statistics and able to understand and work with quantitative methodologies, data modelling, trend analysis and forecasting, for example in economics and climate change.

Government Ministries, Departments and State-Owned Enterprises: ***Statistics New Zealand*** gathers, collates, analyses and validates data about New Zealand's household spending, population and employment. Graduates are recruited from mathematics, statistics and other maths-based disciplines to Statistical Analyst roles. The skills and aptitudes ***Statistics New Zealand*** looks for include: good organisational skills and the ability to work well under pressure; excellent communication skills; the ability to work well in a team environment and build productive working relationships; a passion for analysing data and using it to tell meaningful stories about and for New Zealanders; a background and/or interest in economic, social, population, or environmental statistics; the ability to think critically about situations and explore broadly for solutions; self-motivation and initiative. When you combine statistics with study in another field, such as biology, agriculture or environmental studies, you are likely to increase your chances of getting a job. A Master's degree could also improve your chances.

Ministry of Business, Innovation and Employment (MBIE) employs Mathematics and Statistics graduates to the Sector Performance Team in the Evidence,

Monitoring and Governance Branch. Statisticians and data scientists work in the Branch and graduates may apply for entry level analyst roles. ***MBIE*** looks for well-rounded people with a solid grounding in mathematical and statistical principles; passionate, lifelong learners able to learn new techniques in a rapidly changing world; team players who can work together on complex projects and, particularly at higher levels, able to communicate well with many different stakeholders.

Other government ministries such as ***Ministry of Health, Ministry of Education, Ministry of Social Development*** and ***Ministry of Defence*** also employ graduates with numerical skills.

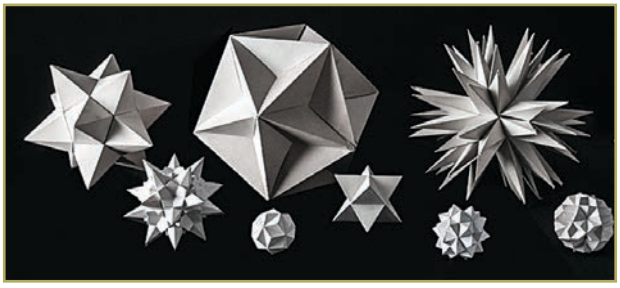
Treasury is the Government's lead economics, financial and regulatory policy advisor, charged with helping to raise living standards and keep the New Zealand economy healthy. Every year Treasury recruits for its Summer Intern programme and Graduate Analyst programme. Treasury looks for students with a broad range of academic backgrounds. It isn't what you studied that matters but how you think. Are you an analytical problem solver? Are you a good verbal and written communicator? Are you great at building and maintaining relationships with people from a range of backgrounds and stages?

The Reserve Bank manages 'monetary policy' ensuring that New Zealand has a stable and efficient financial system. The Bank employs well-qualified graduates initially to Graduate Analyst roles. Successful job candidates have a minimum of Honours in econometrics, economics and financial mathematics.

The Government Communications Security Bureau (GCSB) contributes to New Zealand's national security by providing information assurance and cyber security to the New Zealand Government and critical infrastructure organisations, foreign intelligence to government decision-makers, and cooperation and assistance to other New Zealand government agencies. Mathematicians will ideally have a Bachelor's or higher degree in one or more of the following: abstract algebra, number theory, combinatorics, graph theory, complexity theory, mathematical analysis, cryptography, coding theory, operations research, optimisation, probability theory, and statistics. Intelligence Analyst roles are recruited from a wider range of graduates.

State-owned enterprises (SOEs) like ***Transpower*** (the owner and operator of New Zealand's high-voltage electricity transmission grid) and mixed ownership model companies like ***Meridian Energy, Genesis Energy*** and ***Mighty River Power*** (electricity generators and retailers) employ Mathematics and Statistics graduates and also graduates from other highly numerate disciplines like physics and engineering to Statistician, Financial/Business Analyst and Pricing Analyst roles. ***KiwiRail*** has Business Analyst or Data Analyst roles and many corporate roles within finance and ICT such as an Enterprise Architect, for which mathematics or statistics qualifications would be ideal. In marketing, skills in statistics would be ideal for data gathering and data modelling. Graduates with mathematics and statistics plus some business qualifications would be well positioned for a strategy role. Both mathematics and statistics are useful for roles within KiwiRail's Portfolio Management office, where they have technical writers and analysts who analyse risk and do forecasting and data modelling. ***MetService*** gathers, analyses and provides weather information for the public of New Zealand, and for a wide range of domestic and international commercial customers. They employ Mathematics, Statistics, Physics and Geophysics graduates. Roles include Trainee Meteorologist, Meteorologist, and Research Scientist. Personal attributes include communication skills, ability to work in a team, genuine interest in weather, and capacity and willingness to cope with rotating shift-work if in a Meteorologist position.

Crown Research Institutes: ***AgResearch, Scion*** *(New Zealand Forest Research Institute Limited),* ***Plant & Food Research, ESR*** *(Institute of Environmental Science and Research),* ***Landcare Research, GNS Science*** *(Institute of Geological and Nuclear Sciences),* ***NIWA*** *(National Institute of Water and Atmospheric Research).* About 65 percent of all CRI staff are involved in scientific research. Generally technicians are qualified to Master's level whilst scientists have doctorates. CRIs employ graduates with Master's and PhDs in Mathematics and Statistics for Mathematical Modelling. For example ecological statisticians are employed at ***Landcare Research; ESR*** employs biostatisticians, applied mathematicians, chemists and biochemists. ***NIWA,*** with over 600 staff, employs



PhD or promising Master's graduates to roles such as Data Analyst, Climate Modeller, Acoustic Scientist and Fisheries Analyst. The ideal candidate would have a PhD in Applied Statistics and Biological Sciences. A double degree, one being in quantitative science, is crucial for graduates who want to work at ***NIWA***, however a promising graduate with a PhD in applied statistics may get the job over a candidate in science without statistics.

Local and regional authorities have roles such Economic Research Analyst; Asset Manager (plus work experience); Data Analyst (transport; built and green environments); Strategic Asset Planner; GIS Analyst. ***Wellington City Council*** looks for people with strong teamwork skills, good interpersonal and verbal and written communication skills, the ability to manage ambiguous environments and set their own goals. ***Auckland Council*** employs statisticians in Customer and Digital Services among others.

Private Sector: Mathematical and statistical skills are required by many companies, even if not necessarily highlighted in job descriptions. The selection below gives an indication. It is worthwhile networking and researching companies in areas of your interest, and marketing your skills to prospective employers as well as applying for graduate programmes and internships.

Financial Institutions including banks, insurance companies, business and management consulting firms: The financial sector employs statisticians, financial mathematicians, financial analysts, actuaries, investment advisors, share-brokers, operations researchers, economists, economic statisticians and auditors (accountants). They target graduates with degrees in Mathematics, Statistics, Actuarial Science, Money and Finance, Economics and Econometrics. For example ***PricewaterhouseCoopers (PwC)*** employs Mathematics, Statistics and Actuarial Science graduates as Actuarial Analysts where they start or continue to develop the skills required to become a professionally qualified actuary. An Actuary interprets statistics to determine probabilities of accidents, sickness and death, or uncertainty in financial markets, investments and asset management. Actuarial Science applies mathematical skills to a range of applied subjects, and helps to solve important problems for insurance, government, commerce, industry and academic researchers. Mathematics and Statistics graduates with a double degree in Economics or Finance could work at ***PwC*** in Finance and Economics Consulting or Financial Risk.

Industry, commerce, engineering: Graduates combining Statistics, Computer Science, Economics, Management and other commerce subjects, are in demand. Manufacturing and processing companies and utility suppliers in the telecommunications, electricity, gas and petrochemical industries, employ theoretical and applied mathematicians, operations researchers, statisticians and economists. Applied mathematics is used in all branches of engineering which include: civil, mechanical, electrical and electronic, chemical and process, natural resources, mining and forestry engineering.

IT, computer games, computer graphics: The IT industry often recruits graduates from maths-related disciplines in addition to graduates from computer science and engineering. Large companies have graduate and internship programmes. A conjoint degree with computer science is a powerful combination for jobs such as Business Analyst, IT Risk Analyst, Database Administrator, Software Developer and more. For example ***IBM*** recruits a range of graduates as Graduate Consultants who are assigned a mentor on a project with a client, and are rotated over two years in a variety of roles. They may then be employed as a Business Analyst, Sales Support Coordinator, Project Manager, Project Executive Support and as part of the service delivery group. In the technical space they are employed as Software Engineers and Technical Consultants.

PikPok, a subsidiary of ***Sidhe*** game developer, considers mathematical and statistical skills extremely valuable in their analytics staff when combined with a high degree of technical expertise, such as computer or information science. People in analytics roles need to be comfortable both analysing data and working directly with large quantities of raw data. In general ***PikPok*** recruits people with work experience, rather than a direct graduate, for Analytics Manager roles.

Business services, marketing, marketing research, data science companies: A general understanding of mathematics, particularly statistics, is very valuable in business services, including marketing, market research, accounting, management and communications. Data analysis can involve: analysis, modeling and design of Big Data models; translating business data requirements into appropriate technical specifications; information architecture. Big Data analytics is the process of examining large data sets containing a variety of data types - to uncover hidden patterns, unknown

GRADUATE PROFILES

correlations, market trends, customer preferences and other useful business information. ***SAS***, a company that specialises in analytics, business intelligence and data management software and services, has a one-year graduate programme in which graduates complete three business function rotations – consulting, pre-sales and technical support. ***SAS*** encourages graduates of mathematics, statistics, science, finance, business, IT, and computer science degrees to apply. ***SAS*** also links graduates with customers for internships through the ***SAS*** Work Placement Programme.

Data science companies such as ***Harmonic Analytics*** employs graduates to Data Scientist entry level positions where they extract, transform and load (ETL) data, do data quality assessment, bring the data into a statistical language and conduct some rudimentary exploratory data analysis. You will need to know statistical programming languages, have programming and statistical capability along with excellent communication skills. Data scientists work closely with clients out in the field, listening and talking so as to understand their requirements. Effective team work, a friendly, courteous and respectful attitude are crucial as data scientists work with a great range of people and cultures.

Education: Schools, universities and other educational institutions employ teachers and educators at all levels.

To work at a university you will need to have a PhD. Applicants for teacher training with degrees in Mathematics, Physics and related disciplines are always welcomed as there continues to be a shortage of new entrants to the profession in these subject areas.

JOB TITLES

Some of the sample jobs listed below may require further study at postgraduate level and/or an additional degree in another area such as science, arts, business, economics, law, computer science, engineering or architecture.

Acoustic scientist • actuary • banker • big data architect • bioinformatics scientist/consultant • business analyst • climate modeller • computer programmer • data analyst • data modeller • data scientist • demographer • economic analyst • financial risk analyst • fisheries analyst • insurance risk surveyor • investment analyst • investment/funds manager • market analyst • market researcher • mathematician • mathematics teacher • mathematics tutor/lecturer • network assistant engineer, operational researcher • operations research consultant • policy analyst • research analyst/ statistician • research mathematician • social science researcher • statistician • stockbroker • survey designer • survey statistician.

Asheel Ramanlal

Data Driven Sales and Service Analyst
Kiwibank

I chose to study mathematics at university because I had always enjoyed it. It's great working with numbers, identifying and analysing trends, learning new concepts and working through problems. I enjoyed the fact that mathematics was challenging and that every day, there was always something new to learn. At Victoria, I studied pure mathematics. I loved that it was very conceptual and theoretical, just "out there" kind of mathematics that also had this massive element of creativity to it. The classes were great and the lecturers even better. They were always up for a chat about all aspects of mathematics.

I undertook post-graduate mathematics for the passion and really wasn't thinking of career options at the time, but I've found that passion tends to lead you into the right career. At university I was able to develop some programming skills. 'Big data' is where it's at right now and with the technologies evolving rapidly, it is really useful to know how to use the tools to make use of big data. You can develop loads of skills studying mathematics, including analytical and logical thinking; problem-solving; a surprising degree of creativity and innovation; and the ability to understand the logic behind processes.

After Victoria I landed a job with Statistics NZ through a careers evening. They wanted more than just statisticians, they wanted numerically minded people, people who could analyse data and process information in a logical manner – mathematics taught me those very skills. After working there for two and half years, I took a year off to travel and when I came back I started work at Kiwibank in Data Driven Sales and Service. We manage the customer database for service and marketing campaigns.

I definitely recommend mathematics. It's tough but great fun and opens up a lot of options. Employers often don't tend to ask for mathematicians specifically but in fact, that's exactly what they are looking for. Mathematics teaches you skills that are applicable in so many fields so take the challenge and study it – the world needs more mathematicians.

Melanie Northway

Data Analyst
Earthquake Commission (EQC)

I took a gap year after high school to take some time to decide what I wanted to do in the future. By about half way through the gap year I decided I definitely wanted to go to university and also decided that my favourite subject at high school was Mathematics. Math was my favourite subject at school because there is a definite black and white answer, and a definite black and white way to get the answer. I also enjoy using and memorizing formulas and algorithms to solve problems.

It was an awesome feeling getting a much more sophisticated understanding of Math at university. It's a really cool subject, and even though some parts are really complicated, it is so relevant to every day life, and it's cool getting to see the applications. I particularly enjoyed the tutorials because you were taking the theory and applying it to real problems.

Doing mathematics trains you to solve problems in a step-by-step way. It taught me to think more logically, and how to manipulate numbers; also the obvious skill of being able to do technical mathematics. During my studies I learned to work hard, to time-manage and to articulate any questions I had to do with math.

My degree definitely helped me into my current job. I was on reception at EQC, and they heard I was doing a Math degree so they thought I would make a good data analyst. Data analysts typically have to be great with numbers, be logical and have efficient problem solving skills, which is everything that a math degree teaches.

EQC does insurance for natural disasters and people lodge claims with us. I analyse data about the damage that the disasters cause. I make summary reports of the data on a large scale and reports for specific teams within EQC with just a small subset of all of the data. I do this by using SQL to get data out of the database.

I would advise students of mathematics and statistics to be prepared to work hard to understand the course content (there are plenty of resources to master the material) and to have fun along the way. Mathematics is an exciting subject and it's relevant to so many things.

Dr Sione Paea

Lecturer, Mathematics
University of the South Pacific

Mathematics came naturally to me when I grew up as a child. I always loved playing with numbers and mathematics has become one of my greatest strengths. When I enrolled at university it was an easy decision to major in mathematics.

I have always enjoyed discussing difficult mathematical problems with my colleagues and lecturers and this was an important part of my studies at Victoria University. I also have the courage and capability to solve high-level mathematical problems such as those I tackled in my PhD research.

I have gained a range of mathematical skills from my research-based studies and this has also helped me to deepen my mathematical knowledge and the application of it. I also learned about a range of mathematical software and how to manage my time and workloads wisely in order to achieve the best out of my studies. Being an academic researcher at the university level is very tough but having the ability to be able to discipline myself well is the strategy I used to be successful in my academic journey.

I have always loved teaching and it was my hope to work as an academic so I could share my mathematical knowledge and skills for the benefit of others. My qualifications and the skills I gained at Victoria University were very important for my current job as a lecturer and a researcher at the University of the South Pacific.

Maths is fun and it should be understood, shared, and taught in a way it could possibly make sense to people and their everyday lives. Skills in mathematics are becoming more important in many areas of work so students would do well to include mathematics and statistics in their degrees. My words of encouragement are: "Never quit, aim high, and think big. Never ever think small about yourself. You have to desire and drive to be the best. Set a goal and don't quit until you attain it."

Many thanks to all my mathematics networks; Te Ropu Awhina of Victoria University of Wellington and my family for helping me realise my dream.

Katherine Large

Fisheries Modeler
National Institute of Water and Atmospheric Research (NIWA)

When I enrolled for Mathematics and Statistics courses at Victoria University I already had a degree in Applied Science. But I'd been mucking about doing lots of other things, mostly poorly paid manual labour. I wanted to do something more useful and interesting with my brain, and definitely be able to earn better pay. I thought a year of math and stats courses would build on my biology degree and lead me into a career as a secondary school teacher.

I enjoyed the study so much I wanted to continue. Half way through my final year I went to a careers day at Victoria and met people from NIWA and the Ministry for Primary Industries who were offering graduate scholarships in quantitative fisheries science. The upshot was that I got the scholarship, which paid fantastically, and allowed me to study two more years for my Master's. When a job came up they encouraged me to apply.

During my Master's degree I enjoyed learning statistical methods in greater depth. I liked being able to work independently, to set my own goals and learn to be more critical in my approach to problem solving. I honed my analytical and writing skills and built on lessons learned in my degree – not to give up, to ask lots of questions and stay focused. I learned to think around a problem, hunt for ideas and be interested in the process of solving the puzzle. This approach helps me in my work at NIWA.

I found the Mathematics and Statistics Department incredibly helpful. They challenged me to do my best and were very supportive. Guidance from the Chair in Fisheries Science at Victoria was also invaluable. Applied statistics throws you into other science disciplines and sets you on a path of science collaboration. I find this most rewarding. My study set me up perfectly to figure out how statistics can help inform and support fisheries science.

I suggest students talk to faculty staff about what courses would best match their interests and where these courses might lead. I also encourage students to jump at opportunities to study independently in a research capacity, and to participate in forums that allow them to communicate their ideas in front of a critical audience.

Thomas Butt

Research Analyst/Statistician
UMR Research

During my first year of study in 2011 I unexpectedly became a father so getting a reliable job became a necessity. After trying a combined major with another subject I decided to focus entirely on Mathematics, with Statistics as my second major as I thought it would improve my job prospects. It did, and I enjoyed it just as much as maths.

I found my studies increasingly fascinating as my understanding of mathematics grew, helped by a few spectacular lecturers who showed me entirely new perspectives on the ideas around mathematics, and consequently the world. I also found the independence and flexibility allowed by university studies was hugely beneficial to both my young family and my learning; while help was there if and when required, it was never imposed, as was often the case in earlier education.

Mathematics improved my problem solving abilities through logical reasoning and taught me clear, creative thinking to find the simplest possible solution. Statistics gave me the skills to confidently understand and explain statistical ideas, which are vital for undertaking and interpreting just about all quantitative research.

Two months before my final exams I applied for two jobs. One gave me an interview and a job offer straight away, which I accepted. The week after my last exam I started my first proper job as a Research Analyst/Statistician at UMR Research and two years later I am still there and have continued my statistics studies part time. I now manage a fortnightly nationwide telephone omnibus survey, which includes questionnaire design, analysis and reporting for clients such as political parties, corporations, government departments and charities.

The thing that helped me most was unlearning the idea that mathematics was about rote learning formulas and instruction. Mathematics is more a skill than a body of knowledge, once you know the basics everything else can be constructed from them; the more you practice, the better you get and the further you can go. And don't be put off by people who think mathematics is not a practical skill, employers know mathematics majors are intelligent people and recognise that other skills and knowledge can be learned on the job. This means you and your skills will be in high demand.

MATHEMATICS AND STATISTICS AT VICTORIA

Victoria offers courses in pure and applied mathematics, statistics and actuarial science at undergraduate and postgraduate levels. Subjects may be studied independently or combined with a wide range of other subjects. Calculus and applied mathematics go well with science courses; discrete mathematics and algebra are suited to computer science students; statistics is also an essential tool in the social and natural sciences; and actuarial science combines naturally with commerce and economics. These courses all lead on to Bachelor of Science (BSc) undergraduate degrees with majors in Mathematics, Statistics or Actuarial Science. The School of Mathematics and Statistics also offers courses at first-year level for students who wish to strengthen their mathematics without going on to more advanced studies.

Students who major in Mathematics and Statistics often decide to do postgraduate study. An Honours degree (BSc Hons) involves taking an additional year of advanced papers that extend the undergraduate material. A Master's Degree (MSc or MA) typically involves writing thesis based upon a research project and may also involve coursework. The Master of Applied Statistics can be taken in a 12-month period full time and involves advanced coursework, training in research methods and statistical consultancy, work placement and a research project. A PhD (or Doctorate) involves the production of a PhD thesis based on original research which results in new knowledge. Completion of a PhD requires three years full-time study.

The university also offers a Graduate Diploma in Science for graduates who wish to advance their undergraduate-level knowledge in a different field – specialisms include actuarial science, computer graphics, ecology and biodiversity, geophysics, mathematics, physics and statistics. Graduates wishing to pursue postgraduate study, but who do not want to enrol in Honours or Master's degrees, may take a Postgraduate Diploma or Certificate of Science.

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