University of Southern Queensland

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Undergraduate Research Scholarship Program Available Projects for 2023

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School of Agriculture and Environmental Science

Project Title: Using APSIM to Identify tactical cropping options and decisions that maximize farm system drought resilience

Project supervisor/s and contact details	Assoc. Prof Keith Pembleton, 07 4631 1921, Keith.Pembleton@usq.edu.au
School and/Centre affiliation (if appropriate)	School of Agriculture and Environmental Sciences
Additional information	To be eligible for this scholarship students will need to have completed Agronomy (AGR2303).
Project description	Crop management decisions leading up to and during periods of drought impact how rapidly a farming system can recover after a drought breaks. During periods of drought farmers face conflicting priorities to seek income vs protecting soil carbon and ground cover resources that are critical for long term system sustainability. For example, farmers may be able to secure income by making hay from failed crops when hay prices are high due to drought, however this practice decreases surface organic matter which will limit infiltration of water when it does rain. This project aligns with a Future Drought Fund Innovation Grant project titled: "Customising ARMonline to make dry-land grain growers more productive, profitable and adaptive to drought creating environmental, economic and social resilience" being delivered by UniSQ in collaboration with the Queensland Department of Agricultural and Fisheries. This project aims to transform how producers of broad acre crops in Queensland and Northern New South Wales manage drought risks to their farming businesses. In this project you will design and undertake simulation experiments using the Agricultural Production Systems Simulator (APSIM) to investigate crop management options to increase farm drought resilience and sustainability. You will analyse and present simulation data and help design and implement new functionality into the ARMonline suite of stakeholder decision support tools (ARMonline.com.au). You will be working with Agricultural Economists, Agricultural Scientists and Software Developers at UniSQ and Queensland Department of Agriculture and Fisheries and will interact with leading farmers and agronomists from the Northern Grains Region (central Qld to northern NSW).
Future research activities	This project work could be expanded, with additional analysis, into an Honours project in the Bachelor of Science Honours program. The modelling and data analysis research skills developed in the project is sought by industry and can be transferable to future post-graduate research projects that implement modelling and data analysis methodologies.
Project location	The project can be completed online or on-campus. The project will be entirely desktop based. If you choose to complete the project on-campus you will be provided with a desk and UniSQ computer to complete the project. To undertake this project online you will need to provide a computer with a web cam (for zoom meetings with the project team).
Time commitment	The expected time commitment for this project will be 1 to 2 days per week for 10 weeks.
Benefits for successful candidates	By completing this project you will develop advanced skills in biophysical crop modelling specifically with in the APSIM framework. You will work with researchers from both UniSQ

	and the Queensland Department of Agriculture and Fisheries. You will also meet and engage with industry leaders in the northern grains region.
Project outcomes	The research from this project will be incorporated and disseminated to industry through the decision support tools available at ARMonline.com.au. Successful completion of the project may result in the preparation of a manuscript for peer review and publication after the completion of the scholarship.

Project Title: Accurate Cattle Counting Using Unmanned Aerial Vehicles (UAVs) and Artificial Intelligence (AI)

Project supervisor/s and contact details	Dr. Jacob Humpal, Dr. Derek Long, Dr. Di Wu
School/Centre affiliation	School of Agriculture and Environmental Science School of Mathematics, Physics and Computing Centre for Agricultural Engineering
Additional information	This project can be conducted by 2nd and 3rd year undergraduate students in Engineering, IT or Agriculture focused sciences. It is expected that the candidate has some, IT literacy and foundation (having taken some introductory computing courses) and have an enthusiasm for artificial intelligence and its applications, especially AI in agricultural.
Project description	Background: Cattle farming is a significant contributor to the global economy, with accurate cattle counting being a crucial aspect of efficient farm management. Traditional counting methods are time-consuming, labor-intensive, and prone to errors. This proposal outlines an innovative approach to count cattle using Unmanned Aerial Vehicles (UAVs), more commonly known as drones, integrated with Artificial Intelligence (AI) algorithms. Objective: To develop efficient and accurate cattle counting system using UAVs and AI technology. To minimize errors in cattle counting and enable better farm management. To assess the feasibility and cost-effectiveness of implementing the proposed system on a large scale.
Future research activities	It is anticipated that this project has the potential to evolve into an Honours-level or even a Higher Degree by Research (HDR)-level endeavor, offering opportunities for the candidate and others to engage in comprehensive research within this area, possibly including machine learning models, programming, and large-scale system development. The expertise and experiences acquired by the candidate throughout this project are highly adaptable, enabling them to apply IT and AI technologies across various high-impact domains effectively.
Project location	The candidate could choose their preferred location, either online or at one of the three UniSQ campuses, to complete the project. The supervisory team will maintain close contact with the candidate to provide supervision via Zoom meetings and/or face-to-face meetings if appropriate.

Time commitment	The project will run for 10 weeks in S2 or S3, 2023 and the candidate will be required to commit to working up to 2 days per week. The candidate can decide which days of the week they will work on the project in consultation with the supervisory team.
Benefits for successful candidates	This project will provide the following benefits to the candidate. Specifically, this project will provide the candidate with: 1. Hands-on exposure to IT and AI technologies and an opportunity to engage in an interdisciplinary research project to solve a real-world problem; 2. Hands-on experience in real-life large-scale data collection, storage and cleaning along with a good understanding of various potential data quality issues and possible solutions. 3. Experiences in conducting a systematic literature review with critical thinking, summarizing and analytic skills. 4. Initial experience with various classification models, frameworks and their implementation. 5. A highly collaborative research environment with researchers from different disciplinary expertise and backgrounds in computer science, artificial intelligence, and agricultural.
Project outcomes	This project will lead to following outcomes: 1. This project will help us better understand the requirements and the features of imaging data. 2. A literature review surveying the existing UAV-based image analysis and systems will be produced. 3. Sufficient data will be collected which will be potentially used to train machine learning detection and classification models. 4. A paper manuscript will be written based on the project outcome. Depending on contribution, the candidate will be listed as a co-author or acknowledged in the final publication(s).

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Project Title: Glasshouse phenotyping for improved root-lesion nematode resistance in chickpea

Project supervisor/s and contact details	Dr Rebecca Zwart, Rebecca.Zwart@usq.edu.au, Ph: 4631 1544
School/Centre affiliation	School of Agriculture and Environmental Science
Additional information	This project is suitable for a 2nd or 3rd year student studying an undergraduate degree in Plant Science. Completion of a statistics course would be advantageous, but not essential. Necessary training will be provided.
Project description	The root-lesion nematodes *Pratylenchus thornei* and *P. neglectus* are widely distributed throughout Australian grain regions and cause yield losses to many cereal and pulse crops. Integration of resistant crops in farming systems is recognised as the most practical, effective and economical management strategy for plant-parasitic nematodes. Chickpea (*Cicer arietinum*) is a host of root-lesion nematodes. However, breeding for resistance is hindered by the lack of genetic diversity in the *C. arietinum* cultigen. Wild relatives of chickpea, *C. reticulatum* and *C. echinospermum*, from the centre of origin of chickpea in southeast Turkey, have been identified with improved levels of resistance to root-lesion nematodes. Characterisation of the resistance genes in these wild Cicer lines will enable the development of molecular tools to enhance the ability of breeders to incorporate, deploy and select improved levels of root-lesion nematode resistance rapidly and efficiently to produce new commercial chickpea cultivars. This project is linked to a Grains Research and Development Corporation (GRDC) funded project aimed to map the genetic location of genes contributing resistance to *P. thornei* and *P. neglectus* in interspecific crosses between cultivated chickpea and wild Cicer lines and involves the collection and analysis of phenotypic data from glasshouse experiments. You will be working with researchers at UniSQ's Centre for Crop Health.
Future research activities	This project work could be expanded, with additional genetic analysis, into an Honours project in the Bachelor of Science (Honours) program. The phenotypic data collection and statistical analysis skills gained in this project can be transferable to future post-graduate research projects that involve conducting glasshouse experiments.
Project location	To conduct this project, you will be required to come to the Toowoomba campus to work at the research facilities of the Centre for Crop Health.
Time commitment	The expected time commitment for this project will be 2 days per week for 10 weeks. Data collection from the glasshouse experiments will commence in Oct-Nov.
Benefits for successful candidates	You will work and interact with researchers and HDR students within the Crop Nematology team as well as more broadly with researchers at the Centre for Crop Health working on a mirid of economically important plant diseases. During this project you will develop skills in data collection, processing of plant and soil samples from glasshouse pot experiments, extraction and counting of nematode samples using a light microscope, and training in statistical analysis of data in R.

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Project outcomes	The phenotypic data collected during this project is critical to enable genetic mapping of novel root-lesion nematode resistance genes in the newly identified superior wild Cicer lines. The data collected and analysed during this project will contribute towards the preparation of a manuscript for peer review and publication on which you would be a co-author.

School of Business

Project Title: Analysis of existing and future QLD air freight network operations – Team Global Express

Project supervisor/s and contact details	Associate Professor Tarryn Kille tarryn.kille@usq.edu.au Ryan Stewart (Aviation Safety & Training Manager), Team Global Express (Industry Partner) ryan.stewart@teamglobalexp.com Dr. Michael Lane (Senior Lecturer – Information Systems) michael.lane@usq.edu.au Dr. Maneerat Tianchai (Lecturer – Aviation) maneerat.tianchai@usq.edu.au Anup Shrestha (Senior Lecturer – Information Systems & School of Business Employability Lead) anup.shrestha@usq.edu.au
School/Centre affiliation	School of Business
Additional information	This project is best suited for UniSQ Bachelor of Aviation students in their second or third year of study, with an interest in Aviation Logistics and Air Freight. There are two (2) positions available. The ideal candidate will have: • Developed research skills appropriate for advanced undergraduate studies, including familiarity with library and database research; • A basic understanding of EndNote; MS Excel and MS Word (further training will be provided if necessary); • Developing skills in critical thinking and evaluation; • Good written and verbal communication skills; • Good attention to detail; • Ability to work as part of a team; • Ability to work independently (under supervision).
Project description	Over the past two decades, the air cargo industry has demonstrated significant growth (Dresner & Zue, 2020). Although world air cargo traffic stagnated from mid-2011 to 2013 (Boeing, 2014), the growth returned in 2014 accounting for approximately 35% of global merchandise trade by value (International Air Transport Association, 2014, 2015). Additionally, the COVID-19 pandemic severely impacted passenger carrying air transport operations. However, the freight needs in response to the pandemic spurred the continued growth and expansion of the air freight sector from 2019. The Australian Government's Bureau of Transport and Regional Economics (2022) updated growth estimates predicting a projected growth in air freight activity of 103 per cent between 2020 and 2050. Air cargo has the effect of facilitating trade whilst contributing to global economic

	development and creating millions of jobs. Air freight continues to be an important contributor to Australia's economic activity (Department of Infrastructure, Transport, Regional Development & Communications, 2020). For regional, remote and sea locked communities with economies supported by the transport of perishable, low weight, high value products, access to regional air freight networks becomes even more imperative (McGregor, 2007). However, regional communities often have limited access to airfreight opportunities (whether that be through dedicated air cargo capacity, or dedicated passenger services with spare cargo space capacity for the carriage of air cargo). This research project responds to a specific industry research question from an industry partner - Team Global Express (TGE). The TGE (Air Freight Division) provides a wide range of aviation logistics services with an extensive air fleet, global network and relationships with major commercial airlines. The TGE Air Freight Division's Queensland state network consists of intra and interstate operations, with four separate aircraft operators conducting freight movements based on destination requirements. The network has grown and developed organically based on freight volume need and operating cost for individual ports, creating multiple interrelated and contingent operating requirements in the service delivery for TGE customers. Supported by TGE (Air Freight Division), the project aims to: 1) analyze existing and future QLD freight network operations; and 2) develop a model that provides the right fleet for the right network route structure. The student researcher will be an active participant in: • conducting an analysis of current freight volumes within QLD networks. • preparing a route analysis, including review on how TGE should hub-and- spoke. • reviewing the Precision Timing Schedule for aircraft departures and freight cut off times, interlinking the QLD network for maximum service provision. • conducting an analysis of aircraft fleet suitability for the existing network and options for improving efficiencies. The student will be mentored through the process of collaborative research with industry-based and academic supervisors. On successful completion of this project, students may apply for credit towards MGT3303 The Equipped Graduate.
Future research activities	This project is the beginning of a larger project and scope of work associated with the use of appropriate aircraft and future air transport technologies to manage the response to the airfreight task of Team Global Express into the future. The research skills that the candidate will develop over the course of this project are transferable to future research activities.
Project location	The project can be conducted predominantly online (i.e., via Zoom and Teams). However, students may be required to attend meetings at the Team Global Express office at Brisbane Airport.

Time commitment	The elements of the project with which the student will collaborate as part of the scholarship program will run for 10 weeks The student will be expected to work 8 hours (approx. 1 day) per week. This will include a weekly meeting with the Industry and UniSQ Academic Research Supervisor. It is expected that the project will be conducted during Semester 2, 2023.
Benefits for successful candidates	On successful completion of this research project, the student(s) will be able to: 1. apply a range of professional and personal attributes to develop communications that establish and build professional relationships with a broad range of research team members and project stakeholders; 2. apply the principles of team dynamics and work collaboratively to achieve the project tasks; 3. through communicating on the project and task progress with the Project Supervisor, engage in reflective practice that will support transition to a post- graduation career; 4. Demonstrate research skills necessary for accurately conducting an industry- based data analysis research project; 5. Complete allocated research activities and present significant findings to industry. These skills will be beneficial for a student moving into postgraduate study. However, these skills are also valued by industry, are in-demand and necessary for a successful career as a future aviation professional.
Project outcomes	The project will result in: • One (1) presentation to the TGE (Aviation Division) senior executives responding to the project tasks and overarching research question. • One (1) presentation (recorded) to MGT3033 The Equipped Graduate future students to share project success and challenges experienced responding to an industry-based research project, working as part of a collaborative research and industry research team, as well as providing insights into the findings of the ongoing study of discovering important efficiencies in Australia's airfreight task. • The potential for a co-authored research seminar / conference paper and presentation.

Project title: Australian aircraft accidents – what do the cones say?

Project supervisor/s and contact details	Natasha Heap (Lecturer) Natasha.heap@usq.edu.au
School/Centre affiliation	School of Business
Additional information	This project is best suited for UniSQ Bachelor of Aviation students in their second or third year of study, with an interest in aircraft accident investigation and / or forensic investigation. There are two (2) positions available. The ideal candidate will have: • Developed research skills appropriate for advanced undergraduate studies, including familiarity with library and database research; • A basic understanding of EndNote; MS Excel and MS Word (further training will be provided if necessary); • Developing skills in critical thinking and evaluation; • Good written and verbal communication skills; • Good attention to detail; • Ability to work as part of a team; • Ability to work independently (under supervision)
Project description	This project will assist with a current research project being undertaken at UniSQ Aviation, in collaboration with researchers from James Cook University and Florida Gulf State University which has UniSQ Human Ethics approval (H22REA240P1 - Australian aviation accidents - what do the bones say?) Since 1984 there have been c.835 fatal civil air accidents in Australia with an approximate total of 1055 fatalities. Of these fatal accidents c.319 involved more than one fatality (an approximate total of 924 dead). The over-arching project has two areas of investigation: 1) analysis of the use of forensic odontology for the identification of victims of mass disaster and 2) an analysis of types of trauma and fracture patterns suffered by victims of air accidents. In this project each student researcher will be an active participant in: 1. Conducting a systematic literature review; and 2. The writing up of the review with a view to publication. The student will be mentored through the process of collaborative research. It is estimated that the final developments of the written research will fall outside the bounds of the paid scholarship. The student will be credited as a co-author on all publications resulting from the systematic literature review. On successful completion of this project, students may apply for credit towards MGT3303 The Equipped Graduate.

Future research activities	This project is the beginning of a larger project as explained above. The research skills that the candidate will develop over the course of this project are transferable to future research activities. The results of this part of the project will be developed into a publication with the student being a co-author on the article.
Project location	The project can be conducted online. Generally, all team meetings will be conducted via Zoom and a Teams site will be set up for the project to store all data and files.
Time commitment	The elements of the project with which the student will collaborate as part of the scholarship program will run for 10 weeks. The student will be expected to work 8 hours (approx. 1 day) per week. This will include a weekly meeting with the project supervisor. If the student would like credit for MGT3303 this project will need to be completed during Semester 2. If credit for MGT3303 is not required, the student can commence this project any time before January 2024.
Benefits for successful candidates	On successful completion of this research project, the student(s) will be able to: 1. Apply a range of professional and personal attributes to develop communications that establish and build professional relationships with a broad range of research team members and project stakeholders; 2. Apply the principles of team dynamics and work collaboratively to achieve the project tasks; 3. Through communicating on the project and task progress with the Project Supervisor, engage in reflective practice that will support your transition to a post-graduation career; 4. Demonstrate research skills necessary for the accurate conduct of a systematic literature review; 5. Complete allocated research activities that contribute to a body of research for publication. These skills will be beneficial for moving into postgraduate study but are also transferable skills necessary for a successful career as a future aviation professional.
Project outcomes	The project will result in: • A minimum of one co-authored publication in a peer-reviewed scholarly journal (such as Forensic Science Research or Forensic Science, Medicine and Pathology). • The potential for a co-authored research seminar / conference presentation.

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Project Title: The Oral Histories of Sunstate Airline

Project supervisor/s and contact details	Natasha Heap (Lecturer) Natasha.heap@usq.edu.au Dr Tarryn Kille (Associate Professor) Tarryn.kille@usq.edu.au Captain Nick Collie Chief Pilot, QantasLink Flight Operations nick.collie@qantas.com.au
School/Centre affiliation	School of Business
Additional information	This project is best suited for UniSQ Bachelor of Aviation students in their second or third year of study, with an interest in air transport and/or aviation history. The ideal candidate will have: • Developed research skills appropriate for advanced undergraduate studies, • Good written and verbal communication skills; • Good attention to detail; • Excellent time management skills; • Ability to work as part of a team; • Ability to work independently (under supervision); • Personable with good listening skills.
Project description	The documentation of personal narratives and historical experiences in Australia's aviation history is rare. However, as an island nation with significant regional, rural and remote communities, Australia's aviation history is rich and has been a cornerstone to economic growth and prosperity of our nation. Opportunities exist for undergraduate researchers to contribute to a program of research, led by a team of UniSQ researchers partnering with Australia's largest regional airline, Qantaslink, involving the recording, and storing, of the oral histories of retired and current aviation professionals from Australia. Much or Australia's aviation historical artefacts have relied on documented and written sources in an attempt to interpret these artefacts and provide information to the public. However, another valuable data source has been gaining prominence in the past two decades. Numerous oral history projects have appeared around the world initiated by various academic institutions and individuals (Town, 2014). The value of oral historical accounts is significant as they provide a human context to history and offer an opportunity to collect historical data that may otherwise remain untold. Sunstate Airlines, the Queensland arm of Australia's largest regional airline QantasLink, can trace its roots back to 1975 when Bevan Whittaker established Noosa Air with flights linking Noosa to Brisbane in a Britten Norman Islander, a small twin piston engine. From these humble beginnings in 2025 Sunstate will turn 50. Over these 50 years the pilots that have worked within the organisation have lived through and experienced many changes in Australia's history. Many have experienced the 1989 pilot dispute (which dramatically changed the operational and governmental perspectives of Australia's air transport sector). A number of these pilots hold a depth of qualitative data in the form of experiences of previous employment such as Bush

	Pilots Airways (Bushies), TAA or Australian Airlines and flying with veterans of the second world war. A significant number of these pilots also watched the demise of Ansett, the birth of Virgin, the end of the two airline policy in Australia, and have seen the airline transition from small piston engine aircraft to high performance airlines. The number of 'old timers' in Sunstate have retired from flying, and those who have sadly passed away, is increasing. As they leave the aviation industry, our opportunity to record and integrate their experiences, stories and memoirs into Australia's aviation history is retreating dramatically. With the support of Qantaslink as an embedded industry partner, this project will record the oral histories of Sunstate Airline by interviewing the pilots who have flown for the organisation since its inception in 1975. Pilots love a good yarn! This project would entail interviewing the pilots to record these yarns. These stories will be stored for the future and may be made accessible online to future academic and individual researchers. Undergraduate students will assist in • co-designing an interview script for each interviewee; • developing the ethics application and submission; • audio recording of oral histories, the organisation of data storage; • transcribing the audio transcripts; • analysing the transcripts that align personal recounts with historical facts; and • preparing a draft in working towards at least one co-authored publication
Future research activities	The research skills that the candidate will develop over the course of this project are transferable to future research activities.
Project location	The primary location within the Aviation Department at the UniSQ Springfield campus. As the project requires the recording of personal interviews, the student may wish to accompany the UniSQ Project Supervisor to attend interviews where the participant does not wish to engage e-communication platforms (e.g., Zoom or Teams). However, any face-to-face interviews will be conducted in the 'Brisbane or Greater Brisbane Region'. Specific locations will be determined as the project develops.
Time commitment	This project may commence any time after 1 August 2023 through to January 2024 and will run for 10 weeks. The student will be expected to work 8 hours (approx. 1 day) per week. This will include a weekly meeting with the project supervisor.

Benefits for successful candidates	On successful completion of this research project, the student(s) will be able to: 1. apply a range of professional and personal attributes to develop communications that establish and build professional relationships with a broad range of research team members and project stakeholders; 2. apply the principles of team dynamics and work collaboratively to achieve the project tasks; 3. through communicating on the project and task progress with the Project Supervisor, engage in reflective practice that will support your transition to a post-graduation career; 4. Demonstrate research skills necessary for the accurate conduct of a qualitative, interview-based research project; 5. Complete allocated research activities that contribute to a body of research for publication. These skills will be beneficial for moving into postgraduate study but are also transferable skills necessary for a successful career as a future aviation professional
Project outcomes	The project will result in a published, online repository of the recorded oral histories. There is the potential for future seminar presentations / publications in collaboration with Qantaslink.

Project Title: Beyond the paperless office: Sustainability and digital transformation in regional and rural Australia

Project supervisor/s and contact details	Dr Sachithra Lokuge, Sachithra.Lokuge@usq.edu.au Dr Anup Shrestha, Anup.Shrestha@usq.edu.au Dr Fiona Russo, Fiona.Russo@usq.edu.au
School/Centre affiliation	School of Business
Additional information	This project is best suited for 2nd and 3rd year students who are enrolled in business, information systems and information technology degrees. However, considering the cross-disciplinary nature of the topic, we welcome students from other disciplines as well (i.e., health and engineering). We highly encourage (not mandatory) students who have successfully completed CIS1000.
Project description	Digital transformation and sustainability are both relevant and significant dimensions of modern business practices. The importance of these two areas increases with the complex and wicked business problems that require multi-disciplinary solutions. Contemporary examples of such problems include increased carbon emissions, environmental pollution, migration crises and pandemics. In this context, considering the sustainable development-related literature, there is little academic research that identifies the exact role of digital transformation toward sustainable practices, especially in regional areas and in the small to medium enterprise (SME) sector. The aim of this project is to build a solid understanding in relation to the status of the digital transformation in the regional Australia and how such initiatives could support sustainability, for example, to achieve the Sustainable Development Goals (SDGs) that contributes to the rural and regional sector in a meaningful way. The project explores the understanding of sustainability in digital transformation initiatives in rural and regional organisations. The student will work with the supervisors to conduct a systematic literature review (SLR). The objective of this SLR is to develop a conceptual model and articulate the gaps in this research area.
Future research activities	This project can be extended into a final year research project, an Honours thesis or higher degree by research (HDR) research project. The SLR will provide a foundation for broader research aligned to funding priorities of the Australian government in the areas of digitisation, sustainability, and regional/rural business.
Project location	The student can complete the project on-campus or distance online.
Time commitment	The duration of the project is 10 weeks. The student is required to commit at least 4 hours per week to the project. There is no set starting date for this project, and it can be negotiated with the supervision team.
Benefits for successful candidates	Successful completion of this project will build highly relevant business research skills such as accessing and managing existing literature, conducting a systematic literature review by following an evidence-based review protocol, identifying gaps in research, developing initial research models that can be extended further, working in a collaborative research environment, learning to use a citation management tool (e.g. EndNote) effectively and working with researchers from different disciplines. Successful completion of this project alongside high achievement in their degree program may afford students direct entry into the MRES program as a HDR pathway.

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Project outcomes	A systematic literature review and further possible publications from the systematic literature review with the student as a contributor in the research team.

School of Education

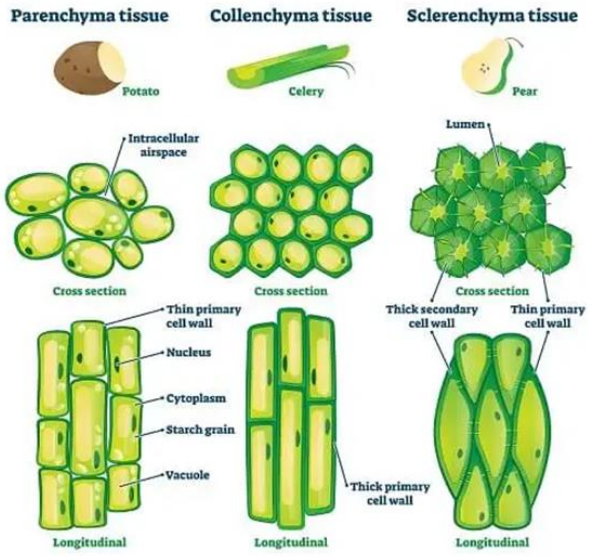
Project Title: Exploring educational perspectives of Sustainability - Educating for a sustainable future

Project supervisor/s and contact details	Professor Petrea Redmond (petrea.redmond@usq.edu.au , A/P Polly Burey, Dr Zahra Gharineiat, A/P Andreas Helwig, Dr Karen Spence, Dr Carole Haeusler
School/Centre affiliation	School of Education and the Centre for Future Materials
Additional information	Applicants best suited to the project should be a 3rd or 4th year Bachelor of Education (Primary or Secondary) students. The applicants are expected to have knowledge, skills and experiences in the Science Australian Curriculum, the Sustainability cross-curricular priority; writing comprehensive unit plans; and have a strong understanding of or ability to research relevant science concepts, including waste recycling.
Project description	These activities are part of a bigger cross-disciplinary project: The New Options for Waste And Saving The Environment (NO WASTE) pilot precinct, which focuses on the design and development of new material circular economies to fit operating environments from regional to metropolitan scales. This project aims to explore educational opportunities to present Science and humanities and social science concepts related to waste recycling and Sustainability associated with teaching years 4 - 10 in the formal Australian Curriculum. The results of this project are anticipated to provide useful research-informed unit and lesson plans for primary and secondary teachers and pre-service teachers.
Future research activities	This project can be extended into a Master of Education, Master of Research or Doctoral research project with the opportunity to explore the transfer knowledge and experience gained from industry, teachers, students, parents and pre-service students.
Project location	The successful candidate can work at the Toowoomba or Springfield campus or online for the project's duration with opportunities to work with other students, academics and researchers. To undertake this project online, you must provide a computer with a webcam (for Zoom meetings with the project team).
Time commitment	The project can be undertaken anytime between mid-June 2023 to February 2024, and the period must be negotiated with the supervisory team. The student would need to be able to commit to 2 days a week for 10 weeks on average.

Benefits for successful candidates	The successful candidate will gain experience working in a collaborative environment and with researchers from different disciplinary backgrounds, in addition to: Understanding the importance of waste recovery and value add. Having the opportunity to meet and engage with industry partners, government and interested stakeholders Teamwork will involve communication and collaboration skills which are important for working and/or researching in varied contexts with colleagues with various priorities, constraints, goals, and sensibilities.
Project outcomes	This is an authentic and relevant project where pre-service teachers will engage in daily activities that practising teachers engage in. Outputs from this project will be incorporated and disseminated to industry for the use of practising teachers and other pre-service teachers. This project will lead to a better understanding of waste recycling and Sustainability for the candidate, pre-service teachers, project teachers and their students. The intended project outcomes are a series of unit plans related to the Science Australian Curriculum and the Sustainability Cross-curriculum priority. It will also allow participants to develop links to industry and more in-depth planning skills.

School of Engineering

Project Title: Experimental imaging and analysis of heterogeneous plant food cellular structure during drying operations

Project supervisor/s and contact details	Wijitha Senadeera (UniSQ) wijitha.senadeera@usq.edu.au , Jasmine Banks (QUT) and Charith Rathnayake (University of the Sunshine Coast)
School/Centre affiliation	School of Engineering
Additional information	Student should be familiarized with MATLAB in general and he or she know Image Processing with it or willing to learn image processing and create algorithms for image analysis using MATLAB. General understating of statistics for data analysis and interpretation. Report writing skills. Suitable for 3rd year Mechanical/Mechatronics or Electrical Engineering student. This project is an eye opener for robotic vision studies.
Project description	**AIM** – Development of an image-based algorithm for the determination of cellular heterogeneity among plant cells during drying and rehydration using MATLAB software **Background**  Figure 1 Different plant cells (Source: Katy, McLaughlin, 2001, Plant Cell, https://biologydictionary.net/plant-cell/) Plant cells are coming in different shapes and sizes (Fig. 1). Changes of cell size and shape deformations are observed during when they undergo food processing operations such as drying and rehydration. These changes can be visualized by using scanning electronic microscopic (SEM) images. Currently these images are analyzed

	with MATLAB image processing algorithms for different parameters like cell area, perimeter etc. Current knowledge of analysis of deformation is on the average behavior of cells considering individual cells. But in actual practice cellular deformations are in a heterogeneous manner. In present modelling work in drying and rehydration, homogeneous or similar cell shapes are used. If heterogeneity can be incorporated in these models' prediction behavior of food products are closer to reality and optimum parameters can be found for processing operations. Experimental scanning electron microscope (SEM) images during drying and rehydration are readily available to be used in developing the algorithm. In that project, average cell parameter algorithm was developed, and this is an extension to incorporate the heterogeneity identification algorithm of the cells in a tissue **What student will do** Student will develop an algorithm using MATLAB image processing techniques to determine the properties (perimeter, area etc.) of 2D SEM images of plant material during drying and rehydration. This algorithm helps to determine cellular heterogeneity (differences in basic cell properties) and ensemble averages during different stages of drying. Steps in the project work (milestones) 1. Literature review on image processing applied to determination of plant cell properties 2. Familiarisation of the image processing in MATLAB 3. Identification and isolation of cell boundaries in SEM images 4. Development of an algorithm to calculate individual cell properties (earlier work is already there to familiarise) 5. Development of an algorithm to calculate cellular heterogeneity 6. Use of statistics to interpret the heterogeneity 7. Report writing
Future research activities	So far, only ideal, and homogeneous models have been developed. In future research, real materials such as fruits and vegetables of commercial significance will be subjected to detailed investigations through computational modelling as well as experiments. This study can be expended to an honors project to study how the parameters such as maturity/ spatial distribution (i.e., location in the cell structure; differences of deformation due to cell sizes/shapes) contribute to cellular deformations in a heterogeneous manner. As, it is expected that, the findings will be of much interest to the field of engineering and science, particularly in industrial scales (i.e., the industrial food processing often requires to predict how a real plant food material will deform during drying e.g., drying of apple pieces from fresh as given in Figure 2 below). Using multiscale modelling techniques, a student can further study for a higher degree at PhD level.  

	Figure 2 Fresh and dried apple rings
Project location	Initial phase of the period student needs to come to university and familiarize with the past completed project. Time to time he/she may need to contact QUT or University of the Sunshine Coast University staff via online to discuss progress and get advice regard to his/her work. Report writing can be undertaken at anywhere and need to discuss the progress with the supervisors through meeting (via ZOOM). Regular meeting per week should be essential.
Time commitment	Project runs for 10 weeks Student needs to work at least 2~3 days per week in the project
Benefits for successful candidates	Student will improve the following. 1. Working with three supervisors who are experts in three different field eg. Food processing, EM, image processing and development of MATLAB Algorithms 2. Familiarised with research environments and how it operates 3. Ethics and safety related to research environment 4. Research report writing and presentation skills
Project outcomes	Student will gain a valuable experience in image processing techniques; this will improve his skills as a novice researcher This model will provide a source of guidance for industrial practitioners to optimize food drying operations in terms of final product quality, nutritious value, and overall process performance. In addition, the developed computational framework has potential future applications in modelling a wide range of plant and animal cells. Publication of findings in Q1 journals (targeting Journal of Food Engineering as a tentative journal and student can be a co-author) Further develop into grant applications

Project Title: Characterization and Pozzolanic Reactivity Evaluation of Australian Calcined Clay for Limestone Calcined Clay Cement (LC3) Production

Project supervisor/s and contact details	Dr Kiru Pasupathy (Kiru.Pasupathy@usq.edu.au) +61 7 3470 4029
School/Centre affiliation	School of Engineering/ Centre for Future Materials
Additional information	It is preferred that students be in their 3rd year of Civil Engineering discipline and have basic knowledge of MS Office.
Project description	Limestone calcined clay cement (LC3) is a new type of blended cement that aims to reduce the environmental impact of cement production. Although Australia has abundant clay sources suitable for LC3, the reactivity and reaction mechanisms of calcined clay (CC) are still unclear due to the complex mineralogical composition of the clay and various calcination techniques. This lack of understanding includes the effects of different calcination schemes, such as duration and temperature, on the pozzolanic reactivity of clay. Additionally, the active components and inert impurities in CC during cement hydration require extensive analysis. A design guideline for LC3 based on different clay sources in Australia also needs to be established. To address these issues, this project aims to characterize the raw and calcined clay from various sources, evaluate the pozzolanic reactivity of different calcined clay sources under different treatment methods, and establish the relationship between the mineralogical characterization of calcined clay sources and the performance of LC3 concrete. The students will be expected to conduct laboratory-scale experimental studies and analyze the test results obtained from the lab work. The proposal identifies three main tasks. Task 1 involves characterizing the physical properties, chemistry, and mineralogy of raw and calcined clay samples. The Malvern Mastersizer 3000 will be used to measure the particle size distribution of the clay, while density and water demand will be measured according to AS3583.5 and AS3583.6, respectively. The morphology of the clay will be observed using a Scanning Electron Microscope, while x-ray fluorescence will be used to determine its chemical composition. The mineralogical characteristics of the clay will be studied using quantitative X-ray diffraction. Task 2 aims to quantify the pozzolanic reactivity of different clay sources and compare the reactivity of CC with that of conventional supplementary cementitious materials such as fly ash and metakaolin. Two types of tests will be used to measure the pozzolanic reactivity of CC: direct and indirect tests. The direct test is based on the strength activity index test outlined in AS 3583.6, while the indirect test involves a "rapid, reproducible, and reliable (R3)" pozzolanic reactivity test developed in Europe and standardized in North America as ASTM C1897-20. Task 3 involves developing a model that predicts the relationship between the mineralogical characterization of clay sources and the mechanical performance of LC3 concrete. The model will be developed based on existing literature studies and the experimental study proposed in this project will be used to assess the reliability of the model.

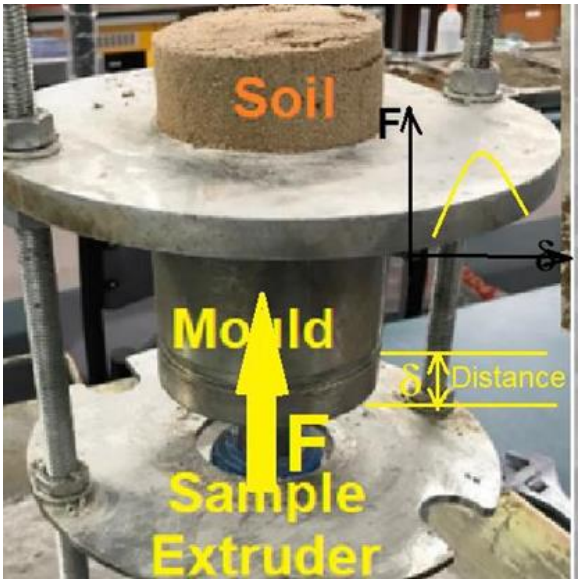
Future research activities	If the project can be extended into a final year research project, an Honours thesis, or HDR research project, it would provide an excellent opportunity for further investigation and development of the research topic. In terms of the transferability of skills to future research projects, this project will equip the student with valuable skills in characterizing raw and calcined clay, assessing pozzolanic reactivity, and evaluating the performance of LC3 concrete. These skills are highly transferable to future research projects related to cementitious materials, sustainable construction, and environmental engineering. Moreover, the project's interdisciplinary nature, which involves elements of materials science, chemistry, and civil engineering, will provide a valuable platform for building a diverse set of skills and knowledge that can be applied to various research projects in the future .
Project location	The project work for this scholarship can be completed both on campus and at a distance. While the characterization of raw and calcined clay samples can be performed on campus, the analysis part can be conducted remotely. In any case, the student will be provided with clear guidance regarding the location and requirements of the project work.
Time commitment	The project duration will be for a total of 10 weeks. During this time, the student will need to commit approximately 1 day per week to the project, depending on the specific tasks and requirements at different stages of the project. The exact number of days per week may vary depending on the progress of the project and any requirements. However, the student will be provided with a clear schedule outlining the specific time commitment required for each phase of the project, so that they can plan their time effectively and stay on track to meet project deadlines.
Benefits for successful candidates	Through this project, the student will have the opportunity to gain valuable research experience in a collaborative environment, working with researchers from diverse disciplines such as materials science, chemistry, and civil engineering. This interdisciplinary collaboration will help the student develop skills in teamwork, effective communication, and problem-solving, which are essential for success in any research project. Moreover, the student will be exposed to a range of laboratory techniques and equipment for characterizing raw and calcined clay samples, assessing pozzolanic reactivity, and evaluating the performance of LC3 concrete. They will gain hands-on experience in data collection and analysis and learn how to interpret and communicate scientific results effectively. The project will also help the student develop skills in critical thinking, time management, and project planning, which will be valuable for future research projects and professional endeavours. Overall, this project experience will equip the student with a diverse set of skills and experiences, providing them with a strong foundation for success in their future research and career aspirations.

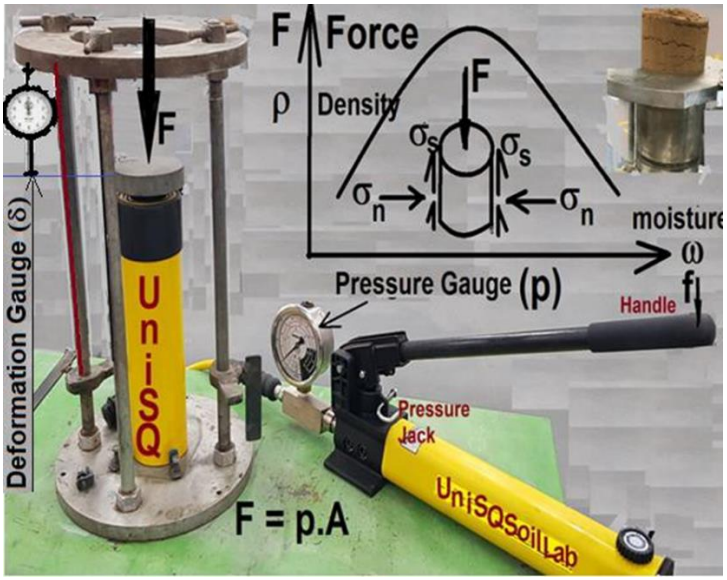
Project outcomes	The intended outcomes of this project are both tangible and significant. Firstly, the project will provide valuable insights into the pozzolanic reactivity of different calcined clay sources, which will help in the development of a design guideline for LC3 based on different clay sources. This guideline will be useful for future research and industry practitioners to optimize the use of LC3 cement in construction projects. Secondly, the project will evaluate the mechanical performance of LC3 concrete made with different types of clay sources in Australia. This will provide useful information for the development of more sustainable and eco-friendly building materials that can help reduce the environmental impact of construction activities. Lastly, the outcomes of this project will be published in a high-impact journal (Q1) and we will collaborate with industrial partners to move to the next level of commercialization. Overall, the project outcomes will provide valuable insights and knowledge that can be used to optimize the use of LC3 cement in construction projects and contribute to the development of more sustainable and eco-friendly building materials.

Project Title: Improvements in soil density and compaction test and analysis

Project supervisor/s and contact details	Dr Habib Alehossein
School/Centre affiliation	School of Engineering
Additional information	Preferred completion of Geotechnical Engineering courses CIV2403 and CIV2901
Project descriptions	Solid minerals, organic matters, water, and voids are the main components of natural soils. However, soil deformability, density and shear strength can reduce substantially as the soil water content increases. An increase in soil water content will increase soil volume, hence reducing its density and increasing its permeability and erosion-ability. By compacting agricultural soils, not only soil pore volume decreases, causing an increase in the bulk density, but also soil void arrangements and structures deteriorate, causing permanent deformation. Proctor compaction testing is rarely used in laboratories, as most of the agricultural soil compaction tests are carried out in the field with the purpose of assessing the suitability of the soil void structure for cultivation. A modified compaction theory and testing is proposed here that can equally benefit both disciplines beyond the conventional proctor test results. This new test measures not only the traditional soil density, but also deformability and shear strength or bonding of the soil, which is highly important to both farmers and engineers. Supervised and mentored by our highly experienced laboratory engineers, you will conduct a series of soil compaction tests under a digitally load-displacement extruder setup to remove your compacted soil specimens. You will take photos and videos of the testing procedures and document them in both EXCEL and WORD files. A typical test will consist of following steps (See figures below as well): (a) You will be given 1500 g of dry coarse soil, plus 250 g dry clay and plus 250 g dry silt to first complete a sieve analysis before your compaction test. You will record all the results and graphs in your EXCEL file. (b) Mix this dry soil well in a dry tray. (c) Measure mass of your compaction mould (M_mould) and all the attached accessories (M_collar, M_base) separately and record them in your EXCEL file. Measure both inner diameter and height of the mould to calculate its exact volume V_mould. (d) Pour this well-mixed dry soil in the mould without applying any compaction and measure the mass of the uncompacted dry soil, M_uc_dry_soil. (e) Apply a compaction test in 3 layers and again measure the mass of the compacted dry soil, M_c_dry_soil. (f) Now add 1%, 2%, ….. water to your 2000 g soil, so that your wet soil total mass in the tray becomes 2000(1+w/100) where w is the total water content. Mix it well in a tray, once ready, cover it with a plastic nylon in order not to lose any soil moisture with time. Otherwise check the soil

	total mass (M_wet_soil = 2000(1+w/100) g) and add water if the wet soil mass in the tray drops below this number due to the loss of moisture to the air) (g) Gently fill up the (one litre volume) compaction mould without “any compaction at all” and measure the mass of the mould with this uncompacted sample inside it. Therefore, this should give you the mass of the WET UNCOMPACTED soil, M_uc_wet_soil. (h) Now start your compaction test - in three horizontal layers with 25 blows on each layer where the hammer hits the soil layer top surface section uniformly. Once compacted sample is trimmed and ready, measure the mass of the mould and the compacted wet sample. Therefore, this should give you the mass of the WET COMPACTED soil, M_c_wet_soil. (i) Now make sure your designed removal setup has a rigid non-deformable and non- moveable base and start the test at very low rate, until reaching the maximum force, after which you can increase the rate as much as you like.





Future research activities	The knowledge and techniques you practice in this project will not only enhance your civil-geotechnical-mechanical engineering soft and hard skills, and EA required competencies and capabilities, but also give you the opportunity and option to transfer them to your future research projects. In addition, the study topic can be extended into an Honours thesis, Master or PhD research work. This is an important topic which has been attractive to mining, civil, agricultural, mechanical and electrical engineers and pertinent industries both nationally and internationally.
Project location	The student will be required to travel to Toowoomba campus to participate in this project. The location is the soil mechanics laboratory.

Time commitment	This project will be conducted during normal working hours (8am to 4pm). Our staff in the lab are flexible enough to work with the student's availability. The entire research project is designed as a 2-month study. The project component of the study involves 10 weeks. You will attend 1 to 2 days per week, depending on your time and availability. The student work will be (i) help completing the tests with our lab staff as part of their team, (ii) help recording all the results, (iii) help analyzing the results, (iv) help doing a literature survey, (v) writing a final report, and potentially (vii) collaborate and help to write a journal article on the subject.
Benefits for successful candidates	This a great opportunity for the engaged student to work with international experts in a collaborative research environment, learning how to conduct and manage highly delicate testing processes and procedures with the highest accuracies and reliabilities - coming up with a new design and novel technique for extracting soil properties, as required in both soil analysis and soil engineering practice. Apart from the skills to manage and conduct the tests, analyzing data and results and writing a professional report, the student will have the opportunity to develop knowledge in soil or geotechnical engineering research and development.
Project outcomes	The outcome of this project in relation to the student engagement are as follows: 1. Learning how to be innovative, as innovation is highly crucial in advancing skills of our future graduates, engineers, researchers or scientists. 2. Participation in a team for the development of a complete new compaction testing tool for the mining, civil, geotechnical and agricultural engineering industries. 3. Collaboration with a team for the development of potential journal publications on this topic and the contributions made by the student. 4. The potential for future research projects at honours, masters and PhD levels.

UniSQ

Project Title: Effect of camera model used in computer vision on prediction performance

Project supervisor/s and contact details	Jason Brown (jason.brown2@usq.edu.au, 07 3470 4026)
School/Centre affiliation	School of Engineering
Additional information	This project can be undertaken by a 2nd or 3rd year student in Electrical/Electronic Engineering, Computer Engineering or Mechatronic Engineering disciplines. The analysis part of the project will use Python as the programming language, so a student with skills and experience in that language will be the best fit. However, it is expected that students who know C, C++ or Java will be able to learn Python while working on this project. Some familiarity with cloud based tools, and specifically Google Drive and Google Colab, will be beneficial.
Project description	Computer Vision is used in a variety of applications such as biometrics, industrial inspection, and object avoidance. It employs a camera or cameras to feed images and/or video to a pre-trained artificial neural network model to discern what objects are present in the image/video, and possibly draw a bounding box around each object. This project aims to build on and extend some existing UniSQ research to determine whether (and if so how) the performance of some general purpose computer vision models depend upon the exact camera employed to capture the images/video. In this project, the student will first collect images and/or video using a variety of cameras, probably webcams for convenience. The data collection will be such that: • the same nominal images and/or video will need to be captured by each camera • the images and/or video will need to be of objects that can be recognised by a pre-trained computer vision model • a variety of scenarios are considered (e.g. distance to object(s), background scene) The captured images and/or video will then be input to a pretrained computer vision model to determine the recognition performance as a function of source camera. This will be done using Python scripts. Some scripts are already available, but it is expected the student will need to extend and customize these for the specific task. The student will also work on the effective presentation of results using the functions of the Python “matplotlib” library. This work has direct relevance to industrial inspection research that UniSQ is participating in with industrial partners.
Future research activities	The project can be extended into a final year research project or HDR research project. The skills acquired through strategic data collection, Python scripting and results presentation can be applied to other research projects.
Project location	This project can be conducted on campus or at a different location (such as the student’s home).

	The main limitation is access to the variety of cameras that will be required for data collection. However, it is anticipated these can be sent to the location of the student for the duration of data collection. The student will need a space (e.g. a room) for data collection that will not be disturbed by others, since images/video will need to be captured using different cameras with a common background.
Time commitment	It is envisaged the student will need to commit to 2 days a week for 10 weeks for this project, although the schedule is flexible. It is anticipated the data collection will take some time and it would need to be completed by Week 5 or 6 to allow sufficient time for analysis.
Benefits for successful candidates	There will be opportunities to work in a collaborative research environment with academics from other disciplines (in particular, Maths and Civil Engineering) who are also involved in the broader project. There may be opportunities to gain some insight into industrial inspection with industrial partners, although this is to be confirmed. The skills acquired will be: • Ability to design a scientific data collection methodology • Python scripting in a cloud environment • Application of general purpose computer vision models • Ability to present results with maximum impact
Project outcomes	The intention is to publish the work in a journal with the student as a co-author.

Project Title: Chemical and Microstructural Characterization of waste glass materials from Council sites in Queensland for incorporating as a sand replacement in road base and concrete applications

Project supervisor/s and contact details	Dr Hannah Seligmann Hannah.seligmann@usq.edu.au Jessica Pahl Jessica.pahl@usq.edu.au
School and/Centre affiliation (if appropriate)	School of Engineering Centre for Future Materials
Additional information	This project is aimed at either a 2nd year or 3rd year Civil Engineering student. The student will need to have basic skills in analysis in excel and be available to do on-campus experimental work in either Springfield or Toowoomba. The student will be trained in experimental design and investigation throughout the duration of this project.
Project Description	Waste glass contributes a large proportion of solid waste material to landfill. In Australia, only 46% of glass products are recycled, and in the 2018-2019 year, 141,140 tonnes of glass products were recorded as being sent to landfill. There has been significant interest in using crushed waste glass product as a replacement for aggregate materials, particularly as a sand replacement in road base and in concrete. However, the sources of waste glass vary significantly, and this variation has been linked to variations in strength and durability. **Project Aim** In this research you will help to characterise the properties of waste glass from varying locations in QLD and quantify how these variations might impact on their applications in the civil construction industry. **Project Activities** The activities that will be conducted as part of this investigation include the following: • Conduct a literature review into how waste glass materials are currently used in the civil construction industry in QLD • Conduct an experimental investigation into the micro-scale properties of waste glass from three (3) different locations in QLD. These micro-scale investigations are likely to include: ○ Scanning electron microscopy and image analysis to determine shape and size properties ○ Atomic force microscopy to determine the surface roughness of glass particles ○ Chemical analysis of the composition of the glass

	• Conduct an experimental investigation into the macro-scale properties of waste glass from three (3) different locations in QLD. The macro-scale investigations are likely to include: ○ Aggregate crushing value ○ Aggregate absorption • ***If time permits,*** prepare mortar cylinders with glass mixes to compare the compressive, and indirect tensile strength of mixes. • Contribute to a journal paper that summarises key findings
Future Research Activities	This project can be extended further into an Honours research project which will open the opportunity to transfer the gained knowledge and experience to future research activities including a Master's or PHD program of research.
Project Location	The successful candidate will be required to work at Springfield or Toowoomba campus for the duration of the project with opportunities to work with other students, research and industrial partners. Some aspects of the project including the literature review and data analysis may be able to be completed off campus from the candidate's home. This would need to be negotiated with the supervisory team.
Time commitment	This project involves the equivalent time commitment to a 2-day week 10 week intensive R and D project. This project may partially assist engineering students tyring to meet their work placement requirements.
Benefits for successful candidates	The successful candidate will gain experience working in a collaborative research environment and with researchers from different disciplinary backgrounds. Skill development will include: ○ Understanding of crushed waste glass uses in the civil construction industry ○ Preparation of a literature review ○ Data collection and data analysis ○ Experimental design and testing ○ Opportunity to meet and engage with industry partners and other interested stakeholders.
Project Outcomes	The results of this project are anticipated to provide useful information that is required to determine the most suitable uses of waste glass in the development of novel and sustainable construction materials. Data from the project may also be used in publishing high quality journal articles. The successful candidate will be a co-author on these outputs.

Project Title: Smart Energy Management of Domestic Hot Water Requirements for Homes with PV Systems

Project supervisor/s and contact details	Dr Yi Cui (Senior Lecturer, Electrical Engineering) Yi.Cui@usq.edu.au Dr Yuting Zhu (Lecturer, Industrial Electrical Engineering) Yuting.Zhu@usq.edu.au
School/Centre affiliation	School of Engineering
Additional information	This project is open for either a 2nd or 3rd year student with a background in electrical engineering or computer science. Programming skills are desirable.
Project description	**Background:** Since hot water is a large part of the energy requirements for a home (up to 20% of total energy demand in Australia and 30% of home energy use in New Zealand), it is ideal as an energy and cost-saving measure for a water heating solution to consume the least possible energy and still provide a satisfactory hot water load. Solar and heat pump hot water systems can achieve the same hot water loads as a standard electric storage water heater with require significantly less electrical energy input. For homes that generate PV electricity, more savings are possible if the heat pump operates preferentially when PV production is high enough to cover the power requirement of the unit. This increases self-consumption and minimizes purchased electricity from the grid for the purpose of hot water generation. **Motivation:** Since 2019, heat pump water heating (HPWH) prototype tanks have been installed in Queensland and Victoria distribution power networks accumulating a massive and unique hot water load profile data asset. The team already has full access to this valuable data asset. The purpose of the project would be an investigation of the potential for increased solar PV-generated electricity utilization using HPWH prototype tanks and smart meter data. Specifically, a control strategy for the HPWH prototype will be developed by integrating the PV generation/load forecasting from the advanced smart meters to enable the power consumption of the prototype tanks to follow the PV power generation, so that the PV power during peak time is consumed by heat pumps to produce and store heat. **Project Activities:** 1. Statistic analysis of hot water usage data collected from a residential house to reveal hot water load patterns for load control strategies. (Week 1-2) 2. Verification of a short-term (day-ahead) hot water load prediction algorithm. (Week 3-5) 3. Development of a residential hot water load control algorithm based on the prediction results for maximising the domestic hot water consumption for homes using PV systems. (Week 7-10) If time permits, the candidate will have the chance to showcase their work at the research meeting of the School of Engineering.
Future research	This project can be extended into an Honours research project that would provide the

activities	opportunity for candidates to apply their knowledge and experience gained from this project towards future research activities, such as a Master's or PhD project.
Project location	During the project's duration, the selected candidate will be mainly based at the Springfield campus, where they will have the chance to collaborate with HDR students, researchers and industry partners. However, certain aspects of the project, such as data analysis, could potentially be completed remotely from the candidate's residence. This would be subject to negotiation with the supervisory team.
Time commitment	This project requires a time commitment equivalent to that of a 2-day per week for 10 weeks.
Benefits for successful candidates	The selected candidate will have the chance to work in a collaborative research setting and collaborate with researchers from diverse academic backgrounds. They will also receive extensive research skills training in research skills. Specific benefits include: 1. Data collection and analytics: to get access to the high-resolution smart meter data of a real-life low voltage distribution network. 2. Power system and renewable energy integration: to understand the solar energy generation and load consumption behaviour of low voltage distribution networks. 3. Industry partners and other stakeholders engagement: to establish effective relationships with the utilities and promote students to a wider community level, including industry and professional bodies.
Project outcomes	1. A smart energy management strategy for households' hot water requirements with PV systems. 2. A report on energy management system development and function description. It is expected that the outcomes of this project will produce valuable insights that are necessary to identify the most appropriate utilisations of solar PV energy to achieve cost-effective management of residential energy. The information gathered from this project could also be utilised in generating high-quality publications in leading academic journals. The selected candidate will have the opportunity to be a co-author of these publications.

Project Title: Solar Thermal Metal Carbon Melt Heat Storage Bead

Project supervisor/s and contact details	Andreas Helwig AProf. Electro-Mechanical Engineering (SoENG/CFM) Dr Tristan Shelley
School/Centre affiliation	SoEng (Electrical/power/mechatronic engineering and relevant science discipline majors) Centre for Future Materials (Sustainable Systems RRC grant research alignment with Solar Impacts collaborative partner)
Additional information	***Background****:* Thermal storage that can achieve significant thermal differential between standard ambient conditions of some hundreds of degrees remains one of the needed outcomes to allow 24-hour use of energy from solar thermal production at temperatures of 450°C as can be reached by the solar thermal Impacts new Fresnel reflector concentrator. For hydro-thermal pyrolysis (nominally at 300°C) to treat organic waste streams, a thermal storage is required to extend the working hours other than daylight hours available. The project is to design an array of hexagonal cross section stackable heat beads assembled on an array standard copper or stainless steel 6.35mm seamless tubing to allow heat to be absorbed and melt a low temperature metal in the copper/graphitic carbon char heat bead to store heat; and then release the heat back into the tubing. N.B.: Carbon graphite/copper press-fit structure formation has been used in the carbon brush industry for over 40 years as earth return axle brush material for electrical locomotives; i.e., this is not a new process – the combination and formation of the hybrid dual pellet of metals, i.e. one a low melting to take advantage of the heat of fusion of the low temperature melting metal, while the high temperature (copper – carbon materials) maintains the structural integrity of the heat bead. One of the continuing barriers for hydro-thermal waste treatment is the cost of thermal energy needed to drive this potential circular economy bio-material waste stream (sewerage, contaminated woods/organics from construction, PFC containing industrial contamination and pesticide loads ag waste streams). Solar thermal Impacts is working with UniSQ CFM RRC Simple research project to develop hydro-thermal energy storage to accomplish this.
Project description	*Stage 1:* CAD-CAM design and construct using 3-D additive printing additive and conventional metal working methods to develop the two steel press-fit moulds for high pressure mechanical pressing of an internal pellet of different metal powders (tin, zinc, aluminum) and graphite inside an outside casing of press-fit copper and graphite particle powder. This composite mechanically formed press fit bead shall be formed with a hole in the middle. The idea is to provide a few samples of each combination of metal for testing. *Stage 2:* Test the various heat beads produced for their thermal heat transfer and heat energy storage characteristics incrementally up to 650°C. The matrix of experimental results is then be analysed and reported in a journal paper.

Future research activities	This is an ongoing RRC project student project investigation (i.e. copper carbon combination which was undertaken in Dec 2022 – Jan 2023) and this project continues the ongoing collaborative research for hydro-thermal waste treatment with Solar Impacts, a partner in the recently started RRC Simple research project associated with the IAESS Center for Future materials.
Project location	Toowoomba Campus P-Precinct laboratories and UniSQ Engineering Workshop, with support location for student's online research in Q-block CFM offices.
Time commitment	Two weeks 35-hour intensive weeks in mid-year break to design, print and construct model size system, plus 4 - 8 hours weekly contact for remaining 8 weeks of the project for testing/results consultations, with some data analysis/reporting undertaken in student's own time.
Benefits for successful candidates	Energy systems and storage are a key to a future more sustainable economy and society. The project gives a student the opportunity to be mentored by an experienced industrial and academic researcher in renewable energy and energy storage systems design, analysis and modelling. The data and report/publication developed will also lead to a potential honours/ masters or HDR research topic in upscaling solar thermal energy storage for bio-material waste streams hydro-thermal pyrolysis processing in circular economy development. The student will develop the following skills: - 3D design and construct skills - risk management skills - experimental design skills and operational commissioning skills - Data collection and analysis - Energy systems and energy flow/efficiency analysis skills - Understanding of the importance of solar thermal storage contribution towards the development various hydro-thermal chemical waste treatments.
Project outcomes	1. Student tangible outcomes are proof of concept, data collection and publication of investigations. 2. Potential contribution to Honours, Masters or HDR future UniSQ research in this sustainable energy topic area. 3. Next R & D step in research for SIMPLE HUB IMPACTS collaborative research into hydro-thermal pyrolysis development for interested municipal councils.

Project Title: Utilization of Glass Waste in Environmentally Friendly Grout Mixtures

Project supervisor/s and contact details	A/Prof Ali Mirzaghorbanali: ali.mirzaghorbanali@usq.edu.au A/Prof Andreas Helwig: andreas.helwig@usq.edu.au Prof Polly Burey: Polly.Burey@usq.edu.au Dr Tristan Shelley: tristan.shelley@usq.edu.au Mr Hadi Nourizadeh: Polly.Burey@usq.edu.au
School/Centre affiliation	Institute of Advanced Engineering and Space Sciences/Centre for Future Materials School of Engineering /School of Agriculture and Environmental Science/Centre for Future Materials/SIMPLE team
Additional information	This project can be conducted by 2nd and 3rd-year students of Civil Engineering discipline. It will be advantageous if the candidate knows how to use Excel for data analysis.
Project description	This project is intended to investigate the mechanical properties of amended grout products mixed with waste materials using compression testing machines. Initially, amended grout samples are cast by replacing cement for various percentages of waste-to-cement ratios ranging from 1 to 5%. Samples then are cured for different curing time intervals (1, 7, 14, 21 and 28 days), and tested for determination of Uniaxial Compressive Strength, Elastic Modulus in Compression and Shear strength. The student will be involved in the following activities: 1. A Literature review on mechanical properties of amended grout products, 2. An experimental study on the mechanical properties of amended grout for various curing time intervals, 3. Preparing a test report 4. Presentation of project outcomes to the School, Centre and/or industry. All the testing equipment and materials are currently available at the School of Engineering. The findings will be presented to the wider community at the Resource Operators' Conference.
Future research activities	This project can be extended further into an Honours research project with the potential for the candidate to go onto future research activities including a Masters or PhD project.
Project location	The successful candidate will be required to work at the Toowoomba or Springfield campus for the duration of the project as there are opportunities to work with other students, researchers, and industrial partners. Some aspects of the project, including literature review and data analysis, may be completed off campus from the candidate's home. This would need to be negotiated with the supervisory team.
Time commitment	This project involves the equivalent time commitment to a 3-day week 10-week intensive research and development project. This project may partially assist engineering students trying to meet their work placement requirements.
Benefits for successful	The successful candidate will gain experience working in a research team where researchers from different backgrounds work together in a collegial environment.

candidates	Skill development may include: • How to carry out a systematic literature review, • How to plan research studies, • How to cast small-scale concrete samples for testing, • How to use Engineering testing equipment, • A general understanding of safety and risk assessment in Engineering, • Data analysis using Excel, • Report preparation and submission **Student may have the opportunity to attend in Resource Operators' Conference in Feb 2024.**
Project outcomes	This project will lead to a better understanding of amended green grout applications in various conditions. An experimental equation will be developed based on the collected experimental data to model the strength of amended grout in relation to various Engineering parameters. Findings will be presented at Resource Operators' Conference in FEB 2024.

Project Title: Pozzolanic Reaction of Waste Glass Powder as a Sustainable Replacement to Cement for Stabilized Road Bases

Project supervisor/s and contact details	Dr Hannah Seligmann Hannah.seligmann@usq.edu.au Jessica Pahl Jessica.pahl@usq.edu.au
School and/Centre affiliation (if appropriate)	School of Engineering Centre for Future Materials
Additional information	This project is aimed at either a 2nd year or 3rd year civil engineering student. You will need to have basic skills in analysis in excel and be available to do on-campus experimental work in either Springfield or Toowoomba. You will be trained in experimental design and investigation throughout the duration of this project. If time permits, you will also be trained in Life Cycle Assessment.
Project Description	The Australian road network is nearly a million kilometres long, of which 86% can be classified as rural granular roads. A common technique to increase the durability of these roads is stabilisation with small proportions of cement. However, due to the sheer length of the road network, a huge quantity of cement is consumed in stabilisation work, making this practice unsustainable. It is common for the cost of binder material (cement) in stabilisation works to be 40% or more of the total cost of the works. Typical energy consumption rates for cement-materials have been estimated to be 5000MJ/t, while the actual placement and construction of the stabilised layer is estimated to result in a consumption of only 50 MJ/t. When crushed to a particle size of less than 75 um, glass material has been shown to have a pozzolanic reaction, similar to that of cement. Waste glass contributes a large proportion of solid waste material to landfill. In Australia, only 46% of glass products are recycled, and in the 2018-2019 year, 141,140 tonnes of glass products were recorded as being sent to landfill. The use of waste glass powder as a partial replacement to cement in stabilised road base layers, may provide a sustainable binder, with dramatically lower embodied energy and cost. **Project Aim** In this research you will investigate the pozzolanic impact of waste glass powder (< 75um) when used as a partial replacement to cement for a stabilised or modified road base material. **Project Activities** The activities that will be conducted as part of this investigation include the following: • Conduct a literature review into how waste glass materials are currently used in the civil construction industry in QLD • Conduct a literature review best practice stabilization techniques for granular road pavements in Australia • Conduct an experimental investigation into the partial replacement of cement with glass powder as a stabiliser. This investigation is likely to include: ○ Particle size distribution of road base material

	○ CBR testing on road base with and without glass additive as stabiliser ○ UCS testing on road base with and without glass additive as stabiliser ○ Moisture absorption on road base with and without glass additive as stabiliser • Undertake a cradle to gate life cycle analysis on the results of experimental testing. The life cycle assessment will look at both cost and environment impact and will be conducted using either OpenLCA or Simapro software. • Contribute to a journal paper that summarises key findings
Future Research Activities	This project can be extended further into an Honours research project at which it will open the opportunity to transfer the gained knowledge and experience to future research activities including a Master's or PHD project.
Project Location	The successful candidate will be required to work at Springfield campus for the duration of the project with opportunities to work with other students, research and industrial partners. Some aspects of the project including the literature review and data analysis may be able to be completed off campus from the candidate's home. This would need to be negotiated with the supervisory team.
Time commitment	This project involves the equivalent time commitment to a 2-day week 10 intensive research and development project. This project may partially assist engineering students tyring to meet their work placement requirements.
Benefits for successful candidates	The successful candidate will gain experience working in a collaborative research environment and with researchers from different disciplinary backgrounds. Skill development will include: ○ Understanding of crushed waste glass uses in the civil construction industry. ○ Data collection and data analysis ○ Experimental design and testing ○ Opportunity to meet and engage with industry partners and other interested stakeholders.
Project Outcomes	The results of this project are anticipated to provide useful information that is required to determine the most suitable uses of waste glass in the development of novel and sustainable construction materials. Data from the project may also be used in publishing high quality journal articles. The successful candidate will be a co-author on these outputs.

Project Title: Development of Grass-Reinforced Natural Fibre Composites for Building Applications

Project supervisor/s and contact details	Assoc Prof Mainul Islam Mainul.Islam@usq.edu.au
School/Centre affiliation	School of Engineering and Centre for Future Materials
Additional information	Any research-minded mechanical or civil engineering students in their second year and above should be able to conduct this project. An understanding of basic statistics and Excel for data analysis will be advantageous.
Project description	Agricultural wastes can be used in the production of environment- friendly composite materials. Wastes can be used as reinforcing constituents to be mixed with a polymeric resin to create engineered natural fibre reinforced composites. Natural fibre reinforced composites made utilising these wastes are relatively new. However, waste reinforced polymeric composites can be engineered through research and development for the uses as various components including sandwich composites for building and other applications as structural and semi-structural components. There has been an incredible development in polymer matrix composites of various plant fibres. Grass fibres are one type of the important plant fibres which occur in different parts of plants, mainly in the stems and leaves. Novel grass-fibre reinforced composites have a great potential particularly in building industries. Quality grasses from lawn mowing wastes will be extracted for chemically treated with simplified processes. Then a suitable polymeric resin will be used for fabricating these composites. The fibres can also be of various size ranges and combinations depending on the potential applications. Various types of sandwich composites can also be made by selecting different constituent materials for skins and these composite cores. Main objectives of this project are to (a) develop novel natural fibre composites using grasses as agricultural wastes with chemical treatment, and a suitable polymeric resin, (b) investigate relationships between various fabrication parameters, (c) investigate mixing behaviour of fibres and resin, (d) characterise mechanical and other behaviours of the developed composites, and (e) develop and investigate properties of novel sandwich composites made of developed composite cores and suitable skins.
Future research activities	A further extension of this project could be an Honours research project, enabling the transferred knowledge and experiences to be applied to future research activities such as Masters by coursework or research and PhD studies.

Project location	It will be necessary for the successful candidate to usually work in Toowoomba campus throughout the duration of the project due to the Toowoomba campus having well-established nationally leading experiment facilities. This will also benefit the candidate by collaborating with other senior students and researchers. The candidate may be able to complete some aspects of the project remotely from their home, such as literature review and data analysis. In this case, this would have to be negotiated with the supervisor.
Time commitment	The time commitment required for the project is normally for 10 weeks with an indicative involvement of 3 days per week, as per a tentative timeline below. Week 1: Become familiar with the project and working environment, Weeks 2-3: Literature review on the topic and relevant area, Week 4: Develop methodology and prepare RMP for experiments, Weeks 5-7: Fabrication and testing of the developed composites, Weeks 8-9: Data analysis and write up, Week 10: Wrap up the project and presentation/report submission.
Benefits for successful candidates	By working in a collaborative research environment with other senior students, researchers and technical staff from different disciplines, the candidate will acquire a diverse range of experience. Skills development may include: 1. Becoming familiar with the nationally leading advanced research centre and facilities, 2. Developing literature review skills through this project, 3. Developing engineered composites using agricultural wastes, 4. Understanding the testing procedures for characterising materials properties, 5. Collecting and analysing experimental data, 6. Opportunity to interact with potential industry and other interested parties which may lead to post-graduation employment opportunities.
Project outcomes	Upon successful completion of the project, the candidate will work with the supervisor to produce a publishable co-authored article in a high impact journal and/or in the proceedings of a national or international conference.

Project Title: Behaviour of concrete made from recycled styrofoam, paper and cardboard

Project supervisor/s and contact details	Dr Wahid Ferdous: Wahid.Ferdous@usq.edu.au Prof Allan Manalo: Allan.manalo@usq.edu.au Assoc Prof Polly Burey: Polly.Burey@usq.edu.au
School/Centre affiliation	School of Engineering/School of Agriculture and Environmental Science/Centre for Future Materials
Additional information	Students in the second and third years in Civil/Structural engineering should be able to conduct this project. An understanding of Excel for data analysis will be advantageous.
Project description	As part of the recycling initiatives, the Federal Government is phasing out plastics, paper, and cardboard that end up in landfills. Australia imports about 52,000 tonnes of polystyrene resin every year for insulation and single-use packaging, with about a quarter recycled and the rest going to landfills. Moreover, Australia generates approximately 5.92 Mt of scrap paper and cardboard, of which 60% is recycled and the remainder is disposed of in landfills. In this study, waste styrofoam (expanded polystyrene), paper, and cardboard will be utilised to manufacture concrete. A number of physical and mechanical properties, including density, compressive strength, splitting tensile strength, modulus of elasticity, will be investigated for different concrete mixes. A more cost-effective and environmentally-friendly concrete solution that minimises waste will be provided by this study, which will help concrete suppliers contribute to a circular economy.  Styrofoam Paper and cardboard Concrete
Future research activities	A further extension of this project could be an Honours research project, enabling the transferred knowledge and experiences to be applied to future research activities such as Masters and PhD studies.
Project location	It will be necessary for the successful candidate to work on Toowoomba campus throughout the duration of the project. There is the possibility of collaborating with other students, researchers, and industrial partners such as EPIC Building System. A candidate may be able to complete some aspects of the project remotely from their home, such as literature review and data analysis. This will need to be negotiated with the supervisory team.
Time commitment	Two/Three days a week, 10 weeks are required for this project. Engineering students can use this to fulfill their work placement requirements.
Benefits for successful	By working in a collaborative research environment with researchers from different disciplines, the candidate will acquire a diverse range of experience. Skills development may include:

candidates	1. Become familiar with the Toowoomba campus's advanced research facilities 2. Designing concrete mixes using landfill waste 3. Understanding the testing procedures used to characterise different grades of concrete 4. Collecting and analysing data 5. The chance to interact with industry partners and other interested parties
Project outcomes	This project aims to improve the understanding of concrete mixes containing landfill wastes. It is also possible that high quality journal articles will be published based on the data collected as part of the project. The successful applicant will participate in the production of these outputs as a co-author.

Project Title: PV-Micro-hydrogen Production from Seawater/Saline Bore Water and Operation Characterisation

Project supervisor/s and contact details	Andreas Helwig AProf. Electro-Mechanical Engineering (SoENG/CFM) Dr Mark Lynch
School/Centre affiliation	SoEng (Electrical/power/mechatronic engineering and relevant science discipline majors) Centre for Future Materials (Sustainable Systems RRC grant research alignment)
Additional information	**Background**: Large Photo-voltaic distributed generation has periods of excess energy generation that causes problems on electrical energy grids voltage and frequency. Creating a load absorption hydrogen production for long terms seasonal energy storage that can be quickly turned on and off is one means of creating such a load sink during peak renewable energy generation that exceeds grid demand. Hydrogen can also be injected up to 10% per volume in our current Australian natural gas pipeline network to improve the carbon footprint of Australia. This project is to create a model size 12V DC PV generation panel/s linked to a designed and 3-D printed array of electrolyser hydrogen cells using special long life cathode and anode materials for use with circulating seawater or saline or hard non-potable bore water to produce hydrogen, and byproducts such as industrial HCl, and NaOH solutions. The idea is to safely commission this scaled model system, and then investigate and characterise its operation, outcomes, reliability and fatigue to be able to be used later after completion of this project to implement an upscaled industrial dynamic model in that MATLAB SIMSCAPE and LCA model. The student should have an interest in sustainable energy systems, come from an electrical, or power, or mechatronics discipline major, with abilities to design 3-D components and print and assemble, be interested in risk management planning, operating systems, as well as have an attitude of curiosity to explore the physical phenomena associated with energy transfer and energy storage/recovery systems. The aim of this project is to contribute to Australia's future energy mix and towards our sustainable economy to support local industry and society, but without using precious potable fresh water.
Project description	CAD-CAM design and construct using 3-D additive printing additive construction methods a group of electrolyser cells using long life corrosion resistant anode and cathode materials to be connected to a 12 PV supply, and also use a dosing pump circulation system of bulk saline water to produce and investigate hydrogen production and study the other off-gasses and by- products. Risk management planning for construct and operation of this system, plus assessment of anode and cathode materials changes during the study to estimate life. Data collection and analysis and reporting (including poster / research paper), with a prepared and recorded poster pitch for hydrogen production as a load absorption ancillary service in the Australian NEM grid.
Future research activities	This project is to investigate the material phenomena associated with hydrogen production from non-potable water (as Australia has limited freshwater supplies), and then produce the upscaled industrial dynamic SIMSCAPE and LCA fatigue life digital twin models for long term hydrogen storage use as a switchable and fast response energy absorber when renewable energy distributed large sources exceed load demand. This will allow a techno-economic- sustainable impact analysis to be undertaken to understand potential roles that cheap green hydrogen production could help Australia reach its climate goal targets while keeping the cost of electrical and thermal energy to acceptable limits.

UniSQ

Project location	Toowoomba Campus Pro-Precinct Engine Lab that is fitted for hydrogen detection or hooded vented chemical lab cabinet, and SoEng Z-Block Computer Labs/ Student workspaces / 3-D printing facilities.
Time commitment	Two weeks 35 hour intensive weeks in mid-year break to design, print and construct model size system, plus 4 - 8 hours weekly contact for remaining 8 weeks of the project for testing/results consultations, with some data analysis/reporting undertaken in student's own time.
Benefits for successful candidates	The intent of this section is for the student to have a sense of what they will take away from this project experience. Energy systems and storage are a key to a future more sustainable economy and society. The project gives a student the opportunity to be mentored by an experienced industrial and academic researcher in renewable energy and energy storage systems design, analysis and modelling. The data and report/publication developed will also lead to a potential honours/ masters or HDR research topic in upscale dynamic modelling for Grid applications. Also outline the skills the student will develop: - 3D design and construct skills - risk management skills - experimental design skills and operational commissioning skills - Data collection and analysis - Energy systems and energy flow/efficiency analysis skills - Understanding of the importance of seasonal storage and development load absorption ancillary services in Queensland's energy NEM grid, while not depleting fresh potable water reserves.
Project outcomes	Student tangible outcomes are proof of concept, data collection and publication of investigations. Potential contribution to Honours, Masters or HDR future UniSQ research in this sustainable energy topic area.

Project Title: Design, manufacturing, and testing of novel lattices

Project supervisor/s and contact details	Dr Sourish Banerjee, email: Sourish.Banerjee@usq.edu.au
School/Centre affiliation	School of Engineering
Additional information	This project is suited for a 3rd year level for both Civil & Mech. It is expected that the student has a background knowledge of mechanics and modelling using any AUTOCAD software. It would be a bonus if he/she has completed a research methodology course.
Project description	Lattice materials have high stiffness and strength to density ratios due to their porosity Natural materials like wood, cork, bone are examples of such materials, while honeycombs and foams are their synthetic manmade counterparts. These materials also possess good thermal insulation and acoustic damping properties. These materials have been used in aerospace and marine industries along with infrastructure, packaging, and sports goods industries. These materials are interesting in the aspect that by changing the topology, different lattice geometries can be obtained with remarkable properties. An example is the negative Poisson's ratio observed in an auxetic lattice, that is not found in solids. This project aims to develop novel ultralight yet stiff, strong, and tough lattices that can be tailored to various applications. Because of the intricate features in various length scales, additive manufacturing methods - 3D printing will be used for making these samples. Objective: To design, manufacture and test a novel topology of lattice with enhanced mechanical performances Student needs to undertake the following activities: • Draw the geometry of the lattice samples • Manufacture the drawn samples in the laboratory using 3D Printing, • At the next step, test the mechanical properties of the lattices using the state- of-the-art experimental facilities at the UniSQ, The student will be guided at each step of the project. Thus they will have a good exposure of designing, making, and testing of these lattices.
Future research activities	The project is a part of a proposed HDR research project. It can be extended to a final year Honours thesis, and to a HDR research project. The research skills and the experience gained during designing and making the samples and, testing would be
	valuable in future research activities.
Project location	The successful student needs to come to Toowoomba campus to carry out the project for the duration of the scholarship.
Time commitment	The student needs to commit at least 2 days per week over the duration of 10 weeks. It can be undertaken in a couple of blocks, and this will need to be negotiated with the supervisor.

Benefits for successful candidates	The student will learn how a research project is conducted and the importance of creative thinking. They will be exposed to how a research activity is undertaken and will gain experience in working in collaborative research environment at the School of Engineering. Apart from the creative thinking, research and communication skills, the student will develop the following skills • Introduction to 3D printing • How to model lattice using an AutoCAD software and make samples using the 3D printing • Experimental testing
Project outcomes	Apart from the test results, it is expected that the project findings will provide an insight into the design, manufacturing process and mechanical behaviour of these novel materials. The knowledge gained will be used in further research on the enhanced design of these lattices. Depending on their contribution and findings, their name will be included in a conference paper and/or in a journal publication in future. In addition, they can continue to a PhD program in this area after graduation. Furthermore, they will learn about a material that they may have seen but would not have known about how changing the topology of the lattices can lead to very different properties.

School of Humanities and Communication

Project Title: Environment and Character in Shakespeare's Theatre

Project supervisor/s and contact details	Professor Laurie Johnson (laurence.johnson@usq.edu.au)
School/Centre affiliation	School of Humanities and Communication and the Centre for Heritage and Culture
Additional information	Applicants should have completed ENL2005, THE1001, or THS2006, with a result of Credit or above, or should be able to demonstrate equivalent knowledge.
Project description	Opportunity for undergraduate researchers to contribute to an international research team studying the impact of climate and environment on the plays and literature of Shakespeare's era. The "Playing Conditions" research program team (with partners in the Museum of London Archaeology, the Hudson Strode Program in Renaissance Studies at the University of Alabama, and University of Bristol) is investigating the impact of the sixteenth-century British climate on Shakespeare's theatre. Our undergraduate researcher will contribute to this project by undertaking character studies across one or more plays to identify some ways that the presentation of character in early modern drama might have changed due to new ways of thinking about climate and environment. The researcher will be able to draw on skills in character analysis and close reading developed in their undergraduate studies and will gain additional skills that equip them to map the content of this analysis onto specific historical contexts. The project requires the researcher to work closely with the project supervisor (Professor Johnson) in transcribing primary texts of the early modern period, reading key resources to construct a vocabulary related to environment, and identifying points of correspondence and difference between primary texts and the plays in the use of this vocabulary. Case studies are not required to follow a pre-determined format, but it is anticipated they will be consistent with the disciplinary norms established in undergraduate studies and will generate a set of findings capable of being written up for publication .
Future research activities	Applicants can expect that the skills and outcomes from the undergraduate research project will be directly transferable to an Honours thesis and to Higher Degree Research in a relevant field of study, along with the potential for further direct involvement in the "Playing Conditions" research program, depending on the availability of future funding opportunities. Production of effective case studies will be viewed as contributing directly to the success of the research program team.
Project location	The research required to complete each case study can be primarily undertaken online using databases to which UniSQ Library provides access (principally, the EEBO-TCP suite) and those to which Professor Johnson can provide access (such as Folger Luna Digital Image Collection). The researcher will be welcome to conduct this research on campus (at the Toowoomba campus of UniSQ) and to participate in supervision and skills development sessions with their supervisor in-person.

Time commitment	It is expected that the project can be completed with a minimum investment of two days per week for the 10-week duration of the scholarship program. This 10-week program does not need to be undertaken in ten consecutive weeks and the dates of commencement and completion may be negotiated by the successful applicant, depending on course commitments during the S2 and S3 calendar in 2023. If the researcher wishes to commence the research program before August 2023, consideration will need to be given to adjust the timing of in-person training due to Professor Johnson's intensive research trip to the UK throughout July. It may however be considered desirable by the researcher to commence the project during this time, to enable them and Professor Johnson to communicate directly about the research process and new findings while Professor Johnson is embedded in the research activity at the Shakespeare Birthplace Trust, the Shakespeare Institute, and other institutions in the UK. Ideally, the researcher will commit to 10 hours of training time (one hour per week for the duration of the project or adjusted to two hours per week for some weeks if the project is commenced during July). In addition to this, the supervisor will be available for a further minimum of 10 hours of consultation and project supervision (one hour per week, including any time in July, during which consultation can be undertaken via Zoom).
Benefits for successful candidates	The researcher's work will be acknowledged as a genuine contribution to this international program team and the researcher will be provided with valuable opportunities to network directly with international research partners as well as with the global network of professional and research organisations to which Professor Johnson is able to connect the researcher, including the Australian and New Zealand Shakespeare Association, the Folger Shakespeare Library (Washington DC), the Museum of Shakespeare (London), and the Shakespeare Institute and the Birthplace Trust (Stratford-upon-Avon). The researcher will also be invited to attend research seminars of the School of Humanities and Communication, discussions with current HDR candidates, and may also be invited to contribute to discussions about international graduate exchange opportunities with the University of Birmingham and Shakespeare Institute, as these arrangements are being negotiated during 2023. Skills that will be developed in training with Professor Johnson may include but are not limited to working with archives and archivists online, learning to read early modern palaeography and typography, transcribing text from original documents, and expanding interdisciplinary knowledge about Shakespearean drama (for example, understanding regulatory frameworks or the business models of early modern playing companies, to be able to examine documents related to the administration and governance of playhouses and playing, and explaining their relationship to play production).
Project outcomes	Depending on the researcher's program of study, participation in the Undergraduate Scholarship Program may be eligible for course credit, to be negotiated with the relevant Program Director. Upon successful completion of the project, the researcher will also be given the further opportunity to work together with Professor Johnson to produce a publishable co-authored essay for a journal or collection with a recognised high profile national or international press. This offer extends beyond the completion of the project but is provided as a long-term outcome of the research in keeping with the broader goals of the "Playing Conditions" research program.

Project Title: Studying International Relations at UniSQ: Expectations, experiences, and motivations

Project supervisor/s and contact details	Dr Jess Carniel (jess.carniel@usq.edu.au) – Corresponding supervisor Richard Gehrmann Dr Mark Emmerson
School and/Centre affiliation (if appropriate)	School of Humanities and Communication
Additional information	This project is best suited for a student in their second or third year (or equivalent in part-time or dual degrees) of studies. As the project focuses on International Relations, a candidate from that discipline is preferred but there are no specific courses within the major that they will need to have completed. The ideal candidate will have: • Developed research skills appropriate for advanced undergraduate studies, including familiarity with efficient library and database research; • Strong skills in critical thinking and evaluation; • Good written and verbal communication skills; • Good attention to detail; • Ability to work as part of a team; • Ability to work independently (under supervision).
Project description	This project contributes to the supervisory team's established research agenda in International Relations teaching and learning scholarship. It seeks to understand the motivations, expectations, and experiences of students studying International Relations in an age of disruption, globalization, online learning, and increased emphasis on "job-readiness". It also aims to understand these motivations and experiences within the additional context of studying at a regional university. The project team seeks a student researcher for the purpose of collaborative co-design with an insider-researcher (student). The student will assist with: • Co-designing the survey and interview instrument; • Co-writing the ethics application; • Conducting and writing up a systematic literature review. The student will be mentored through the processes of qualitative and quantitative research design, collaborative research processes, ethical research design, and collaborative research. It is estimated that the final development of the written research will fall outside the bounds of the paid scholarship. The student will have the option of continuing with the team in order to participate in the data collection and write-up processes. Although they will no longer be paid, they can gain credit for their research by enrolling in HMT3001 (a program capstone course focused on completing a project under supervision) and completing a version or evolution of the project as part of their coursework. A member of the project team will continue as the student's HMT3001 supervisor, and the course assessment will be

	incorporated into the project timeline. The student will be credited as a co-author on all publications resulting from the data collected, even if they do not participate in the write-up process .
Future research activities	If the student wishes to use the research for course credit, they may enrol in HMT3001. They will also have continued access to the data as part of the research team, so may wish to use this existing dataset as part of an Honours thesis. After developing their original research for HMT3001, the supervisory team will work with the student to submit the final essay to E-IR's student essay showcase. E-IR is a well-regarded open-access online magazine and publishing house in the discipline of International Relations. The skills developed throughout the project will be useful for Honours and further postgraduate study. In particular, there is often limited opportunity for IR Honours students to obtain experience in HREC submissions and qualitative data collection beyond desktop research. As such, this is an excellent opportunity to receive training in these areas in preparation for future studies.
Project location	The supervisory team are located in Toowoomba, so any face-to-face activities will be conducted on that campus. If the successful student is not located in Toowoomba, the project can be conducted online using Zoom, email, and Teams, which will be established for the project to store all data and files.
Time commitment	The elements of the project with which the student will collaborate as part of the scholarship program will run for 10 weeks, commencing 3 July and ending 15 September. The student will be expected to work 10 hours (approx. 1.5 days) per week. This includes a weekly meeting with the project supervisor and a fortnightly meeting with the whole project team.
Benefits for successful candidates	In participating in this research project, the student will develop skills in: • Conducting a literature review; • Resource management; • Ethical review processes; • Qualitative and quantitative research design; • Collaborative research; • Developing research for publication (optional). These skills will be beneficial for moving into postgraduate study, but are also transferable skills sought by employers. They will also develop a publication track record and have the opportunity to develop an original piece of research for credit.
Project outcomes	The project will result in: • a minimum of one co-authored publication in a peer-reviewed scholarly journal (such as International Studies Perspectives); • a co-authored research seminar presentation; • a solo-authored piece of research for credit (for a student who continues the project for credit in HMT3001 or honours); • a solo-authored open-access publication (if the student chooses to pursue the

	option of submitting their HMT3001 essay to E-IR).

School of Health and Medical Sciences

Project Title: Establishment and validation of an assay developed for measuring cortisol concentration in hair samples.

Project supervisor/s and contact details	Dr Lin Kooi Ong lin.ong@usq.edu.au Dr Prajwal Gyawali Prajwal.Gyawali@usq.edu.au
School/Centre affiliation	School of Health and Medical Sciences Centre for Health Research
Additional information	This project is best suited for a 2nd or 3rd year student who is undertaking biomedical science or medical laboratory science. Experience with biomedical techniques (eg ELISA) would be advantageous, but not essential.
Project description	Stress is typically defined as external or internal events that disrupt the homeostasis and allostasis of individuals. Stress responses are important and normal reactions to environmental or internal perturbations and can be considered adaptive in nature. Distress occurs when stress is severe, prolonged, and exceeds the capacity of the individual to manage it. There are two main biological pathways that are activated in response to stress – the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS). Chronic activation of both stress response systems can have detrimental impacts on the brain and body. The assessment of SNS activation is difficult to capture as it requires blood sampling and is largely an acute response to stress making assessment of long-term distress by measurement of noradrenaline and adrenaline hormones challenging. However, the HPA axis response, which can result from various sources including physical, emotional and immunological, comprises a rapid onset and a more gradual decline which may last several hours depending on the severity of the stressor. Long-term dysregulation of the HPA axis may result from unpredictable or severe stress exposures. Further, the HPA axis is a known contributor to psychological and physical comorbidities. Classically, stress and/or distress has been assessed using psychometric assessments. The analysis of stress hormones in biological fluids, such as blood and saliva, has also been used to provide a quantifiable, objective measure. Excitingly, the longer lasting HPA axis response and its steroidal nature offers a promising opportunity for its use as a biomarker of chronic stress through the measurement of cortisol in hair. Accordingly, in this project, a student: • Will support a validation of an assay developed for measuring cortisol concentration in hair samples and • Will be involved in critical appraisal of stress management studies where hair cortisol measurements have been used
Future research activities	The research skills that the candidate will develop over the course of this project are transferable to future research activities.

	This assay will be used in various cohort studies and trials in future. This project could be extended to an Honours, Masters, or PhD project.
Project location	The project is located on the USQ Toowoomba campus. Some aspects of the project (eg literature review) may be able to be completed off campus from the candidate's home.
Time commitment	The project will run for 10 weeks, typically 1.5 day a week. This includes meeting with project supervisors. The candidate will be required to commit to working up to 3 days a week, when performing the assays.
Benefits for successful candidates	The candidate will be involved with the following activities and will learn skills in: - Sample handling and processing - Biomedical science techniques such as ELISA - Experimental design - Data acquisition and analysis - Systemic review The candidate will also undertake workshops related to research, as part of the expected time commitment.
Project outcomes	The assessment of cortisol concentrations in hair will be utilised in future studies as a biomarker to dissect the relationship between chronic stress and various neurological/mental conditions. The project will result in one co-authored publication in a peer-reviewed scholarly journal.

Project Title: Digital/computerised tools for assessment of post-stroke cognitive impairment.

Project supervisor/s and contact details	Dr Lin Kooi Ong lin.ong@usq.edu.au Dr Prajwal Gyawali Prajwal.Gyawali@usq.edu.au Dr Anna Girardi anna.girardi@usq.edu.au
School/Centre affiliation	School of Health and Medical Sciences Centre for Health Research
Additional information	This project is best suited for a 2nd or 3rd year student undertaking a health-related degree. Completion of previous courses related to public health/psychology would be advantageous, but not essential.
Project description	Stroke is a leading cause of acquired disability worldwide, and its disease burden is shifting towards that of a long-term condition. Cognitive impairment is common after a stroke and is known to significantly worsen the quality of life of stroke survivors. Stroke induces dysfunction of various cognitive domains including cognitive flexibility, attention, working memory and visuospatial memory. Stroke is a major risk factor for development of dementia. However, there is no gold standard for cognitive screening, with measures needing to cover a broad range of cognitive domains, be valid, feasible and sensitive for identification of post-stroke cognitive impairment. Typically, cognitive screening tools, such as Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) are used to screen post-stroke cognitive impairment. While MoCA is sensitive to detect post-stroke cognitive impairment, it has poor specificity. Excitingly, there is emerging usage of digital/computerised cognitive assessment tools, such as Cambridge neuropsychological test automated battery (CANTAB) to screen post-stroke cognitive impairment. These digital/computerised tools may offer sensitive and reliable measures that can be customised for specific cognitive domains as well as temporal measures post-stroke. Accordingly, in this project, a student will be involved in: • critical appraisal of studies where digital/computerised tools have been applied in stroke population for identification of post-stroke cognitive impairment and • explore the translatability of digital/computerised tools for cognitive assessment in pre-clinical stroke models.
Future research activities	The research skills that the candidate will develop over the course of this project are transferable to future research activities. This project could be extended to an honours, or PhD project.
Project location	The project can be conducted online. Generally, all team meetings are conducted via Zoom and a Teams site will be set up for the project to store all data and files. Occasionally, the research team may meet in-person at Toowoomba campus, but this is not a requirement for the successful candidate.

Time commitment	The project will run for 10 weeks, typically 1.5 day a week. This includes meeting with the project supervisors.
Benefits for successful candidates	The candidate will be involved with the following activities and will learn skills in: • Conducting a systematic review; • Quantitative research design; • Developing research for publication. The candidate will also undertake workshops related to research, as part of the expected time commitment.
Project outcomes	New knowledge gained will contribute to usage of digital/computerised cognitive assessment tools for identification of post-stroke cognitive impairment. This project will provide critical insights to cognitive screening using digital/computerised tools in humans and pre-clinical stroke models. The project will result in a one co-authored publication in a peer-reviewed scholarly journal

Project Title: The good, the bad and the environment: Exploring the relationship between environmental 'goods' and 'bads' with social deprivation and health outcomes

Project supervisor/s and contact details	Prof Tracy Kolbe-Alexander 07 3812 6178 Tracy.kolbe-alexander@usq.edu.au
School/Centre affiliation	School of Health and Medical Sciences
Additional information	This project is suited for a 2nd or 3rd year students. Students with a background in one (or more) of the following areas are likely to benefit from this project and are encouraged to apply: • health behaviours (like physical activity and nutrition) • behaviour change • geo-coding and the built environment • health / allied health (including nursing or psychology) The research methods for this project will be taught during the first 1-2 weeks, so no previous experience is required.
Project description	It's often been said that the post code of where we live is a greater determinant of our health than our genetics. The increasing rates of obesity, chronic diseases such as cardiovascular disease and mental health outcomes can all be in part attributed to characteristics of the built environment in our neighbourhoods. The environment has the potential to influence decisions, whereby some decisions are subconscious or automatic, and has been termed as passive over-consumption. For example, some neighbourhoods might have more parks, or farmers markets and fewer fast-food outlets, which could lead to healthy behaviours. Other areas, typically those with lower socio-economic status, are likely to have more fast-food outlets and fewer sports facilities, leading to fewer opportunities to engage in healthier behaviours. This has been supported by previous research which showed that the distribution and availability of fast food, alcohol, tobacco, and gambling retail outlets has also reported an increase in unhealthy behaviours. Often there's a cluster 'bad' environmental influences – for example, fast food outlets could co-occur with convenience stores, and alcohol or gambling outlets in certain neighbourhoods. Alternatively, some areas might have a cluster of environmental 'goods' like fresh fruit stores co-occurring with parks and gyms. However, at present, we are unsure if these clusters exist in the Darling Downs and West Morton region. This project is part of a larger study that aims to map the environmental 'goods' and 'bads' in the Darling Downs. Using Council records, google (yes google!) and special mapping software, we will document the type and amount goods and bads in the Darling Downs and West Morton. The data collection for the first two councils (Toowoomba and Ipswich) has been completed, as we are now progressing to the remaining councils (eg Lockyer Valley, Scenic Rim, South Burnett and Cherbourg) The undergraduate research scholar will meet with Prof Kolbe-Alexander prior to week

	1 to determine the workplan. Research activities that students will have the opportunity to be involved in include:
	• Receive training in the methods – how to extract data from council records and how to use the special mapping tools.
	• Assist with data collection:
	  ○ Documenting environmental 'bad' exposures such as fast-food outlets, take away stores, convenience stores, alcohol outlets and gaming venues.
	  ○ Documenting environmental 'good' exposures such as sport and physical activity facilities, fruit and vegetable outlets and supermarkets.
	• Invited to attend meetings with stakeholders as an observer – this will give the scholar some experience and exposure to working with industry and research groups (eg West Morton Obesity Advisory Group).
	• Working with Prof Kolbe-Alexander to analyse and summarise findings.
	• Depending on timing, the summer scholar will have the opportunity to present their work at the School of Health and Medical Sciences monthly research meeting. Prof Kolbe-Alexander will facilitate the presentation to stakeholders as well.
	In addition, the undergraduate research scholar will receive general research training facilitated by Prof Kolbe-Alexander. The following topics will be covered:
	• Introduction and overview of Research methods
	• Ethical considerations in research
	• How to read and critique a journal article
	• The path towards a Masters or PhD journey (including stories / experiences from current students)
	• Answering general questions that you might have related to research

Future research activities	This project is part of the larger 'Working on Wellness! (WoW!) Toowoomba initiative. The overall aim of WoW! Toowoomba is to use a systems-based approach to addressing health outcomes such as obesity and mental health and wellbeing in the Toowoomba LGA. Much of the findings are presented to local government, a range of stakeholder and industry, in addition to being presented at conferences and published in journals. This undergraduate research scholarship project could be extended to an Honours, masters or PhD. The student would also establish collaborations with key stakeholders for similar research, or future potential employment opportunities.
Project location	Much of the work related to this project is online / computer based. Therefore, scholars can choose to work off campus, or at the Ipswich or Toowoomba UniSQ campus. Training and meetings will be conducted via zoom or face to face – depending on the scholar's location and preference. However, where possible, face-to-face meetings would be appreciated. Meetings with industry partners will be via zoom.
Time commitment	This project will run for 10 weeks, and the student is expected to commit to 2 days per week.

	Duration: 10 weeks **Days per week:** 2 days **Proposed dates:** The workdays and times can be arranged to accommodate classes, placements etc. Once the scholarship has been accepted, the scholar and Prof Kolbe-Alexander will agree on days and times.
Benefits for successful candidates	The skills acquired in this project will be a strong foundation for similar research that can be undertaken as part of an Honours or HDR degree. The student would also establish collaborations with key stakeholders for similar research, or future potential employment opportunities. Examples of the skills that will be acquired include: • An understanding of the role of the built environment plays on lifestyle behaviours and health outcomes. • Skills in data synthesis and analysis. • An understanding of the research design that could lead to a community-based project • An understanding of the research process, how to read journal articles and ethical considerations. • Develop skills for engagement with stakeholders. • Presentation and communication skills. • Working with research collaborators from various disciplines and sectors.
Project outcomes	The work completed in the undergraduate research scholarship will contribute to the over-arching outcome to determine; a) Do environmental goods and bads co-occur equally in neighbourhoods? b) Do environmental good and bads cluster in neighbourhoods? c) Are the bads clustered in neighbourhoods / areas with more social deprivation (lower socio-economic status)? d) Are the good clustered in neighbourhoods / areas with more social deprivation (higher socio-economic status)? e) Is the clustering of environmental goods and bads linked to health outcomes like obesity, cardiovascular disease and mental health outcomes? f) The application of the New Zealand 'healthy living location index (HLI) in Toowoomba (and eventually Queensland). Undergraduate research scholars will be invited to present their initial findings to stakeholder and industry partners, and / or the School of Health and Medical Sciences research meetings. The scholar will also be invited to continue their involvement with the research. In addition, the summer scholar will be invited to co-author a short stakeholder report if they wish to remain involved in the research.

School of Mathematics, Physics and Computing

Project Title: Data Privacy Protection for Business Analytics: A Collaborative Approach

Project supervisor/s and contact details	Dr. Di Wu, Prof. Ji Zhang, Prof. Xiaohui Tao
School/Centre affiliation	School of Mathematics, Physics and Computing
Additional information	This project can be conducted by 2nd and 3rd year under graduate students in computing or business discipline. It is expected that the candidate has some IT literacy and foundation (having taken some introductory computing courses), be proficient in the use of Microsoft Office Software and display an enthusiasm for artificial intelligence and its applications.
Project description	**Background:** In the modern business landscape, data analytics plays a crucial role in decision-making and strategy development. However, ensuring data privacy and security has become a growing concern for organizations. Federated learning, a decentralized machine learning approach, offers a solution by training models on distributed data without sharing sensitive information. This project aims to explore the application of federated learning to business analysis while preserving data privacy. **Objective**: To investigate the feasibility and effectiveness of federated learning in business analysis by comparing it to traditional data analysis methods. Students will develop a deeper understanding of federated learning, its potential applications, and the challenges it poses.
Future research activities	It is anticipated that this project has the potential to evolve into an Honours-level or even a Higher Degree by Research (HDR)-level program. It has the potential to offer sustained opportunities for the candidate to engage in research within this area, possibly including machine learning models, programming, and large-scale system development. The expertise and experiences acquired by the candidate throughout this project are highly adaptable, enabling them to apply IT and AI technologies across various high-impact domains effectively.
Project location	This project does not have any on-campus research component that must be fulfilled. The candidate is able choose their preferred location, either online or attending one of the three USQ campuses, to complete the project. The supervisory team will maintain close contact with the candidate and will provide supervision through the research period via Zoom meetings and/or face-to- face meetings as appropriate.

UniSQ

Time commitment	The project will run for 10 weeks and can be undertaken in either S2 or S3, 2023. The candidate will be required to commit to working up to 2 days per week for the duration of the project. The candidate has discretion in deciding which days of the week they will work on the project.

Benefits for successful candidates	This project will provide the following benefits to the candidate. Specifically, this project will provide the candidate with: . Hands-on exposure to IT and AI technologies and an opportunity to engage in an interdisciplinary research project to solve a real high impact problem; . Hands-on experience in real-life large-scale data collection, storage and cleaning along with a good understanding of various potential data quality issues and possible solutions. . Experience in conducting a systematic literature review with critical thinking, summarizing and analytic skills. . Initial experience with various classification models, frameworks and their implementation. . Experience in working in a highly collaborative research environment with researchers from different disciplinary expertise and backgrounds in computer science, artificial intelligence, material, and waste management.
Project outcomes	This project will lead to following outcomes: . This project will help us better understand the requirements and the features of business data. . A literature review surveying the existing federated learning methods in business data analysis and systems will be produced. . Sufficient data will be collected which will be potentially used to train the machine learning classification models. . A paper manuscript will be written based on the project outcome. Depending on the contribution, the candidate will be listed as a co-author or acknowledged in the final publication(s).

UniSQ

Project Title: Artificial Intelligence Feature Extraction Approaches for Biomedical data

Project supervisor/s and contact details	Dr. Tianning Li Tianning.li@usq.edu.au Professor Yan Li Yan.li@usq.edu.au
School/Centre affiliation	School of Mathematics, Physics and Computing
Additional information	This project can be conducted by 2nd and 3rd year undergraduate students from Bachelor of Information Technology, Bachelor of Science or Bachelor of Business (Information System Management). It is expected that the candidate has fundamental programming (e.g. completed CSC1401 course), statistics, and data analytics knowledge and has an enthusiasm for machine learning technique and its applications.
Project description	Background: The features of brain signals are valuable to assess the depth of anesthesia, classify different sleep stages or identify/predict the seizure of patients. Some novel time-frequency domain signal processing techniques, which are better suited for non-stationary Electroencephalogram (EEG) signals have been proposed to obtain useful features for different detection or prediction tasks by different researchers. However, the EEG signals are the signatures of neural activities, their great nonlinearity and nonstationarity make the EEG signals hard to assess. In addition, it is hard to apply just one feature extraction method on different patients' EEG data to get satisfactory results because individual patients' EEG data have variability and various factors. As a result, obtaining valuable features efficiently from EEG data is a challenging research task. Objective: To obtain brain signal features efficiently based on Artificial Intelligence techniques for accurately assessing the depth of anesthesia. Students will develop efficient feature extraction algorithms to obtain valuable features based on supervised machine learning techniques.
Future research activities	The project can be extended into a final year research project, an Honours thesis or HDR research project. It is possible to provide sustained opportunities for the candidate to actively engage in further comprehensive research within the field of data analytics. The expertise and experiences acquired by the candidate throughout this project are highly adaptable to other areas such as financial analysis, text mining and so on.
Project location	Scholars are not required to come on campus for this project for the duration of the scholarship. The data collection is based on open databases published online so scholars can complete the project online. The supervisors will arrange regular Zoom meetings to supervise and support students. Face-to-face meetings may be also offered if appropriate.

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Time commitment	The project will run for 10 weeks in S2 or S3, 2023 and the scholar will be required to commit to working up to 2 days per week. Students can flexibly arrange their working time with the agreement of the supervisors. For example, it is acceptable that the candidate works 2 full weeks during June and July – then one day per week thereafter.
Benefits for successful candidates	This project offers numerous benefits to the candidate, including but not limited to: 1. Obtaining systematic research training as a novice researcher 2. Experience in conducting a systematic literature review with critical thinking, summarizing and analytic skills 3. Experience in analyzing massive data sets for pattern recognition and data modelling 4. Experience in using key technical skills of applying Machine Learning techniques to problem-solving and decision- making support 5. Experience with various classification models, frameworks and their implementation. 6. Collaborative research experiences with researchers from different research areas relating to biomedical data.
Project outcomes	The expected and achievable outcomes: 1. The scholar obtains research skills and data science research experiences. 2. Scholar and supervisors develop efficient feature extraction algorithms to obtain valuable features for different brain signal applications. 3. A paper manuscript will be written based on the project outcome. Depending on contribution, the scholar may be listed as a first author or co-author.

UniSQ

Project Title: Privacy-Preserving Face Recognition for Smart Home Applications

Project supervisor/s and contact details	Dr. Wencheng Yang wencheng.yang@usq.edu.au Prof. Ji Zhang ji.zhang@usq.edu.au Dr. Taotao Cai taotao.cai@usq.edu.au
School/Centre affiliation	School of Mathematics, Physics and Computing
Additional information	The project is intended for the 2nd and 3rd year undergraduate students who possess basic information technology (IT) literacy and a foundation in computing and/or cybersecurity regardless their disciplines. The ideal candidate should have completed some introductory courses in these areas and demonstrate an enthusiasm for artificial intelligence (AI) and its applications.
Project description	With the continuous advancement of smart home technology, the use of face recognition technology in smart homes has become increasingly popular. However, applying face recognition technology in the smart home may raise severe concerns about privacy, as it involves the gathering and processing of sensitive biometric data, which are intricately tied to the owner's identity and often considered highly personal and sensitive information. To mitigate these privacy concerns, this project aims to develop a privacy-preserving face recognition system for smart home applications that protects personal privacy while still providing efficient identification and authentication. This project will involve exploring existing privacy-preserving techniques, such as secure multi-party computation, homomorphic encryption, differential privacy, and federated learning, and adapting these techniques to the context of face recognition in smart homes. The project will also involve evaluating the performance and effectiveness of the proposed system. The candidate will have the opportunities to be involved in a wide spectrum of research activities in this project, including: • Conducting a literature review of existing privacy-preserving techniques for face recognition; • Identifying the requirements and constraints of a privacy-preserving face recognition system for smart homes; • Designing and implementing a prototype privacy-preserving face recognition system for smart homes; • Evaluating the performance and effectiveness of the prototype system; • Developing a final report documenting the project process and outcomes. Candidate's involvement in the project activities mentioned above will depend on their progress and abilities. The candidate will have the opportunity to participate in some or all of the activities depending on their performance and potential.
Future research activities	This project can be expanded into an Honours or HDR-level project, offering further opportunities for the candidate to engage in in-depth research in the field. This may

	involve exploring further topics in deep learning and cybersecurity. The skills and experiences gained from this project are highly transferable, enabling the candidate to apply IT and AI technologies to other high-impact research areas beyond the scope of this project.
Project location	The successful candidate will have maximum flexibility in terms of location, with the option to work either online or on campus, depending on preference. The supervisory team will maintain close contact with the candidate through convenient Zoom meetings and/or face- to-face meetings, if on campus is selected, to provide guidance and support throughout the project.
Time commitment	The project can run for any 10-week period between June 2023 and February 2024. During the selected 10-week period, the candidate will be required to commit to working up to 2 days a week on the project. However, the candidate will have the flexibility to choose which days of the week they will work.
Benefits for successful candidates	As a successful candidate working on this project, they will gain valuable experience and develop a range of skills that will be highly transferable to their future career. Some of the benefits of working on this project include: • Gaining valuable experience in conducting a systematic literature review with an emphasis on critical thinking, summarization, and analytical skills. • Getting hands-on exposure to AI and cybersecurity technologies, while participating in solving a real-world high-impact problem. • Receiving initial experience with various face recognition and privacy-preserving models, frameworks, and their implementation. • Working in a highly collaborative research environment with researchers from diverse disciplinary backgrounds in computer science, artificial intelligence, and cybersecurity. • Improving communication skills through regular team meetings, project presentations, and research reports.
Project outcomes	The intended project outcomes include: • Development of a prototype privacy-preserving facial recognition system that can accurately recognize individuals while preserving their privacy. • Demonstration of the effectiveness of the privacy-preserving facial recognition system in a real-world scenario, e.g., smart home. • Evaluation of the performance of the privacy-preserving facial recognition system in terms of accuracy, speed, and computational efficiency. • Writing a manuscript based on the project outcome. Depending on the level of contribution, the candidate will be listed as a co-author or acknowledged in the final publication. The paper manuscript is intended for publication in a peer-reviewed journal or conference.

UniSQ

Project Title: The assessment and forecasting of sea level rise and change in oceanic temperature due to climate change using artificial intelligence in Australia.

Project supervisor/s and contact details	Nawin Raj (Nawin.Raj@usq.edu.au, +61 7 3470 4337)
School/Centre affiliation	School of Mathematics, Physics and Computing. Specific Discipline: Mathematics
Additional information	This project can be undertaken by any 2nd or 3rd year student. The project will use open-source software language such as Python and R, but other programming languages can also be used for data modeling. The student does not need to know the software for modeling but should be willing to learn. All guidance will be provided by the project Supervisor.
Project description	The impact of climate change on the environment and natural resources has been a global concern and the trend continues to increase with the severity and extreme weather patterns. Climate change will significantly affect water resources, agriculture, forest resources, sea level rise, ocean temperature, rainfall, plant life and other climate parameters. These changes and their impacts are interrelated, and their assessment and predictions are an important task. Climate conditions and increased climate variability are among the most important questions and remain a global challenge. Several coastal environments such as beaches, estuaries, coral reefs, wetlands, and low-lying islands are closely linked to sea level changes. Investigations of oceanic processes and their interactions under climate change are extremely necessary to gain an understanding for the extent and impact it will have on the coastal ecosystem. This will be fundamental for better decision making in developing mitigation and adaptation strategies for the future. Hence, this project will consider the impacts and historical trends of sea level rise and the changes in associated oceanic parameters such as temperature and pressure. The project will employ new and advanced Artificial Intelligence methodology to develop efficient models for sea level prediction and trend forecasting. Particularly, machine learning techniques such as deep learning has high capability of analyzing and learning from historical datasets for reliable predictions. The study will utilize observational datasets obtained from Tide Gauges (Source: Australian Bureau of Meteorology) and Satellite (Source: ECMWF) for validation and comparison. With an ever-increasing concern on sea level rise and how it will impact the coastal ecosystem, this study has the capability to build a foundation for a greater scope of study into coastal erosion and changes in wetland ecosystem. This work has a direct relevance to National and State level government priorities. In 2016, Queensland government set up the Qcoast program for identifying coastal impacts from sea level and rely heavily on reliable research for better decision making. This study will also provide the platform for UniSQ researchers to work with industry partners on issues relating to climate change impacts.

Future research activities	The project has a strong potential to be extended into a final year research project or HDR research project. The skills acquired through strategic data collection, data analysis, data modeling, result presentation and project documentation can be successfully applied to other larger research projects.
Project location	This project can be conducted on campus or at a different location. The student will need a laptop or desktop computer for extracting data, analyzing, and reporting.
Time commitment	The student is expected to commit 2 days a week for 10 weeks to complete this project, however the schedule can be flexible. It is anticipated that the time allocation will be as follows: • Data collection and pre-processing phase – 2 weeks • Data modelling – 4 weeks • Result Presentation and Reporting – 4 weeks
Benefits for successful candidates	This project will provide the opportunity for the student to work in a collaborative research environment and acquire skills in scientific data collection, data analysis, data modelling using artificial intelligence techniques and writing a journal paper. Furthermore, it will also allow the student to apply their skills learnt from previous maths and statistics courses in solving a real-life problem.
Project outcomes	The outcome is to publish the work in a journal.

Project Title:Discover and Characterise Exoplanets using Space Telescopes

Project supervisor/s and contact details	Duncan Wright, Chelsea Huang, George Zhou
School/Centre affiliation	School of Mathematics, Physics and Computing / Centre for Astrophysics
Additional information	This project can be conducted by 2nd or 3rd year Physics or Astronomy and Space Sciences students. Familiarity with Python programming would be advantageous. Working with the team on-campus at Toowoomba Campus is preferred, but not essential. There are 3 similar projects available, so we can accommodate up to three Undergraduate Research Scholarship Program students.
Project description	Exoplanetary science is moving forward at a fast pace thanks to large space telescope missions led by NASA and ESA such as Kepler, the Transiting Exoplanet Survey Satellite, the James Webb Space Telescope, and the Gaia mission. UniSQ's own ground-based telescopes at Mt Kent observatory take data that supports the TESS mission. The three projects proposed are: • High precision transit follow-up of Earths and super-Earths with the Minerva Australis array at Mt Kent • Identification and characterisation of newly born planets from NASA's TESS mission • Searching for small planets suitable for atmospheric studies in new datasets from NASA's TESS mission This research project will take place in the Centre for Astrophysics and will involve being mentored by our PhD students and working with the Astrophysics team. The project will train the students in accessing and analysing exoplanet data from the space missions mentioned above and from Mt Kent observatory. Each student will also do an extension of this work on one of the three projects listed above. The aim is to develop the student's capability in accessing space telescope data, and to build on their knowledge of how to develop and conduct an exoplanetary research project.
Future research activities	This research project is targeted at preparing the students for further research such Honours and/or HDR programs, in exoplanetary science or another area of astronomy.
Project location	Ideally the project will be conducted at the Toowoomba campus, but this is not essential. To get the most out of the project, the students need to have regular meetings with the supervisors and casual discussions with other students. There will be some optional visits to Mt Kent observatory for those students able to travel to Toowoomba, but the visits are not a requirement. An excellent candidate who is unable to come to the campus in person will still be considered.
Time commitment	The projects will run for 10 weeks from after the end of the 1st semester 2023 i.e. starting

	June 19th 2023
Benefits for successful candidates	The students will develop a familiarity with the type of space telescope missions that are currently impacting astronomical research. They will understand how to search through literature on a topic to develop and refine a research project. They will learn how to access the space data and use it to address a scientific question. Finally, they will work in a research environment and collaborate with other research students as well as the supervisory team.
Project outcomes	This is a research training project that has the primary aim of developing the skills of the participants in conducting astronomical research. The focused projects may allow for the students to achieve publishable results, depending on the project and the students' progress.

School of Psychology and Wellbeing

Project Title – Understanding Suicidal Ambivalence

Project supervisor/s and contact details	Steven Christensen steven.christensen@usq.edu.au Professor Andrea Lamont-Mills andrea.lamont-mills@usq.edu.au
School/Centre affiliation	School of Psychology and Wellbeing Centre for Health Research
Additional information	This project is best suited for a scholar who is in their third year of undergraduate study and who is undertaking a psychology undergraduate degree. Participation in this project will prepare the student to continue working with the supervision team on an Honours project in a related area. The ideal candidate will have: • Developed research skills appropriate for advanced undergraduate studies, including familiarity with library and database research; • A basic understanding of EndNote; MS Excel and MS Word (further training will be provided if necessary); • Developing skills in critical thinking and evaluation; • Good written and verbal communication skills; • Good attention to detail; • Ability to work as part of a team; • Ability to work independently (under supervision). Scholars must not have a lived experience of suicide given the content of this project.
Project description	This project is housed within the Keeping Safe – Suicidality Across Different Context research program that sits within the Centre for Health Research. This program of research seeks to better understand how individuals move from a state of ideation to acting and what can be done to halt this progress. This project specifically focuses on suicidal ambivalence. Although poorly conceptualised, broadly suicidal ambivalence is where an individual simultaneously wishes to die yet they also wish to be rescued and live. Given the current ambiguous nature of suicidal ambivalence this project seeks to better understand what is and therefore what is not suicidal ambivalence. This project will comprise the following. • Being involved in the development of a scoping review protocol aimed at mapping the empirical literature on suicidal ambivalence; • Assisting in the identification of online forum data where suicidal ambivalence

	appears to be present; and • Assisting in the development of an ethics application relating to a project on suicidal ambivalence in online forums. The scholar will also be trained in scoping review methodology.
Future research activities	This project can be crafted to meet the objectives of PSY4080/PSY4090 so that participation in the project could be used as course credit for one of these courses. Participation in this project will prepare the scholar to continue working with the supervision team on an Honours project in a related area with the anticipation that this will then be extended to a PhD. The scholar is welcome to continue working with the research team in an unpaid capacity.
Project location	This project can be completed either on campus or at the scholar's home. The scholar will need access to a computer, webcam and the internet.
Time commitment	The project runs for 10 weeks, and the scholar must be able to commit 1.5 days per week that includes supervision meetings. The project can be undertaken anytime between August to November 2023. It may be that the work occurs in blocks of time rather than 1.5 days per week for 10 weeks.
Benefits for successful candidates	The successful scholar will gain experience working in a collaborative research environment. Along with the following: • Skills in scoping review methodology • Data identification and data collection skills • An understanding of the ethical application process
Project outcomes	It is anticipated that the scoping review, once conducted, will be published. The scoping review outcomes will be used as the basis for future Honours and PhD projects.

Project Title: Green Parenting: Understanding parents' pro-environment behaviours to promote environmentally friendly parenting

Project supervisor/s and contact details	Dr Carolina Gonzalez carolina.gonzalez@usq.edu.au
School/Centre affiliation	School of Psychology and Wellbeing
Additional information	This project is best suited for Psychology students in the third year. Some interest in parenting, childhood, and early prevention are highly recommended. Students are required to have good critical thinking and written communication skills.
Project description	In the last few decades, there is a growing interest to mitigate the impact of climate change in our lives. Having fewer children has a direct benefit for the environment (Wynes &Nicholas, 2017); however, supporting young families can also have a positive impact in a world of ageing population (Ofori-Asenso et al., 2018). Green parenting refers to those behaviours that parents engage in to raise their children in an environmentally friendly way. UNICEF (2021) has provided some suggestions for parents to raise their children in an environmentally friendly way, having in mind that these behaviours are also consistent to their children's developmental stage. However, limited research has been conducted to understand parents' pro-environment behaviours. This project aims to understand parents' pro-environment behaviours when raising their children in an environmentally friendly way in Australia. This project will provide a framework about green parenting that will be used to inform future research and public policy. This project includes the following research activities: 1. Conduct a scoping review of the international literature about green parenting to identify definitions, theoretical models, measures, and key variables of interest. 2. Prepare a national survey to identify parents' environmental behaviours and gaps in the support available. 3. Prepare interviews with parents who are currently actively engaged in green parenting and relevant stakeholders to identify facilitators and barriers to pro-environment behaviours. The student will assist with: - Conducting and writing up a scoping review protocol, - Co-designing the survey and interview protocol, - Co-writing the ethics applications.
Future research activities	This project will prepare the student to continue working with the supervisor on an Honours project in a related area with the potential to expand this work towards a HDR degree (e.g., PhD)

Project location	Most of the project work can be done online as the project will be mostly desktop based. However, the student is expected to work on-campus at least one day per week, and more days if needed. When working on-campus, a desk and UniSQ computer will be provided to the student.
Time commitment	The student will need to commit 3 days per week, for 10 weeks. The proposed dates are 3rd July to 8th September, but this can be discussed with the successful candidate.
Benefits for successful candidates	The student will acquire foundational skills for research required for an Honours or HDR degree. The student will be able to develop knowledge and skills in: - Conducting a literature review, - Pre-registering study protocol (for scoping review and empirical study), - Project management skills, - Ethical review process, - Quantitative and qualitative research, - Critical thinking skills, - Liaison with relevant stakeholders, - Academic writing for publication, and - Science communication (optional, though conference presentations). These skills are desirable for a future research career, but they are also transferable into the workforce.
Project outcomes	This project will involve as outcomes: - One co-authored publication in a high impact peer-reviewed journal; and - One co-authored conference presentation.

Project Title:Developing artificial lighting for wellbeing, not just for seeing

Project supervisor/s and contact details	Dr Daniel Joyce; daniel.joyce@usq.edu.au
School/Centre affiliation	School of Psychology & Wellbeing and Centre for Health Research
Additional information	This project is best suited for a 3rd year undergraduate with interest or training in psychology/neuroscience or a related field, as well as some training in research methods. Strong general computing skills along with familiarity with programming or electronics (or a strong desire to learn) would be beneficial.
Project description	Light is a tremendously powerful driver of mental health, physical health, and human behaviour. However, our current light exposures are extremely unhealthy – we spend ~90% of our lives indoors under artificial lighting that is very different in its physical properties from the sunlight under which life has evolved for billions of years. This aberrant lighting is implicated in the development of mental disorders and disease, but recent advances in lighting technology and our new knowledge of brain pathways mean that we can now begin to develop 'humancentric' lighting that makes us feel, think, and even sleep better too, through precise manipulations of LED lighting's timings, intensities, or colours (spectra). In this project, you will work in the UniSQ Light Lab to help determine these manipulations and objectively measure how such lighting is sensed by the visual pathways (pupillometry), perceived by the brain (EEG), and sets human behaviour (psychomotor vigilance tasks, survey measures of mood and alertness). With guidance, you will help design experiments; prototype lighting; recruit for, be involved in, and run experiments; analyse data; and/or prepare this data for scientific publication. During this project you will be exposed to the above methods as well as programming and signal processing.
Future research activities	The research skills developed over this project are transferable to future research activities, and this project has the potential to be extended into an Honours, Masters or PhD project. The skills developed during this project will be an asset to anyone interested in careers in biomedical device development, experimental psychology, medicine, neuroscience, or research management.
Project location	The UniSQ Light Lab is located at Ipswich campus. There will be some opportunities to work from home, but as this is an experimental project students will need to be able to attend Ipswich campus regularly. Note that there is a free shuttle bus that regularly connects the Toowoomba, Ipswich and Springfield campuses.
Time commitment	This project will run for 10 weeks in the second half of 2023, with some flexibility in the start date. This project will involve periods of more concentrated activity (e.g., during data collection) but will on average require a 10-to-15-hour commitment per week. Participation can be tailored to fit with university studies or work commitments.

Benefits for successful candidates	In this project the student will experience how research is performed in a university context. They will learn how to synthesize information from multiple disciplines (e.g., built environment, neuroscience, psychology) to inform research directions and develop experiments. Further, the student will develop skills in project management, participant recruitment, programming, data cleaning and analysis, and report writing. Depending on research outcomes during the project, attendance at the Australasian Neuroscience Society Conference (Brisbane, December 2023) is a possibility, with registration paid by lab funds. The Light Lab is a member of the newly developed UniSQ Sleep and Cognition Laboratories and the student will have opportunities to interact with expert researchers in this unit, as well as with the Centre for Health Research.
Project outcomes	In this pilot project, data are expected to be disseminated as conference presentations and as scientific journal articles with the possibility of co-authorship for the student. The findings from this project may also be incorporated into an Australian or international grant application to pursue fruitful areas as revealed by the data from this project. Because LEDs use existing lighting fixtures, once we develop these interventions, their adoption could be as simple as changing a lightbulb!

Project Title: Bridging the Gaps: Improving health and wellbeing and fostering inclusive models of care with culturally and linguistically diverse (CaLD) and sexually and gender diverse communities

Project supervisor/s and contact details	Professor Amy Mullens, Dr Kirstie Daken, Dr Aastha Malhotra, A/Professor Annette Bromdal
School/Centre affiliation	School of Psychology & Wellbeing, Centre for Health Research, Health and Social Justice Research Theme
Additional information	This opportunity is recommended for a psychology student in their 2nd or 3rd year with an interest in applied or community-based health research through a social justice lens. This opportunity will provide the scholar with exposure to diverse communities (e.g., CALD, sexually diverse, gender diverse) and a wide range of interdisciplinary research methodologies relevant to improving health and wellbeing of priority communities and in partnership with industry/community partners; regarding health and wellbeing or chronic health conditions (e.g., HIV, sexual and reproductive health, Hepatitis, COPD, diabetes). The scholar will also have an opportunity to interact with other student scholars including HDR students in a learning community.
Project description	The scholar will assist the team with varied current projects (such as in CALD sexual health and/or gender affirming health care) matched in part to the scholar's interests, experience and academic/professional goals: • primary and secondary data analysis of existing data sets (e.g., qualitative, process evaluation, scoping/systematic reviews) • literature searching and synthesis to guide identifying current trends and gaps in the literature to inform arising research outputs (e.g., publications, presentations, industry reports) and future funding submissions • assist with preparing research proposals and writing ethics proposals for subsequent phases of research • contributing to stakeholder engagement processes for meaningful co-design of applied research projects with industry partners (including members of affected communities, clinicians, public health etc) and inclusive practice
Future research activities	This project has the potential to be extended into a final year research project (including a WIL or Capstone project), as well as for an Honours or HDR project (Master's or PhD). The research skills developed by the scholar through this opportunity will also be highly relevant and transferable to future research and/or clinical activities.
Project location	The work required for this project is based largely online or via computer. The scholar can elect to work on campus at Ipswich or Toowoomba UniSQ campus or work off campus. The scholar will be invited to attend team meetings, including industry partners and academics from other universities (typically held via zoom due to varied geographic locations of participants).
Time commitment	The duration of the project is for a ten-week period from 17 July to 22 September

	2023. There is some flexibility re hours/days per week for the scholar, however a commitment of at least 4 hours per week is needed. Weekly meetings with the supervisors/team will be negotiated based on student availability (sometime between Mon-Thurs and 9-3). The scholar will also be invited to attend meetings with the research team and industry partners.
Benefits for successful candidates	The scholar will learn the following skills: • literature searching and synthesis from academic and grey literature sources • data analysis skills in mixed-methods approaches • writing for academic, research and professional audiences • content knowledge in the areas of social justice, health conditions, CALD • key stakeholder engagement and research translation
Project outcomes	The contributions from the scholar will help to meaningfully advance the work of the larger team of research in terms of analysis and dissemination of key findings from previous research; and preparing for future phases of the program of research to fill critical knowledge gaps to reduce health disparities, including progressing research implications regarding policy, practice and/or training outcomes.

School of Law and Justice

Project Title: The Environmental Protection Act: An Evaluation of 30 years operation in Queensland from the perspectives of the regulators, industry and the public

Project supervisor/s and contact details	Professor Noeleen McNamara Noeleen.mcnamara@usq.edu.au Ph 07 3812 6374 Dr Bob Zhao, Senior Lecturer Bob.zhao@usq.edu.au Ph 07 3812 6360
School/Centre affiliation	School of Law and Justice
Additional information	Students should be at least in their 2nd year of study of a Bachelor of Laws degree. Students must be confident enough to interview practicing lawyers, environmental managers, mining executives, government officers. Students will be given training in how to approach and interview these professionals as part of the scholarship. It is desirable (although not necessary) that students have completed LAW2107 Environmental Law. Whilst interviews could be conducted through Zoom, it may be beneficial for the student to travel to Brisbane City to conduct interviews with practitioners in person, should this suit both parties.

Project description	
	The Queensland *Environmental Protection Act* (EP Act) was passed in 1994. The legislation initially addressed air, noise and water pollution, but has since been expanded to include most aspects of environmental harm – including waste and mining. As such, this Act has a major impact on development in Queensland. As the 30th anniversary of this legislation approaches, it is timely to review the effectiveness of this legislation from a range of stakeholder perspectives. This project will involve the student researcher participating in the following tasks (together with the academic staff involved in the project). 1. Performing a literature review about the effectiveness of the legislation in terms of enforcement. This will concern the review of the Dept of Environment and Science's publications concerning regulation and enforcement, together with some comparison with jurisdictions such as NSW and Vic. 2. Conducting interviews with leading environmental practitioners (solicitors and barristers), government officers, and the environmental staff of key industries in Queensland. Wider coverage will be gained via a survey. Questions that will be asked could cover the following general themes: • A consideration of enforcement under the EP Act – has this been appropriate; how it targeted the 'real' polluters; are the penalties being imposed by the courts in keeping with those in other Australian states • Can improvements be made to allow the public to participate more appropriately in decisions concerning the environment in Queensland. Is the environmental 'duty of care' appropriate? • Does the EP Act provide sufficient safeguards to protect Queensland from the impacts of climate change? • Can improvements be made in the system of licensing of industry and licence conditions? • Is the regulation of certain industries, such as mining, appropriate and how can it be improved? • Are the safeguards for end of mine closure appropriate? The academics will identify relevant practitioners for the students to interview and will provide training to the student about the processes used to do this. 3. The outcomes of this project will be reported through at least two journal articles, and the student will be a co-author on these articles. 4. A further important outcome for the student will be the contact that has been made with industry professions, particularly the environmental and planning lawyers that will be interviewed. This introduction will be particularly useful for students wanting to practice in the emerging fields of climate change, environment and planning law.

Future research activities	This project will provide students with an understanding of the practical application of legislation and regulations from the viewpoint of the regulators; legal practitioners and a range of industry professionals. In doing so, it will introduce the students to regulatory theory and regulation in a range of industries. This experience will be valuable for students in doing a research project in the Bachelor of Laws (Honours) Project and later in a HDR program. Regulatory theory is an important foundation when understanding the application of environmental laws, and these skills will be transferable to other areas of the law (such as workplace health and safety/ the regulation of ACCC and ASIC).
Project location	The project can be conducted online and on campus. All the surveys are conducted online. There is no travel necessarily required for data collection – although the student may choose to interview some participants in-person. Team meetings can be either held online or occasionally in-person at the Ipswich campus. A team's site will be set up for the project to store and share relevant data and files. The time and location for meeting is negotiable due to the study schedule and geographical disparities of team members.
Time commitment	The entire research project is designed as a 10 week study. The milestones of the project are as the following (although the dates are subject to negotiation, as these dates are designed to given the student time to conduct interviews at the end of the interim trimester): August 2023: Initial literature review (1 day per week for 3 weeks). August 2023: stakeholders review (1 day) 4-15 September 2023: Conduct interviews (during the block at the end of the interim trimester (4 days) 18 Sept – project meeting Sept/ Oct 2023: carry out data analysis and draft working papers (6 days) Nov 2023 – Jan 2024: Supervisors finalise the journal articles
Benefits for successful candidates	The student will have the opportunity to: • Receive training in research methods – how to conduct interview, data collection and data analysis • Develop communication skills by conducting interviews with a broad range of stakeholders, including leading environmental practitioners, government officers and the environmental staff of key industries in Queensland). • Become familiar with basic literature review, ethical considerations in research, as well as pathway towards a Masters or PhD journey. • Publish academic publication (journal articles/research reports) with supervisors as recognised co-author • Depending on timing, the scholar will have the opportunity to present their work at the School of Law and Justice monthly research meeting.

Project outcomes	A key early step of this research project is to identify those areas where reform would deliver the greatest benefit for the environment, business and the community, while maintaining strong environmental standards. The scholar is encouraged to publish discussion papers based on the findings of this project, from the perspectives of background information about the Act and the outlook for the Queensland environment, focus areas for how the Act could be improved, and principles to guide future reform. The scholar will be able to develop further collaborations with environmental legal scholars in multiple areas, such as environmental governance, sustainable development and indigenous involvement in environmental legislation.

Centre for Astrophysics

Project Title - Dynamical simulations of Small Solar system Bodies

Project supervisor/s and contact details	Dr. Timothy Holt, timothy.holt@usq.edu.au
School/Centre affiliation	Centre for Astrophysics.
Additional information	Open to 2nd or 3rd year undergraduate students, with a background in Astronomy and/or programing. Linux access necessary, Python and LaTex experience preferable, but can be taught.
Project description	There are currently over 800,000 small Solar system bodies known: asteroids, Trojans, comets, Centaurs, and the like. Many of these objects are moving on unstable orbits, and will one day be ejected into interstellar space. Others move on orbits that are stable for the life of the Solar system. This project will investigate the life of a Small solar system body or small group of objects. By using n-body simulations of the Solar system, the dynamical history and future of the object or objects can be investigated. The specific body or group is to be selected by the student, with the help of their mentor. Simulations can then be conducted, with the time-frame specific to the object. The results are then analysed and presented in a journal format.
Future research activities	This project investigates a single object, but the methodology can be expanded to any population of Solar system bodies, depending on the students competency level. The project will also give students the chance to engage with professional-level simulations and to gain experience writing an academic-style journal article. The skills learnt in this project could be transferred to any future simulation-based science endeavor.
Project location	The project is designed to undertaken remotely. Access to a computer with Linux, or willingness to install Linux on an existing machine, will greatly help accelerate the project. VPN access to the USQ HPC may be requested, pending on the student's experimental design and experience level.
Time commitment	The time commitment for this project is 10 weeks, at approximately 25hrs (3 days fulltime) per week. This will greatly depend on student's existing programing skills, particularly, Linux, Python and LaTex. While not strictly necessary, a higher level of outcome would be achieved with more advanced skills.
Benefits for successful candidates	A student participating in this project should achieve the following skills: • Independent research subject selection, with a degree of automation • Conduction of a high-quality literature review • Designing and running a professional level computer simulation. • Python analytical skills • Creating a journal article using a given style guidelines using Latex.
Project outcomes	The outcome of this work is to be a report in the style of an academic journal article, including a literature review, simulation methodology, figures presenting analysed data and

	meaningful conclusions.

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