

# **NANYANG** research programme



## **Project Titles / Synopsises 2022**

**NANYANG RESEARCH PROGRAMME**  
**Overview of Project Titles 2022**

| Category                       | Project Code  | Project Title   |
|--------------------------------|---|---|
| <b>ENGINEERING</b>             | <a href="#"><u>CEE01*</u></a>                                     | Plastic-eating worms: What can we learn from the worms to deal with plastic waste?                            |
|                                | <a href="#"><u>CEE02*</u></a>                                     | Plastic-microbe interaction in marine environments  |
|                                | <a href="#"><u>CEE03</u></a>                                      | Osmosis-based membrane technology for water purification, desalination and renewable energy harvesting        |
|                                | <a href="#"><u>EEE01</u></a>                                      | Impact of Electromagnetic Radiation on Humans   |
|                                | <a href="#"><u>EEE02</u></a>                                      | Simulation Study on Optical Fibre Transmission System   |
|                                | <a href="#"><u>EEE03</u></a>                                      | Research and development of spectrum-adaptive table lamp  |
|                                | <a href="#"><u>EEE04</u></a>                                      | Emissions from Rare-Earth Ions by the Energy Transfer from ZnO Nanocrystals Embedded in SiO <sub>2</sub> Film |
|                                | <a href="#"><u>EEE05</u></a>                                      | Power Supply System for Smart Contact Lens  |
|                                | <a href="#"><u>EEE06</u></a>                                      | Advanced Gallium Nitride High Electron Mobility Transistors (HEMTs) for High-Frequency Applications           |
|                                | <a href="#"><u>EEE07</u></a>                                      | Implement Environmental Sensor Under Internet of Things   |
|                                | <a href="#"><u>EEE08</u></a>                                      | Wireless Charger of Implanted Devices   |
|                                | <a href="#"><u>EEE09</u></a>                                      | Smart Car Sharing in On-Demand Mobility   |
|                                | <a href="#"><u>EEE10</u></a>                                      | Reconstruction of Reference Signal for DVB-T2 System  |
|                                | <a href="#"><u>EEE11</u></a>                                      | Deep learning based robust channel estimator for orthogonal frequency-division multiplexing systems           |
|                                | <a href="#"><u>EEE12</u></a>                                      | Data-Driven Method for Li-Ion Battery Health Monitoring   |
|                                | <a href="#"><u>MAE01</u></a>                                      | Virtual & Augmented Reality Technology Enhanced Army Logistic Training  |
|                                | <a href="#"><u>MAE02*</u></a>                                     | Solar-driven conversion of carbon dioxide to chemicals  |
|                                | <a href="#"><u>NIE10</u></a>                                      | Designing an Artificial Intelligence and / or Robotics System for Potential Real-World Applications           |
|                                | <a href="#"><u>SBS01</u></a>                                      | Ex vivo engineering of cellular surfaces, a transfection independent approach                                 |
|                                | <a href="#"><u>SCBE01</u></a>                                     | Plasmonic Nanostructures Based Surface Enhanced Optical Sensors   |
|                                | <a href="#"><u>SCBE02</u></a>                                     | Life Cycle Assessment of Pharmaceutical Nanoparticles from Bioavailability versus Manufacturing Perspectives  |
|                                | <a href="#"><u>SCBE03</u></a>                                     | Reactor Simulation using Aspen Hysys  |
| <a href="#"><u>SCBE04</u></a>  | Process Simulation  |   |
| <a href="#"><u>SCSE01*</u></a> | Detection and Recognition of Handwritten Mathematical Expressions |   |

\* denotes that the project can be offered as NRP Enrichment / H3 Science Research

| Category  | Project Code                         | Project Title  |
|---|--------------------------------------|--|
| <b>SCIENCES</b>   | <a href="#"><u>MAE03</u></a>         | A New Analytical Technique for Solving Nonlinear Differential Equations                                  |
|   | <a href="#"><u>NIE06</u></a>         | Acute Effects of Using Reusable Cloth Mask During Aerobic Exercise                                       |
|   | <a href="#"><u>NIE07</u></a>         | CREATE: Do more creative people adapt better?  |
|   | <a href="#"><u>NIE11</u></a>         | Pure and Doped BiFeO <sub>3</sub> Thin Film for Photodetector  |
|   | <a href="#"><u>NIE12</u></a>         | Plasma Assisted Low Temperature Graphene Synthesis   |
|   | <a href="#"><u>NIE15</u></a>         | Optimising Power Output of Simple Microbial Fuel Cells   |
|   | <a href="#"><u>SCBE05</u>*</a>       | Development of new technologies for precision genome engineering   |
|   | <a href="#"><u>SCBE06</u>*</a>       | Development of new programmable RNA editing tools  |
| <b>BUSINESS, HUMANITIES, ARTS &amp; SOCIAL SCIENCES</b> | <a href="#"><u>NIE01</u></a>         | The Neuroscience of Math Learning  |
|   | <a href="#"><u>NIE02</u></a>         | Topics in Singapore English  |
|   | <a href="#"><u>NIE03</u></a>         | Am I procrastinating?: Examining Time Management Skills Among University Students in Singapore           |
|   | <a href="#"><u>NIE04</u></a>         | Covid-19, Nostalgia and Sport  |
|   | <a href="#"><u>NIE05</u></a>         | Nostalgia, leisure participation and habit   |
|   | <a href="#"><u>NIE08</u></a>         | Effect of In-Games Advertisement on Sponsor Recall   |
|   | <a href="#"><u>NIE09</u></a>         | Exploring the Role that Game-Based Worlds and Immersive Environments Potentially Play in Learning        |
|   | <a href="#"><u>NIE13</u></a>         | Sense of Food Resiliency among Secondary/JC students in Singapore  |
|   | <a href="#"><u>NIE14</u></a>         | Food Allergy Knowledge, Attitudes, and Preparedness Among Consumers and School Canteen Service Personnel |
|   | <a href="#"><u>NIE16</u></a>         | Literary Theory and Modern Poetry  |
|   | <a href="#"><u>SCI01</u></a>         | Can AI Help Students and Teachers?: An Investigation of AI's Potential in Education                      |
|   | <a href="#"><u>SCI02</u></a>         | Who Are Chatbots?: A Study of Company Digital Personas   |
|   | <a href="#"><u>SCI03</u></a>         | Top Dog in the Lion City: Experiences with Singapore's Robotic Pup                                       |
|   | <a href="#"><u>SCI04</u></a>         | Fighting Fake News: Defining, Determining and Dealing with Deliberate Online Falsehoods in Singapore     |
|   | <a href="#"><u>SOH01</u></a>         | Singapore Crypto-Linguistics: Deciphering the Singapore Stone  |
|   | <a href="#"><u>SOH02</u></a>         | Become a Glyph-Breaker: Deciphering Linear A   |
|   | <a href="#"><u>SOH03</u></a>         | A Sociolinguistic Investigation of French, German, Italian and Spanish in Singapore Shop Signs           |
|   | <a href="#"><u>SOH04</u></a>         | Translating world literature in Singapore (1950-90s)   |
|   | <a href="#"><u>SOH05</u></a>         | Arab philanthropies and how they influence the spread of Arabic Language on Singapore landmarks          |
|   | <a href="#"><u>SSS01</u></a>         | The effects of languages on financial decision-making  |
| <a href="#"><u>SSS02</u></a>                            | Assessing Social Attributes of Faces |  |

\* denotes that the project can be offered as NRP Enrichment / H3 Science Research

**ENGINEERING**

**CEE01**

**Title** Plastic-eating worms: What can we learn from the worms to deal with plastic waste?

**Description** The large-scale production and use of plastics coupled to a low recycling and incineration rate (~20%) for plastic waste have resulted in severe plastic pollution to the environment. To address this global concern, it is imperative to develop efficient, cost-effective processes to convert plastic wastes into valuable commodities. The state-of-the-art plastic recycling involves mechanical and/or chemical methods, which often require extensive use of energy and toxic chemicals. Biotechnological processes employing depolymerizing enzymes are a promising, more sustainable alternative that can be operated under mild conditions. One challenge that limits the application of biotechnological processes is the highly heterogeneous nature of plastic waste and the lack of highly active enzymes for depolymerization of mixed plastics. Mealworms, superworms, and wax moths have been observed to be capable of ingesting plastics and reducing their weight possibly via polymerizing and metabolizing the plastics.

In this project, we aim to learn from these plastic-eating worms on how to deal with plastic waste. We will unravel biochemical mechanisms responsible for depolymerization in the gut metagenomes of the worms. The microorganisms and/or enzymes identified in this proposed work may be applied to process plastics, as a part of the engineering solutions to end plastic wastes by bio-cycling them to valuable commodities such as bioplastics.

**Project offered as** [NRP Enrichment / H3 Science Research](#)

**College / School** School of Civil & Environmental Engineering

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge** (i) Basic biology and microbiology knowledge  
(ii) Basic chemistry/biology lab skills  
(iii) Being comfortable working in a highly interdisciplinary research environment

**Other Requirements** NIL

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**ENGINEERING**

**CEE02**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Plastic-microbe interaction in marine environments   |
| <b>Description</b>        | South East Asian seas receive outputs from five of the top ten nations for marine emission of plastic debris, resulting in public concern about the impacts of this pollution on the health of this vulnerable marine environment. Reducing the threat of plastic pollution is especially critical to the region because coastal waters provide diverse ecosystem services supporting economic growth, food supply and livelihoods, particularly in coastal regions where over 70% of the approximately 650 million human population in South East (SE) Asia. Of particular concern, is the region's plastic production is increasing at a rate higher than the global average, driven by a market value of USD 3.4 billion. To address the growing problem, we need to understand environmental transformation of plastic better and to analyse the resulting adverse effects. Plastic breakdown in the marine environment is predicted to be very slow, but this is based on poorly evidenced assumptions. A critical knowledge gap regarding its transformation is the role played by microorganisms, which quickly colonise plastic surfaces and secrete a biofilm to become an integral component of the marine plastic debris. The objective of this project is to characterise the interactions between biofilm and plastic surfaces in order to understand how they transform plastics in SE Asia marine ecosystems. |
| <b>Project offered as</b> | <a href="#">NRP Enrichment / H3 Science Research</a>   |
| <b>College / School</b>   | School of Civil & Environmental Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | (i) Basic chemistry, biology, and microbiology knowledge<br>(ii) Basic chemistry/biology lab skills<br>(iii) Being comfortable working in a highly interdisciplinary research environment  |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**CEE03**

**Title** Osmosis-based membrane technology for water purification, desalination and renewable energy harvesting

**Description** Osmosis is a natural process in which water molecules from a low concentration solution spontaneously permeate through a semi-permeable membrane into a high concentration solution. Based on the principle of osmosis, different types of membrane technology have been developed such as reverse osmosis (RO) and pressure-retarded osmosis (PRO). In RO, a hydraulic pressure, which is higher than the osmotic pressure difference between the high concentration solution and the low concentration solution, is applied in the high concentration solution side. The applied hydraulic pressure can overcome the osmosis and push the water molecules in the high concentration solution reversely permeating through the membrane into the low concentration side. This process has been widely used in seawater desalination and water purification. In PRO, the applied hydraulic pressure in the high concentration solution is lower than the osmotic pressure difference between the two solutions. Thus, it cannot overcome the osmosis. The water molecules from the low concentration side still transport through the membrane to the high concentration side, but their permeation rate is retarded by the applied hydraulic pressure. PRO can be used to harvest the osmotic energy to generate electricity. Osmotic energy is a new type of renewable energy originated from the mixing of two solutions with different salinities such as river water mixing with seawater at estuaries.

In practice, RO and PRO can be designed in different processes. In this project, various parameters on the performance of RO and PRO with different designs will be systematically investigated. These parameters include hydrodynamic conditions (e.g., applied hydraulic pressure and cross-flow velocity), feed solution conditions (e.g., salt concentration/salinity and composition) and membrane properties (e.g., water permeability, salt permeability, salt rejection, structural parameter, surface roughness, charge and hydrophilicity/hydrophobicity). The research will be conducted by lab experiments. Students in this project are expected to gain a comprehensive understanding of principles of osmosis-based membrane processes such as RO and PRO for various applications related to water and energy production. Students will also gain an understanding of the influence of various parameters on the performance of RO and PRO.

|                           |   |
|---------------------------|---|
| <b>Project offered as</b> | <b>NRP Enrichment</b>                       |
| <b>College / School</b>   | School of Civil & Environmental Engineering |
| <b>Target Group</b>       | Year 5 / JC 1                               |
| <b>Group Size</b>         | Individual / Pair                           |
| <b>Specific Knowledge</b> | Physics, chemistry, mathematics             |
| <b>Other Requirements</b> | NIL   |

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**ENGINEERING**

**EEE01**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Impact of Electromagnetic Radiation on Humans   |
| <b>Description</b>        | <p>Exposure to electromagnetic fields is not a new phenomenon. However, during the 20th century, environmental exposure to artificial electromagnetic fields has been steadily increasing as growing electricity demand, ever-advancing technologies and changes in social behaviour have created more and more artificial sources. Everyone is exposed to a complex mix of weak electric and magnetic fields, both at home and at work, from the generation and transmission of electricity, domestic appliances and industrial equipment, to telecommunications and broadcasting.</p> <p>Heating is the main biological effect of the electromagnetic fields of radiofrequency fields. In microwave ovens this fact is employed to warm up food. The levels of radiofrequency fields to which people are normally exposed are very much lower than those needed to produce significant heating. The heating effect of radio waves forms the underlying basis for current guidelines. Scientists are also investigating the possibility that effects below the threshold level for body heating occur as a result of long-term exposure. To date, no adverse health effects from low level, long-term exposure to radiofrequency or power frequency fields have been confirmed, but scientists are actively continuing to research this area. This project will investigate on the mobile band of frequencies and their impact on human cells.</p> |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | School of Electrical & Electronic Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Individual  |
| <b>Specific Knowledge</b> | Passion towards doing the literature survey, collection of data, interpretation of the results and above all commitment.  |
| <b>Other Requirements</b> | NIL   |

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**ENGINEERING**

**EEE02**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Simulation Study on Optical Fibre Transmission System   |
| <b>Description</b>        | <p>Design study on wavelength division multiplexed optical fibre transmission system will be attempted in this project using Optisystem simulation tool. The tasks are listed below.</p> <ol style="list-style-type: none"><li>1) Understand the necessary components of an optical transmitter which are optical source, electrical pulse generator and optical modulator.</li><li>2) Visualization of optical and electrical signals with the usage of an optical spectrum analyzer, oscilloscope visualizer as well as an optical time domain visualizer.</li><li>3) Experimenting global parameters such as sample rate, number of samples and time window.</li><li>4) Exploring with component properties and the visualizer parameters.</li><li>5) Executing the simulation to gain results from the visualizers in order to make comparisons and discuss the results.</li><li>6) Design a simple transmission system, a wavelength-division-multiplexed passive optical network (WDM-PON).</li></ol> |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | School of Electrical & Electronic Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Individual  |
| <b>Specific Knowledge</b> | Background in optics and physics  |
| <b>Other Requirements</b> | NIL   |

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**ENGINEERING**

**EEE03**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Research and development of spectrum-adaptive table lamp  |
| <b>Description</b>        | <p>Table lamps currently in the market could have warm or cold white light. Users will choose the one which is suitable for them. However, users typically do not know the scientific reasons for their choice. In fact, our eyes have been evolved to adapt to sunlight, which changes from dawn to dusk with various light spectrum from warm to cool white light. The project will do research on the sunlight spectrum through the day and build the table lamp with a tunable spectrum that can change the spectrum according to the user's need or following the sunlight so that users have a feeling of outdoor light.</p> <p>Students will not only learn about the sunlight spectrum but also control the light with a simple microcontroller (Arduino) and coding.</p> |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | School of Electrical & Electronic Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Individual / Pair   |
| <b>Specific Knowledge</b> | NIL   |
| <b>Other Requirements</b> | NIL   |

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**ENGINEERING**

**EEE04**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Emissions from Rare-Earth Ions by the Energy Transfer from ZnO Nanocrystals Embedded in SiO <sub>2</sub> Film   |
| <b>Description</b>        | Rare-Earth (RE) ions have been extensively used for various source of light emissions. The emissions cover a wide range of spectrum, from visible to near infra-red, and hence they have been used for lighting, displays, optical amplifier and many others. The optical excitations of the RE ions, however, requires specific wavelength which is challenging and relatively expensive to have. In this project, we will use semiconductor ZnO nanocrystals to act as sensitizers. The optical excitation of the ZnO nanocrystals is quite easy to have, as long as the photon energy is higher than the bandgap. The RE ions can in turn be excited by the energy transfer from the excited ZnO nanocrystals and give emissions when the RE ions relax to the ground states. The RE ions and the ZnO nanocrystals will be incorporated in SiO <sub>2</sub> films. The project involves the fabrication and the characterization of the samples. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | School of Electrical & Electronic Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Pair  |
| <b>Specific Knowledge</b> | Very good in Physics and Chemistry.   |
| <b>Other Requirements</b> | NIL   |

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**ENGINEERING**

**EEE05**

**Title** Power Supply System for Smart Contact Lens

**Description** A smart contact lens is considered as one of next generation wearable electronic devices. Recently, many well-recognized companies including Google Inc. announced conceptual ideas of various usage of smart contact lens and research groups in academia started to report the demonstration of various components to be utilized in the smart contact lens such as sensors and actuators. The one of challenge of development of various components for smart contact lens is harsh environment on eye ball meniscus of limited space and fluidic media. In addition, small energy capacity due to limited space requires energy efficient communication system to transfer the information to the user. Hence, the component of smart contact lens demands miniaturization as a form of thin film on the curved meniscus for user convenience, corrosion resistance in the fluidic media, and ultimate safety for eye protection. In this study, a student will learn how to fabricate a micro battery on a contact lens device. The flexibility and proper electrochemical reaction of the fabricated micro battery will be studied. Finally, we will study how the electronic devices is integrated with a fabricated battery in a smart contact lens.

**Project offered as** **NRP Enrichment**

**College / School** School of Electrical & Electronic Engineering

**Target Group** Year 5 / JC 1

**Group Size** Individual

**Specific Knowledge** General Chemistry and Physics covered in JC

**Other Requirements** NIL

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**ENGINEERING**

**EEE06**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Advanced Gallium Nitride High Electron Mobility Transistors (HEMTs) for High-Frequency Applications  |
| <b>Description</b>        | Gallium Nitride (GaN) based High-Electron-Mobility Transistors (HEMTs) have been widely recognized as the preferred choice for next generation high-frequency and high-power device applications such as 5G/6G wireless communications, high power electronics, satellite communications and sensors etc. This is due to its inherent material properties such as wide band gap with high breakdown voltage and higher saturation velocity which enable it to operate at high-frequency, high-power, high-temperature and harsh environment. In this project, the student will learn the basic operation, characterization techniques and analysis of HEMTs thus allow them to understand what it takes to achieve high-frequency and high performance GaN HEMTs for many key emerging applications. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Electrical & Electronic Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual   |
| <b>Specific Knowledge</b> | A-Level Physics and Mathematics  |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**EEE07**

**Title** Implement Environmental Sensor Under Internet of Things

**Description** There has been very strong interest and attention in the past few years focused on the Internet of Things (IoT). The IoT refers to a network of physical objects embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. It allows remote sensing and control across network infrastructure, creates opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. [1] One of the challenges in the IoT technology is the provision of energy for the sensing, electronics, communication, etc. It is important that the deployed devices are autonomous, that is, able to harness environmental energy and be self-sufficient so that there is no need to provide and replace batteries. Among the various sources of energy that can be harnessed from an indoor environment, light energy has been shown to be one of the most efficient and widely available.

In this project, the student will study and implement an environmental sensor to sense and transmit signal wirelessly to a host for real-time monitoring of the environmental parameter of interest. The scope will also include the building of communication circuit and circuit for harnessing of light energy to power the sensor and communication circuits, to realize a fully autonomous sensor.

1. [https://en.wikipedia.org/wiki/Internet\\_of\\_Things](https://en.wikipedia.org/wiki/Internet_of_Things)

**Project offered as** NRP Enrichment

**College / School** School of Electrical & Electronic Engineering

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge** No pre-requisites. Students should preferably have an interest in electronic engineering and in the study of renewable energy.

**Other Requirements** NIL

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**ENGINEERING**

**EEE08**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Wireless Charger of Implanted Devices  |
| <b>Description</b>        | It is noted that changing the battery of implanted devices can be difficult and painful. Therefore, it is desirable to have a system that can charge the implanted devices wirelessly. The objective of this project is to study the mechanism of a wireless power transfer system and to implement a system that demonstrates wireless charging capability. Various designs associated with wireless power transfer will be reviewed and a particular method will then be selected for simulations and experiments. It is hoped that a prototype can be designed for demonstration at the end of the project. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Electrical & Electronic Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Pair   |
| <b>Specific Knowledge</b> | NIL  |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**EEE09**

**Title**

Smart Car Sharing in On-Demand Mobility

**Description**

Singapore has gone through a remarkable urbanisation process for the past several decades. So far, about 12% of the accessible land has been used for building traffic roads, and it is simply impossible to continuously expand the traffic network. To meet the ever-growing number of traffic demands, advanced traffic management techniques such as traffic signal control and flow management by road pricing have been developed and implemented. In addition, it is commonly believed that, by promoting ride sharing, the number of travel demands may be significantly reduced, which could ease the high pressure faced by LTA on pan-island traffic management. In this project the student will learn to model a simple traffic network and analyse the impact of ride sharing on travel demand reduction.

There are several objectives that the student is expected to meet:

- (1) To learn how to model a ride sharing problem as a mathematical programming problem.
- (2) To learn some simple optimisation techniques, in particular, the Lagrangian multiplier method. If time allows, some evolution algorithms may also be learned.
- (3) To apply relevant optimisation techniques to the ride sharing problem and solve it with right tools.
- (4) To develop a simple simulation based case study to illustrate the solution.

During this process, the student is expected to learn some basic concepts of linear programming, mixed integer linear programming, Simplex, Lagrangian relaxation and genetic algorithms. The simulation case study may be developed within a realistic traffic simulator PTV VISSIM, which also allows the student to understand some basic traffic management principles.

**Project offered as**

**NRP Enrichment**

**College / School**

School of Electrical & Electronic Engineering

**Target Group**

Year 5 / JC 1

**Group Size**

Individual / Pair

**Specific Knowledge**

- (1) For students who intend to develop their own optimisation algorithms, knowledge about calculating function derivatives may be needed. Nevertheless, this is not mandatory, as specific optimisation tools can be used to solve relevant optimisation problems.
- (2) Students may use their own familiar programming languages to develop some case studies. Yet, they will be encouraged to use PTV VISSIM, which will be provided by my group at NTU.

**Other Requirements**

NIL

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**ENGINEERING**

**EEE10**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Reconstruction of Reference Signal for DVB-T2 System   |
| <b>Description</b>        | Recently, the Terrestrial Digital Video Broadcast (DVB-T2) system has widely been deployed worldwide as well as in Singapore. It can provide much better signal quality. The main focus of this project is on the decoding of the DVB-T2 signals and its reconstruction. The challenge will be on the reconstruction of the signal under different types of channel conditions, including additive white Gaussian noise (AWGN) and fading. The performance of the algorithms will be studied and verified through simulations. Matlab simulation will be conducted to study its performance under different scenarios of channel conditions. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Electrical & Electronic Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual   |
| <b>Specific Knowledge</b> | Preferably to have basic programming skills in Matlab, though it is not compulsory, as the student should be able to pick up the skill during the execution of the project.  |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**EEE11**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Deep learning based robust channel estimator for orthogonal frequency-division multiplexing systems   |
| <b>Description</b>        | Orthogonal frequency-division multiplexing (OFDM) techniques have been widely used for wireless communication systems. To further improve the performance and robustness of the OFDM systems, deep learning based algorithms have been introduced. In this project, we aim to study and design a deep learning based receiver for OFDM system in an end-to-end approach. We will explore the advantage of the deep learning model to recover the distorted signal. Moreover, the channel state information will not be required as compared with the traditional method. Matlab and Python simulations will be conducted to study the performance of the proposed system. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | School of Electrical & Electronic Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Individual  |
| <b>Specific Knowledge</b> | Preferably to have basic programming skills in Matlab and Python, though it is not compulsory, as the student should be able to pick up the skill during the execution of the project.  |
| <b>Other Requirements</b> | NIL   |

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**ENGINEERING**

**EEE12**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Data-Driven Method for Li-Ion Battery Health Monitoring  |
| <b>Description</b>        | <p>This project aims to develop a data-driven method to real-time monitoring the health of the Li-ion batteries.</p> <p>Artificial intelligence (AI) algorithms will be developed to learn from a battery health data set, train a health monitoring model, and then be used for real-time state-of-health (SOH) monitoring of the batteries.</p> <p>The project involves programming in computers, preliminaries of AI and programming is needed.</p> |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Electrical & Electronic Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | Artificial intelligence, machine learning, computer programming.<br>Battery health monitoring.   |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**MAE01**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Virtual & Augmented Reality Technology Enhanced Army Logistic Training  |
| <b>Description</b>        | <p>Military training plays an utmost important role in defense. Safety and productivity are two sides of a same coin with the military training. This project is interested to develop innovative virtual &amp; augmented reality (VAR) technology to enhance the military training in collaboration with the Army Logistic Training Institute. In particular, this project will look into the detail of Singapore Self-Propelled Howitzer (SSPH) system. Two students will be recruited in this project working on the design and simulation of the SSPH with the aid of the latest VAR technology.</p> <p>One of the students will be taking care of the design of SSPH in full three-dimension and the other student will be responsible for interactive simulation. Students with a strong interest in design and programming are encouraged to apply the project. Knowledge and skill using 3ds Max and Unity3D, as well as Java or C# scripting will be an advantage.</p> <p>The project students if accepted will work with a team in NTU for the entire design and development phase.</p> |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | School of Mechanical & Aerospace Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Pair  |
| <b>Specific Knowledge</b> | Students with strong interest in design and programming are encouraged to apply the project. Knowledge and skill using 3ds Max and Unity3D, as well as Java or C# scripting will be an advantage.   |
| <b>Other Requirements</b> | NIL   |

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**ENGINEERING**

**MAE02**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Solar-driven conversion of carbon dioxide to chemicals   |
| <b>Description</b>        | Traditional energy source alternative to petroleum such as coal worsens the climate change by emitting more greenhouse gases. Greenhouse gas emission consists of mainly carbon dioxide (CO <sub>2</sub> ) and methane emission, where CO <sub>2</sub> contributes to more than 55%. Greenhouse gas emission results in global warming that causes about 300,000 casualties every year. These global challenges are even more critical to Singapore. Global warming results in sea level rise, which is an immediate threat to Singapore because most of Singapore island is less than 15 meters above the sea level. Global temperature would increase by 4°C with current greenhouse gas emission trend, which could cause sea level rise about 10 meters. This would result in more than 15% Singaporean homeless. Carbon dioxide can be converted to energy carriers like carbon monoxide and hydrocarbons via photoelectrochemical reactions; reducing the greenhouse gas emission and meanwhile producing useful energy sources. Catalyst is the key for this conversion. Nanoimprinting is a promising technique for scalable and cost-effective fabrication of such catalysts. In this project, student will make nanostructured catalyst by nanoimprinting method. Student will learn and comprehend the nanoimprinting technique, and then improve the metal nanostructured catalyst fabricated using this technique for CO <sub>2</sub> conversion. |
| <b>Project offered as</b> | <a href="#">NRP Enrichment / H3 Science Research</a>   |
| <b>College / School</b>   | School of Mechanical & Aerospace Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual   |
| <b>Specific Knowledge</b> | NIL  |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**NIE10**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Designing an Artificial Intelligence and / or Robotics System for Potential Real-World Applications   |
| <b>Description</b>        | In this project, you will learn how to use open-source hardware (such as Arduino and Raspberry Pi), Artificial Intelligence (AI) computing platforms (such as NVIDIA Jetson) and sensors (such as cameras or microphones) to design and train an AI robot for a real-world application of your choice. You will be supported in your learning by a team of designers and developers who have extensive experience with open-source hardware and software. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | National Institute of Education   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Individual / Pair   |
| <b>Specific Knowledge</b> | Interest in maker culture, artificial intelligence and robotics is a plus. Experience with programming languages such as Python will be helpful though not necessary.   |
| <b>Other Requirements</b> | NIL   |

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**ENGINEERING**

**SBS01**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Ex vivo engineering of cellular surfaces, a transfection independent approach.   |
| <b>Description</b>        | <p>The identity of mammalian cells is commonly defined by their appearances or the types of surface receptors they present. In the meantime, cells also constantly undergo transformation and such that receptor expression profiles would morph into distinct profiles over time. Such surface receptor profiles are often considered as signatures of different cells types, and hallmarks of immune cell differentiation and development/activation stages. Harnessing this surface receptor distribution would be a convenient method to optimize cell based immuno-therapy. Engineered cells with more stable surface receptor profiles, or with enhanced presentation of functional groups would possess the ideal activities to facilitate research and biomedical applications.</p> <p>In this NRP project, the student(s) would work with an experienced research fellow to optimize and/or co-develop an engineering protocol to modify surface receptors, using enzymatic approaches.</p> <p>Type of lab work involved:</p> <ol style="list-style-type: none"> <li>1. Planning and molecular cloning.</li> <li>2. Biochemistry</li> <li>3. Structural Biology</li> <li>4. Cell biology, immune activation assays.</li> </ol> <p>No chemical hazard, no pathogens.</p> |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Biological Sciences  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Pair   |
| <b>Specific Knowledge</b> | This is a suitable beginner's biology project for High school students who have firm Math background.  |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**SCBE01**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Plasmonic Nanostructures Based Surface Enhanced Optical Sensors  |
| <b>Description</b>        | Ultrasensitive detection of biomarkers is of considerable interest for early disease diagnosis. To improve the sensitivity of traditional on-surface assays, we will develop a plasmonic substrate prepared by 2D assembly of metal nanoparticles for enhanced fluorescence readout. The 2D assembly will be prepared by self-assembly of polymer-coated metal nanoparticles at the water/oil interface and then transferred to glass or PET substrate by dip-coating. The substrate will be characterized by scanning electron microscopy and UV-vis absorption spectrometer. For improved detection sensitivity, we will optimize the optical property of the building block nanoparticles and the thickness of the polymer coating to match the extinction spectrum of the plasmonic substrate to the excitation/emission spectra of the fluorescent dye. A sandwich assay will then be performed on the plasmonic substrate with the capture antibody and the detection antibody labelled with dyes. The fluorescence signals will be read out by a fluorescence microscope and be compared with results obtained with pure glass or PET substrates. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Chemical & Biomedical Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | Chemistry and Physics  |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**SCBE02**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Life Cycle Assessment of Pharmaceutical Nanoparticles from Bioavailability versus Manufacturing Perspectives  |
| <b>Description</b>        | Nanoparticles of active pharmaceutical ingredients (API) have emerged as an effective strategy to enhance the systemic bioavailability of poorly soluble drugs. This is attributed to the fast dissolution rate afforded by the large specific surface area of nanoparticles. The high bioavailability translates to lower dosage requirement compared to the conventional drug formulation by microcrystalline drug particles. The lower dosage requirement also means less drug products need to be produced and less drug is wasted after administration (as most of it will be absorbed by the patient's body), thus smaller environmental footprints from the manufacturing. However, the production of API nanoparticles is time-consuming and energy-intensive process by size reduction by milling or high-pressure homogenisation. This leads to large environmental footprints from the manufacturing. In this project, we would like to answer the research question whether the smaller footprints afforded by the higher solubility of API nanoparticles are adequate to overcome the larger footprint in their production step? The students will learn how to carry out basic principles of Life Cycle Assessment (LCA) analysis to answer this research question. Students with great interests in medicinal chemistry and mathematics are encouraged to participate. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | School of Chemical & Biomedical Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Individual / Pair   |
| <b>Specific Knowledge</b> | Basic Chemistry   |
| <b>Other Requirements</b> | NIL   |

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**ENGINEERING**

**SCBE03**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Reactor Simulation using Aspen Hysys   |
| <b>Description</b>        | Chemical engineering is not just about experiments, but also about playing with simulation software. In this project, we shall look into various parts of a chemical plant especially the reactors. Reactors are the heart of the chemical process. We shall employ the Aspen HYSYS modelling platform - a user-friendly and exciting tool - to simulate and understand the operation of different parts of chemical plants. The broad aim of this project is to look at different types of reactors (catalytic reactors, Fluidized Bed reactors, etc.) with the aid of typically used simulation tools. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Chemical & Biomedical Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Pair   |
| <b>Specific Knowledge</b> | Aspen Hysys Software<br>Chemical Reactions   |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**SCBE04**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Process Simulation   |
| <b>Description</b>        | Chemical engineering is not just about experiments, but also about playing with simulation software. In this project, we shall look into various parts of the chemical plant. We shall employ the Aspen HYSYS modelling platform - a user-friendly and exciting tool - to simulate and understand the operation of different operations of chemical plants. The aim of this project is to give students a light appreciation of some core chemical engineering fundamentals with the aid of typically used simulation tools. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Chemical & Biomedical Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Pair   |
| <b>Specific Knowledge</b> | Students will be doing modelling   |
| <b>Other Requirements</b> | NIL  |

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**ENGINEERING**

**SCSE01**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Detection and Recognition of Handwritten Mathematical Expressions  |
| <b>Description</b>        | <p>Digitizing handwritten mathematical expressions has been an increase in the usage in education, engineering, and science. Engineers, researchers and students may need to write many sophisticated mathematical expressions in their reports research papers etc. in word or Latex. However, it is not an easy job. Having touch-screen devices, they can easily write down those expressions but the recognition is a challenge.</p> <p>In this project, the student will study existing machine learning techniques of handwritten mathematical expression recognition. The student will propose an improvement or integrate the existing work into a system. The system will convert the handwritten mathematical expressions into the Latex format seamlessly. The work can be applied on an auto-assessment system for mathematics quiz.</p> |
| <b>Project offered as</b> | <a href="#">NRP Enrichment / H3 Science Research</a>   |
| <b>College / School</b>   | School of Computer Science and Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | Good at Mathematics and have some basic programming background<br>Interested in AI, machine learning.  |
| <b>Other Requirements</b> | NIL  |

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SCIENCES

MAE03

|                           |  |
|---------------------------|--|
| <b>Title</b>              | A New Analytical Technique for Solving Nonlinear Differential Equations  |
| <b>Description</b>        | At present, a few special nonlinear differential equations are known to have exact solutions, but many which are important in engineering and science applications are not yet available. The scope of this project is to exploit a new analytical technique for solving nonlinear differential equations. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Mechanical & Aerospace Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | Good at mathematics  |
| <b>Other Requirements</b> | NIL  |

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SCIENCES

NIE06

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Acute Effects of Using Reusable Cloth Mask During Aerobic Exercise  |
| <b>Description</b>        | <p>As Coronavirus Disease 2019 evolves to become an epidemic and the future of mask wearing activities is unknown, understanding the physiological effect and exercise performance with reusable cloth mask (RCM) is essential. It is hypothesized that RCM impedes airflow transmission between environment and user, hence a negative impact on the ventilatory breakpoint (<math>V_{pt}</math>) and physiological variables (i.e. blood lactate, heart rate and oxygen consumption). However, the understanding is not concrete and many other studies conducted on surgical mask shows conflicting results.</p> <p>There are three objectives to the study: 1) To investigate the physiological effects of reusable cloth mask (RCM) worn during exercise, 2) To investigate the perceived exertion level and perceptual discomfort of RCM during aerobic exercise, and 3) to determine the appropriate exercise intensity level while wearing a RCM during exercise for healthy adults.</p> <p>The study will look into the physiological makers, perceptual mask discomfort, and rate of perceived exertion during aerobic exercise. The study adopts a randomized crossover counterbalanced experimental design. All participants will be randomly assigned into the experimental (with RCM) or control group (without RCM) and the changeover will take place in the following week. A submaximal graded exercise treadmill protocol will be used to conduct the experiment where the ventilatory breakpoint will be identified. The protocol requires participants to run and rest for four minutes each, on an alternate basis until volitional exhaustion is achieved.</p> |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | National Institute of Education   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Individual / Pair   |
| <b>Specific Knowledge</b> | <ol style="list-style-type: none"> <li>1) Communication skills</li> <li>2) Attention to details</li> <li>3) Adhere to protocols and guidelines for safe procedures in laboratory</li> <li>4) Positive learning attitude and open mind</li> <li>5) Basic understanding of human anatomy, circulatory and respiratory systems, effect of exercise and training</li> </ol>   |
| <b>Other Requirements</b> | NIL   |

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SCIENCES

NIE07

**Title**

CREATE: Do more creative people adapt better?

**Description**

The aim of this project is to test experimentally whether cognitive creativity (i.e., divergent thinking) is associated with behavioral flexibility and adaptability in a goal-directed motor task, both at the movement (i.e., kinematic) and at the brain levels (i.e., neural organization). In other words, are more creative people better at adapting their behavior to novel and dynamic situations?

To answer this question, we propose to measure both cognitive creativity through divergent thinking, as well as behavioral flexibility and adaptability in a motor task, at the kinematic and neural levels. Correlations/regressions will thereafter look at the potential association between high cognitive creativity and high capacity to adapt to novelty. To conduct such measurements, surveys, motion capture (i.e., infra-red camera) as well as brain imaging techniques (i.e., functional near infrared spectroscopy) will be used.

Results of this project will inform whether it could be possible to detect, early, persons who could be "better learner", in the sense that some persons could be more keen to learn new things (whatever the domain) than others.

**Project offered as**

**NRP Enrichment**

**College / School**

National Institute of Education

**Target Group**

Year 5 / JC 1

**Group Size**

Individual

**Specific Knowledge**

No real prerequisite for this project, maybe an appetite for sport/motor behavior, although this is not mandatory.

**Other Requirements**

NIL

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SCIENCES

NIE11

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Pure and Doped BiFeO <sub>3</sub> Thin Film for Photodetector   |
| <b>Description</b>        | Multiferroic (exhibiting both ferroelectric (FE) and Ferromagnetic (FM)) are promising candidates for designing multifunctional devices including novel high density magnetic storage memories, sensors, photovoltaic devices, micro actuators etc. Multiferroics are also being synthesized as a composite system, e.g. as a product property of a composite phase consisting of a magnetostrictive and a piezoelectric material. Whereas BiFeO <sub>3</sub> is single-phase multiferroic system exhibiting both FM and FE. In the present work, we will focus towards the development of BiFeO <sub>3</sub> thin films on cost effective corning glass, ITO/glass and Pt/Si substrates. Further to achieve significant enhancement in the ferroic properties, site doping engineering approach will be employed by adding dopants at the A-site and B-site in BiFeO <sub>3</sub> lattice. At the end of work, emphasis will be made to realize the photodetector from pure and doped BiFeO <sub>3</sub> thin films. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | National Institute of Education   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Pair  |
| <b>Specific Knowledge</b> | Motivated for basic Physics and magnetism. Hands-on skills towards experimental Physics.  |
| <b>Other Requirements</b> | NIL   |

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SCIENCES

NIE12

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Plasma Assisted Low Temperature Graphene Synthesis  |
| <b>Description</b>        | Well-stabilized chemical vapor deposition (CVD) method has been used for quite long time for the growth of graphene on the copper and nickel substrates. In order to grow the high quality graphene on copper and nickel substrates using CVD, high temperature processing above 1000 oC is required. High growth temperature does not allow us to grow the graphene on the various desired substrates which are useful for various applications like wearable and flexible electronics. Hence, we propose a plasma assisted graphene growth in which carbon precursor will be exposed to RF plasma before deposition. The plasma will help to dissociate the carbon and will promote the graphene growth even at very low temperature close to room temperature. The approach can be used to grown the graphene on various type of substrates. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | National Institute of Education   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Pair  |
| <b>Specific Knowledge</b> | Motivated to learn advance materials characterization techniques.   |
| <b>Other Requirements</b> | NIL   |

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SCIENCES

NIE15

**Title**

Optimising Power Output of Simple Microbial Fuel Cells

**Description**

Microbial fuel cells (MFC) are bio-electrochemical devices, where some of the energy from the food source of the microbes in the MFC that is released via cellular respiration, is "stolen" and converted into electrical energy. This technology has potential use in areas such as power generation using sewage as the food source, thus recovering energy that would otherwise be lost as heat to the atmosphere as the raw sewage decomposes.

In small scale experiments, the power output of simple MFCs is limited and useful mainly as a teaching tool, only able to light up LEDs and very low power digital circuits. For this purpose, a curriculum package has been developed for school-based programmes where student teams investigate the parameters influencing MFC power output, principally its voltage output over time, and hence use their data to design-and-make improvised MFCs with improved performance. In these investigations, it is noted that each parameter varied (e.g. type or concentration of sugar used as food source, oxidising agent, electron mediator, size and shape of chambers, type of electrode, etc) results in varied performance in a non-linear, non-intuitive relationship. This is due to the complex interactions between each parameter. For example, changing the concentration of one reagent might influence reactivity and internal conductance that should improve voltage output, but at the same time, such changes might stress the microbes and thus reduce their rate of respiration.

This project seeks to establish and map the effect of changes to MFC parameters in isolation and in combination. Understanding these complex relationships will help towards optimising MFCs for production of power at modest scales to contribute towards the search for sustainable energy sources, as well as further develop them as teaching activities for science education from school to university levels. There is also scope for student-led innovation of MFC design, engineering and discovery, dependent upon the interests of students on the project.

**Project offered as**

**NRP Enrichment**

**College / School**

National Institute of Education

**Target Group**

Year 5 / JC 1

**Group Size**

Individual / Pair

**Specific Knowledge**

Basic knowledge of cellular respiration, reduction-oxidation (redox) chemistry, and electricity (voltage, current, power, resistance, etc). Interest in interdisciplinary science, STEM, and science education would be vital. Student(s) should ideally have access to school lab where controlled chemistry-based experiments can be conducted, and ideally should have dataloggers with voltage sensors available. Some experimentation can be done in school lab, if these resources are available.

**Other Requirements**

NIL

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SCIENCES

SCBE05

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Development of new technologies for precision genome engineering   |
| <b>Description</b>        | An ability to introduce precise changes in the genome of a living cell lends itself to many biomedical and biotechnological applications. In recent years, CRISPR-Cas has emerged as a powerful system that enables us to engineer the genome of plants and animals, including humans. However, the efficiency of precision genome engineering remains low in many human cell types. In this project, we will explore different strategies to enhance the ability of CRISPR-Cas to install any defined edit in the human genome. If successful, our work will bring CRISPR technologies one step closer to clinical reality as a new form of therapeutics. |
| <b>Project offered as</b> | <a href="#">NRP Enrichment / H3 Science Research</a>   |
| <b>College / School</b>   | School of Chemical & Biomedical Engineering  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | Some knowledge of molecular biology and genetics, some research experience on a biology- or biomedical engineering-related project, willingness to work hard.  |
| <b>Other Requirements</b> | NIL  |

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SCIENCES

SCBE06

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Development of new programmable RNA editing tools   |
| <b>Description</b>        | The ability to engineer the genomes and transcriptomes and living cells lends itself to many biomedical and biotechnological applications. In recent years, CRISPR-Cas has emerged as a powerful system for genome and transcriptome engineering. Briefly, a Cas enzyme is recruited to a target site by a programmable guide RNA. In so doing, it can also bring along an effector domain to modulate the target gene. Here, we are interested in developing new Cas13-based technologies to install A-to-I or C-to-U editing events in RNA transcripts. The tools developed may be used as a new therapeutic modality for well-defined genetic diseases and can also be utilized to study RNA editing in various biological contexts. |
| <b>Project offered as</b> | <a href="#">NRP Enrichment / H3 Science Research</a>  |
| <b>College / School</b>   | School of Chemical & Biomedical Engineering   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Individual / Pair   |
| <b>Specific Knowledge</b> | Knowledge of molecular biology and genetics, past research experience on biology-or biomedical engineering-related topics, willingness to work hard.  |
| <b>Other Requirements</b> | NIL   |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE01**

**Title** The Neuroscience of Math Learning

**Description** The study of children who consistently attain low achievement scores in mathematics is challenging because there could be many underlying reasons for math struggles which include language difficulties, sensory processing deficits, inappropriate instructions, poor attitude towards mathematics, high anxiety or lack of home support. These factors may be exacerbated if the child has other learning difficulties such as attention deficit / hyperactivity disorder, global developmental delay, or other underlying deficits. In this study, we use educational neuroscience methods to investigate if math performance can be predicted using behavioural and neurological data. We will also look into the design of neural-informed games to help students in their math learning.

**Project offered as** **NRP Enrichment**

**College / School** National Institute of Education

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge**

- Good understanding of math curriculum
- Interest in educational neuroscience
- Experience with mathematics games
- Experience with statistical methods will be an advantage

**Other Requirements** NIL

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE02**

**Title** Topics in Singapore English

**Description** For this project, we will work on natural language data from Colloquial Singapore English (otherwise known as Singlish). Data will either be collected through elicitation/production tasks, designed experiments, or from existing corpora/data sets. Singapore English is a contact variety of English with several unique features. The specific aspect of Singapore English, as well as how the data is analysed will depend on the linguistic subfield of your choice: syntax (structure), semantics/pragmatics (meaning), or phonology/phonetics (sound). I am fine with adopting whatever linguistic framework you prefer to use.

**Project offered as** **NRP Enrichment**

**College / School** National Institute of Education

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge** Native speaker of Singapore English, or have easy access to one.  
Good intuition, interest and curiosity in the way language is produced and processed.

**Other Requirements** NIL

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE03**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Am I procrastinating?: Examining Time Management Skills Among University Students in Singapore  |
| <b>Description</b>        | Procrastination is often seen in our daily life. This proposed study aims to explore the degree to which university students in Singapore report themselves to be procrastinating and explore the potential relationships between the tendency of procrastination and their time management skills. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | National Institute of Education   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Pair  |
| <b>Specific Knowledge</b> | - interested in human psychology<br>- good at numbers and have an interest in survey research methodology   |
| <b>Other Requirements</b> | NIL   |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE04**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Covid-19, Nostalgia and Sport  |
| <b>Description</b>        | The COVID-19 pandemic is an extensive international health crisis and the rate of infection of this pandemic is rapid. However, people are still resuming and starting to engage in fitness activities, switching to mostly home-based and outdoor activities. Researchers also found that participating in sport supports physical and psychological well-being and simultaneously promotes better responses towards different types of disease. In other words, during such turmoil periods, it is essential to understand the meaning of sport participation and promote individuals' well-being. In this study, we will examine the effect of nostalgia on well-being and the intention to participate in sport activities during the COVID-19 pandemic. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | National Institute of Education  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual   |
| <b>Specific Knowledge</b> | NIL  |
| <b>Other Requirements</b> | NIL  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE05**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Nostalgia, leisure participation and habit   |
| <b>Description</b>        | The COVID-19 pandemic is an extensive international health crisis and the rate of infection of this pandemic is rapid. However, people are still resuming and starting to engage in fitness activities, switching to mostly home-based and outdoor activities. Researchers also found that participating in sport supports physical and psychological well-being and simultaneously promotes better responses towards different types of disease. In other words, during such turmoil periods, it is essential to understand the meaning of sport participation and promote individuals' well-being. In this study, we will examine how nostalgic emotions have an effect on leisure-time physical activity participation intentions and habits during COVID-19 in Singapore |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | National Institute of Education  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual   |
| <b>Specific Knowledge</b> | NIL  |
| <b>Other Requirements</b> | NIL  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE08**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Effect of In-Games Advertisement on Sponsor Recall   |
| <b>Description</b>        | The aim of this research is to the rate of sponsor recall when respondents are exposed to brands appearing in sports video games. Respondents will be tasked to play a console racing game. After the game, respondents will complete a survey to examine the rate of sponsor recall for brands that appear in the game. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | National Institute of Education  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual   |
| <b>Specific Knowledge</b> | 1) Have an interest in sports sponsorship and racing console games (PS platform)<br>2) Able to recruit up to 30 respondents to play console games<br>3) Able to conduct statistical tests i.e. t-tests   |
| <b>Other Requirements</b> | NIL  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE09**

|                           |   |
|---------------------------|---|
| <b>Title</b>              | Exploring the Role that Game-Based Worlds and Immersive Environments Potentially Play in Learning   |
| <b>Description</b>        | Since 2009, lesson units have been carried out in a number of schools with the aim of developing an understanding about how game-based worlds and immersive environments can be leveraged for learning; these lesson units have been used in a variety of subjects, such as Geography, Literature, and Design & Technology. If you are interested in thinking about such worlds and environments, and / or about maker culture and open-source hardware / software, with a view to designing more authentic learning experiences, we welcome your participation in this project, which is likely to be sufficiently flexible to support your own particular areas of interest. You will be working as part of a team of designers and software developers as we help build teacher-capacity in curriculum and pedagogy. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | National Institute of Education   |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Individual / Pair   |
| <b>Specific Knowledge</b> | A healthy interest in collaborative learning. Interest in maker culture, game-design and learning through games is a plus.  |
| <b>Other Requirements</b> | Participation in this project will likely involve site visits to schools around Singapore.  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE13**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Sense of Food Resiliency among Secondary/JC students in Singapore  |
| <b>Description</b>        | <p>The COVID-19 pandemic caused many unplanned disruptions of varying magnitudes, worldwide. With the growing global population reaching an estimated 9 billion in 2050, inflation in food costs and decreased food supplies contribute to the decline and urgency in tackling food security. In Singapore, 90 per cent of our food supplies are imported. The government’s Food Resilience (FR) mitigation measures included stockpiling, diversification of food sources and providing funds to support and boost production supplies by local high-tech farmers at the national level<sup>2</sup>. However, at community and households, Household FR is defined as a household’s ability to withstand stresses in disruptions in food availability often caused by multiple factors such as sudden reductions in food supplies, surges in food prices or massive food contamination. Recent spates of panic buying to stock up both essential and non-essential supplies which led to empty supermarket shelves; are tale-tale indicators of low household FR which underpinned an insufficient comprehension about the mitigation efforts to assure and prevent panic, massive hoarding. Leveraging on the current situation, it is important to initiate a national initiative to educate and promote greater awareness towards building household FR as a means to cope with such an unplanned crisis and declining food supplies. The aim of this project is to measure the level of awareness and preparedness of teenagers in Singapore in handling potential food crisis.</p> |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | National Institute of Education  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | NIL  |
| <b>Other Requirements</b> | NIL  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE14**

**Title** Food Allergy Knowledge, Attitudes, and Preparedness Among Consumers and School Canteen Service Personnel

**Description** Allergies to food is a common occurrence, yet consumers with allergies often react adversely after consuming certain foods because they were not aware of the ingredients used to make the food product. Therefore it is pertinent that food service providers have the knowledge on common food allergen. Food products sold off the shelves should also include warnings of potential allergens. This research aims to determine the knowledge/awareness of food allergens among front of the house (FOH) workers, as well as consumers. Data collected will be useful in designing initiatives/programmes that can help the food industry and general public.

**Project offered as** NRP Enrichment

**College / School** National Institute of Education

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge** NIL

**Other Requirements** NIL

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**NIE16**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Literary Theory and Modern Poetry  |
| <b>Description</b>        | Literary theory represents a prescient and exciting framework through which to explore modern themes and ideas that poets reflect in their work. This research project aims to explore the pertinence of philosophical constructs to modern poetry (from 1900 to the present day). The student will choose a school /branch of literary and critical theory (structuralism, poststructuralism, psychoanalysis etc) and employ its methods to analyze and understand the work of a modern or contemporary poet. This project will provide the student with the opportunity to engage in interdisciplinary work, as we will engage in both theoretical exploration and the close analysis of poetry and poetic movements in the 20th and 21st centuries. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | National Institute of Education  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | A strong background in Literature at the junior college/IP level is required.  |
| <b>Other Requirements</b> | NIL  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SOH01**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Singapore Crypto-Linguistics: Deciphering the Singapore Stone  |
| <b>Description</b>        | The Project is aimed at trying to solve the puzzle of the yet-undeciphered writing system of the Singapore Stone, with the goal to unveil the language hidden behind that mysterious script. Tasks include internal analysis of Singapore Stone's writing system and documentary research. Make grammatological comparisons with possibly related scripts. Work with a multidisciplinary Research Team trying to find new answers to this enigma. The Project has also an archaeological component in the search for the 'missing' fragments of the Singapore Stone, 'lost' on the route between the Indian Museum at Calcutta and the National Museum of Singapore. Moreover, on the computational side, we'll try to apply the Gröbner Basis principles, implemented into an algorithm especially developed for the Project, to the fragmentary text of the Singapore Stone, aiming at reconstructing, in its entirety, the text itself. This would provide us and scholars all over the world with a possibly reliable document to work on for the interpretation of the Singapore Stone and its unique writing system and, ultimately, for its decipherment. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Humanities   |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | None - Optional: elementary expertise in Applied Mathematics, Computer Algebra, Computational Algebraic Geometry, and Computational Commutative Algebra.   |
| <b>Other Requirements</b> | NIL  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SOH02**

**Title** Become a Glyph-Breaker: Deciphering Linear A

**Description** The Project tries to solve the puzzle of the yet-undeciphered Aegean writing system of ancient Crete, Linear A, dating back to the Bronze Age, and of the unknown language hidden behind the script, Minoan. Tasks include internal analysis of Linear A tablets, corpus analysis of Linear A, development of crypto-linguistic approaches to the Linear A texts, application of an experimental methodology aimed at deciphering Linear A. The external analysis component includes comparisons, at the grammatological and linguistic level, with other (possibly related) ancient writing systems and languages of the Mediterranean, conducted both according to philological methodologies and to cryptanalytic methods. In particular, the Project aims at developing a cryptanalytic 'brute force attack' on the undeciphered Linear A writing system, by testing and implementing advanced elements of a software to accomplish the first complete cryptanalytic attack on Linear A, possibly reconstructing the Minoan phonetics and phonology and isolating significant clusters of symbols. That would lead to the decipherment of the undeciphered Aegean writing system. The test and possible 'cryptanalytic attack' will be implemented by using a Python programme specially developed for this task. The pioneering Research associates Crypto-Linguistics, Historical Linguistics, and Language Deciphering with Digital Humanities and Computer Science. An additional component of the Project is aimed at the development of the first complete digital corpus of Linear A. The goal is, eminently, to reproduce one-by-one all the Linear A documents, from clay tablets to vase inscriptions, and to digitize them, in order to provide a complete digital corpus independent from the physical books and collections of Linear A currently available. This component of the Project is in Digital Humanities, requiring some expertise in Computer Graphics (and, optionally, in Freehand Drawing). No previous knowledge of the Linear A writing system or of Aegean Archaeology is, conversely, expected. The Linear A Digital Corpus would be the first complete digitized corpus of this Aegean writing system and would represent a valuable instrument for scholars all over the world working on the decipherment of Linear A. Moreover, it would be an original contribution to the field of Corpus Linguistics.

**Project offered as** **NRP Enrichment**

**College / School** School of Humanities

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge** None - Optional: elementary Python Programming experience; elementary Computer Graphics experience.

**Other Requirements** NIL

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SOH03**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | A Sociolinguistic Investigation of French, German, Italian and Spanish in Singapore Shop Signs   |
| <b>Description</b>        | This study is a first step in investigating the recurrent forms and patterns of French, German, Italian and Spanish as used in commercial shop signs across different business sectors in Singapore. It seeks to uncover the users' motivations behind the use of French, German, Italian and Spanish here via surveys. Apart from the four official languages and their various spoken dialects, Singapore is host to a variety of other minority languages (Gordon 2005). French, German, Italian and Spanish are another case in point. Apart from its economic value, the popularity of French, German, Italian and Spanish seems to be due to its positive associations with high culture, haute couture and elegant lifestyle. These associations appear to be increasingly exploited in commercial signs across the island. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Humanities   |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Pair   |
| <b>Specific Knowledge</b> | Interest in European languages.  |
| <b>Other Requirements</b> | NIL  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SOH04**

**Title** Translating world literature in Singapore (1950-90s)

**Description** Singapore's national image has long been struggling between two extremes, namely from "a cultural desert" (Crane et al. 2002, 150) to an "Air-conditioned city" (George 2020). The cultural desert is used to allegorize the barrenness and destitution of the literary landscape of Singapore. Whereas the trope of "air-conditioned city" is an irony to denote the overarching governmental top-down policies in all walks of life of Singaporeans. These kinds of discourse, though they sound controversial and unwelcoming, have been prevailing in society for a long while and emerged from a socio-historical background. As early as the 1960s, the first Prime Minister of Singapore, Lee Kuan Yew (1923-2015), has already set the tone of nation-building. The key governance mottos are "practicalism and survivalism." Extravagance is not preferred and aestheticism is preposterous. Hence, the simple act of writing poetry is "a luxury we cannot afford". (Chia & Ip, 2014) Scholars then concluded that the development of humanities and the creative industry of Singapore has long been lagging behind other Asian cities. (Yang, C. N. et al. 2015, 130–133). But is that true?

This project aims to revisit all these controversies through the lens of translation activities from the period of the 1950s to the 1990s. Translation is a bridge to the world. Translation is also a propellant for creative transformation which pumps in new ideas or inspirations from the world. During the nation-building process, Singapore had never severed its connection to the world. Therefore, translation is an integral point for us to see how the literary and cultural landscape developed through time even though literary creation may be hibernated or suppressed in the nation-building process.

Students will learn the socio-historical, cultural and literary past of Singapore through a qualitative and quantitative study. Quantitative study means students need to harvest a trove of news/magazines/books from various databases to generate statistics and figures to build evidence and distribution of translation activities in the period. Qualitative study, on the other hand, requires the student to formulate their argument, understanding and appreciation of the translation pattern through critically reading the translation texts. The project may also require students to do oral histories/ interviews with translators, editors, publishers or writers in order to offer a holistic understanding of the cultural landscape in the past. It is a project designed to guide students to appreciate and critique works of literature in a bilingual context (Chinese and/or English). The project will require students to have a passion for literature, history and Singapore society. The basic skill of digital literacy such as searching verifiable and creditable sources for research will be honed.

Chia, C. & Ip, J. (2014). *A Luxury We Cannot Afford: An Anthology of Singapore Poetry*. Math Paper Press.

Crane, D., Kawashima, N., & Kawasaki, K. (2002). *Global Culture: Media, Arts, Policy, and Globalization*. (1st ed.). Routledge.

George, C. (2000). *Singapore: The air-conditioned nation: essays on the politics of comfort and control 1980-2000*. Landmark Books.

Yang, C.N., Yu, Y.S. & Wang G.W. et als., (2016). *Lee Kuan Yew: Through the Eyes of Chinese Scholars*. (1st ed.) Singapore World Scientific.

|                           |   |
|---------------------------|---|
| <b>Project offered as</b> | <b>NRP Enrichment</b>   |
| <b>College / School</b>   | School of Humanities  |
| <b>Target Group</b>       | Year 5 / JC 1   |
| <b>Group Size</b>         | Pair  |
| <b>Specific Knowledge</b> | - A English and Chinese language competence<br>- Good command of MS office, esp word, excel etc |
| <b>Other Requirements</b> | NIL   |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SOH05**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Arab philanthropies and how they influence the spread of Arabic Language on Singapore landmarks  |
| <b>Description</b>        | Alkaff Mansion, Aljunied MRT station, Bussorah Street - what do they have in common? In ancient Singapore, Arab philanthropists have played a fundamental role in turning a sleepy, fishermen's island into one of the most bustling trade hubs in Southeast Asia. These individuals, such as Syed Omar Aljunied, were wealthy merchants and philanthropists who arrived in Singapore during a time where new opportunities for trade abound in newly set up Singapore. Their contributions were monumental as they had played a part in the developments of key infrastructure in Singapore. How has their influence pervades the Singaporean landscape especially in the names of streets and landmarks? How have these names evolved or changed over the years? This study seeks to understand how significant these philanthropists were such that their names have been eternalized in Singapore's landmarks. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Humanities   |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Pair   |
| <b>Specific Knowledge</b> | Nil  |
| <b>Other Requirements</b> | Nil  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SSS01**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | The effects of languages on financial decision-making  |
| <b>Description</b>        | A growing literature in behavioural economics has investigated the effects of languages and linguistic patterns on economic decision-making. Along this line of research, this project will explore how subtle linguistic cues influence people's financial decision-making (such as risk preference, time preference, and personal finance decisions). Participating students are expected to design a behavioural experiment, conduct experimental sessions and analyse the data collected under my supervision. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Social Sciences  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Pair   |
| <b>Specific Knowledge</b> | Knowledge in economics and skills in programming are preferred but not required.   |
| <b>Other Requirements</b> | Nil  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SSS02**

|                           |  |
|---------------------------|--|
| <b>Title</b>              | Assessing Social Attributes of Faces   |
| <b>Description</b>        | We tend to make inferences about a person's traits or attributes based on the appearance of faces. For example, we judge trustworthiness, attractiveness, dominance or threats, based on the face images, though the accuracy of such judgment is under debate. It has been shown that our judgment of trustworthiness can be built within the first 100 ms after seeing the face. There have been extensive studies evaluating such social dimensions of the faces. However, there are still open questions remaining to be answered. For example, what are the most important factors in assessing facial attributes? Are there associations among these different attributes? How does the previous exposure to faces of similar or different attributes affect our judgment of subsequently presented faces? Such as, does happy face appear more trustworthy than neutral or sad face? We will use online surveys and/or psychophysical experiments to address these questions. |
| <b>Project offered as</b> | <b>NRP Enrichment</b>  |
| <b>College / School</b>   | School of Social Sciences  |
| <b>Target Group</b>       | Year 5 / JC 1  |
| <b>Group Size</b>         | Individual / Pair  |
| <b>Specific Knowledge</b> | Good at math and writing in English.   |
| <b>Other Requirements</b> | NIL  |

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SCI01**

**Title** Can AI Help Students and Teachers?: An Investigation of AI's Potential in Education

**Description** This project is ideal for a student who is interested in a career in education or in AI user experience engineering and design. In this project, the student will be responsible for recruiting a sample of 20-30 professional educators to interview about their perceptions toward AI in education. These professionals can be faculty and staff at the student's JC/Secondary/High School institutions, or at tuition centers if the student prefers.

Student will recruit the sample and conduct 20-30 minute interviews. Then, interviews will be transcribed and the student will conduct a thorough literature review regarding AI's potential in education. The student will then conduct a thematic analysis of the interviews, extracting key themes and revealing important insights into the potential (or lack thereof) for AI in education.

This project requires a student who is courageous and possesses initiative - recruiting the sample will be an independent process that the student is fully in control of. An inadequate (small) sample will be unlikely to yield good results. After the interviews are complete the project will require critical thinking and creativity from the student. This makes the project perfect for students who enjoy finding the deeper meaning in things and "reading between the lines" when they think about big issues. This project does not require extensive literature review search from the student as the mentor can provide most of the relevant materials. Instead, the most important student skills for this project are initiative, creative-thinking and time-management.

Ultimately, the goal of this project is to produce research that will lead to the optimal integration of AI into education. AI likely can help students and teachers in some way, finding out how is one of the grand challenges of the next decade for education worldwide; the NRP student will be a key player in this process of discovery.

**Project offered as** NRP Enrichment

**College / School** Wee Kim Wee School of Communication and Information

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge** The most important student skills for this project are initiative, creative-thinking and time-management. No prerequisite skills are needed in terms of software - however knowledge on how to quickly transcribe audio recorded interviews (via freely available software or fast typing skills) will save the student a lot of time throughout the project.

**Other Requirements** NIL

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SCI02**

**Title** Who Are Chatbots?: A Study of Company Digital Personas

**Description** People increasingly encounter chatbots or "virtual agents" when they visit websites. The companies and organisations that control these websites have a choice of what persona to attach to their chatbots. Jamie is a well-know example in Singapore, but Jamie is a relatively young woman with a professional appearance. Not all chatbots are presented this way.

In this research project, the NRP student will conduct a sweeping inventory of websites and the chatbot personas attached to them. Our goal is to see if certain industries or public functions tend to present chatbots in certain ways. For example, is it more common to find a "male" chatbot on a financial services company webpage? Our analysis can extend beyond just visiting websites and taking notes. The NRP researcher may choose to interact with the chatbot to see what the "personality" is. Is it formal, informational, positive, neutral?

The majority of this project is completed on the timeline that suits the NRP student. Most of the project is truthfully just browsing the web and taking notes. While this may seem simple, the volume of data required is massive; the NRP student should plan on dedicating a few hours each week to the project, on average. The NRP student may choose to also be involved in data analysis and visualisation near the conclusion of the project.

This project is excellent for NRP students who need flexibility and also have exceptional self-discipline. It is also excellent for students who wish to think carefully about the best way to create a representative sample of companies and organisations.

**Project offered as** **NRP Enrichment**

**College / School** Wee Kim Wee School of Communication and Information

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge** Requires the ability to browse the internet and take notes in a spreadsheet. Project does require self-discipline as the project timeline will move in 2-4 phases; this means the student will need to self-manage workload during these phases.

**Other Requirements** NIL

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SCI03**

**Title** Top Dog in the Lion City: Experiences with Singapore's Robotic Pup

**Description** Do you remember the yellow robotic dog thing that was deployed to some parks and park connectors at the start of the circuit breaker? It was supposed to tell people to socially distance etc. The “dog” went from instagram celebrity to just-a-normal-part-of-life in just a few days. Why? This is one of the only real-world deployments of a robotic enforcer, your job is to figure out how people in SG experienced this event. The best way to figure out how Singaporeans feel about the robotic dog is to talk with people who interacted with it. This means the NRP student will want to recruit interview subjects that are likely to have encountered this robotic dog. Bishan-AMK was one of the park corridors where this dog could be found; therefore this NRP project is especially well-suited to students who live nearby or who have many friends/family in that area.

The majority of the work in this NRP project will be finding people and then getting them to agree to a brief interview. For the well-networked student who enjoys talking to people, this will be relatively easy. However, transcribing interviews can be a chore, so the NRP student must have excellent discipline and work ethic. The NRP student should also be courageous and prepared to "steer" the interview in the intended direction. For example, an interview subject may diverge from the interview topic to talk about related things like surveillance, privacy, robots, or treatment of animals. The NRP student will need to have the social skills needed to ask the right questions and get the interview back on track - your mentor can help give you some key lines that you can use for this purpose.

After collecting approximately 20 interviews (10-20 minutes each), the NRP student can choose to participate in the analysis as we read the transcripts to figure out how Singaporeans experienced this interesting event. Who knows if yellow robotic dogs will ever patrol Singapore parks again, your work will cement this moment in history for future generations to read about.

**Project offered as** NRP Enrichment

**College / School** Wee Kim Wee School of Communication and Information

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge** The most important "skill" for this project is having a large social network and a willingness to recruit interview subjects. This will especially be the case if the student lives near one of the areas that the robot was deployed (e.g., Bishan-AMK park corridor).

**Other Requirements** NIL

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**BUSINESS, HUMANITIES, ARTS & SOCIAL SCIENCES**

**SCI04**

**Title** Fighting Fake News: Defining, Determining and Dealing with Deliberate Online Falsehoods in Singapore

**Description** This project looks into how different stakeholders define, determine, and deal with fake news and other forms of disinformation spreading in Singapore. It involves a series of interviews and focus group discussions with social media users, journalists, technology professionals, businesses, and policy makers in Singapore.

If you join our project, you will have the opportunity to: 1) help in conducting interviews and running focus group discussions (FGDs); you will get the chance to ask questions and meet stakeholders; 2) assist in reviewing the academic literature on disinformation; 3) be trained in analyzing qualitative data by working with the researchers in going through the interview and FGD transcripts; 4) contribute to writing academic articles and news commentaries based on our findings; 5) co-present our findings in workshops and symposia in Singapore.

Through the project, we aim to understand how different stakeholders define the problem of fake news and disinformation in Singapore; by understanding the scope and depth of the problem, we can propose proper interventions in proactively responding to this problem by improving social media literacy among Singaporeans as well as ensuring information quality in the country.

**Project offered as** NRP Enrichment

**College / School** Wee Kim Wee School of Communication and Information

**Target Group** Year 5 / JC 1

**Group Size** Individual / Pair

**Specific Knowledge** We are inviting students who possess the following:

- Ability to work and learn in a multi-cultural setting.
- Ability to interact effectively with people and researchers from different background cultures.
- Adaptability: Able to respond to the situation positively and effectively while remaining productive.
- Attitude: Be willing to learn and contribute to discussions.
- Planning and organizing: Is able to establish goal-oriented plans and to translate plans into actions.
- Language: Excellent command of the English Language, both spoken and written is a requirement. Ideally, applicants would possess good knowledge of a secondary local language such as Chinese, Malay and Tamil.
- Willingness to meet with the research team regularly during the duration of the project (e.g. once a week).

**Other Requirements** NIL

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