

An Indian-Australian research partnership

Project Title:	Modelling Self-Regulated Learning Using Learning Analytics	
Project Number	IMURA0864	
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IITB Department:	Educational Technology	

Research Clusters:

Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? <i>(Please nominate JUST <u>one</u>. For more information, see www.iitbmonash.org)</i>		Highlight which of the Academy's Theme(s) this project will address? <i>(Feel free to nominate more than one. For more information, see www.iitbmonash.org)</i>	
1	Material Science/Engineering (including Nano, Metallurgy)	1	Advanced computational engineering, simulation and manufacture
2	Energy, Green Chem, Chemistry, Catalysis, Reaction Eng	2	Infrastructure Engineering
3	Math, CFD, Modelling, Manufacturing	3	Clean Energy
4	CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control	4	Water
5	Earth Sciences and Civil Engineering (Geo, Water, Climate)	5	Nanotechnology
6	Bio, Stem Cells, Bio Chem, Pharma, Food	6	Biotechnology and Stem Cell Research
7	Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng	7	Humanities and social sciences
8	HSS, Design, Management	8	Design

The research problem

Define the problem

Technology-enhanced learning environments (TELEs) can support and help users learn how to solve complex decision-making tasks. Complex decision-making tasks help learners to develop strategies such as resource management, tradeoff analysis, negotiation, and critical thinking, decision-making skills important to prepare learners for future learning. The solution to these tasks is often ill-structured and there can be multiple solution approaches. Hence, novice users often have difficulties in making progress when working on complex problems. To help such learners with personalized and adaptive feedback when they are performing sub-optimally, learning environments should model learner's performance and behaviour as they work on their learning and problem-solving tasks. The focus of this proposed project is to collect and analyse data from multiple sensors to model learners Self-Regulated Learning (SRL) when they are working on complex decision-making tasks. Data from multiple sensors such as a webcam, eye-trackers, screen capture videos, log files, and performance in the learning environment are collected with the timestamp to model the learner's SRL processes.

Project aims

Define the aims of the project

The key aims of this project are:

- Develop a Technology-Enhanced Learning environment to conduct research studies.
 - Innovate data collection techniques using Machine Learning to pre-process, align and analyse the fine-grained temporally ordered learners' behaviour collected from multiple sensors such as an eye-tracker, facial-emotion analyser, and trace data.
 - Develop and validate a novel technique to model learners' SRL processes in a complex problem-solving task.
- Develop and examine the personalised and adaptive feedback system to support novice learners in need.

Expected outcomes

Highlight the expected outcomes of the project including likelihood of patents

- The research outcomes of this project will be published in international journals and conferences
- This project will lead to new grant proposals and new collaboration with experts in this field

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

Providing personalized and adaptive learning content to the learner using data mining and AI algorithms is one of the grand engineering challenges of the 21st century. Developing a learner model to provide personalized feedback will lead to enhanced e-learning systems

What interactions have led to development of the project?

Provide details of previous communications/meetings (if any). Please indicate how this project will expand to include future collaborations and an enduring long-standing relationship between IITB and Monash.

We didn't have any communication prior to writing this joint proposal. However, the IITB supervisor was a student at the IITB-Monash research academy and he planned to meet the Monash collaborator once in every month using Skype.

How well do the IITB and the Monash supervisor(s) know each other?

Provide details of previous collaborations (if any). For new collaborators, have you had a chance to meet each other in person or through VC or Skype?

We are new collaborators and we planned to have a Skype meeting before recruiting the student in Dec 2019.

Potential RPC members from IITB and Monash

Provide names of the potential research progress committee members (RPC) and describe why they are most suited for the proposed project.

IITB: Prof. Ritayan Mitra from the educational technology department. Prof. Mitra's research interest includes learning analytics and his comments will help to enhance the proposed project.

Monash: Dr Roberto Martinez-Mandonado from the Faculty of Information technology. Dr. Martinez-Mandonado's research is in multimodal learning analytics and his input will be of great value for the proposed project.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

Students with M.E/M.Tech/M.S in computer science
Research works in Machine Learning, Data Mining

Necessary Courses

List three tentative core courses relevant to the project that the student should complete during his/her coursework at IITB (the student will require to secure 8 point in these courses)

We expect students to complete the below courses in IITB to gain the domain knowledge in the proposed project.

1. Introduction to Educational Technology
2. Research Methods in Educational Technology
3. Adaptive Tutoring Systems
4. Learning Analytics and Educational Data Mining

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

Select up to **(4)** keywords from the Academy's approved keyword list (**available at <http://www.iitbmonash.org/becoming-a-research-supervisor/>**) relating to this project to make it easier for the students to apply.

Data Science
Modelling and Simulation

Additional costs and equipment

Describe below additional costs that would be needed to complete this project.

This would typically include project-related costs (such as consumables).

Student travel to Australia, Conference travel should not be included here. They are already provided for, separately.

PLEASE NOTE, LEAVING THIS SECTION BLANK DOES NOT IMPLY AUTOMATIC SANCTION OF RS 3.0 LAKHS/AUD 6000.

Cost to Renew Software licenses for 2 years – AUD 5000. Required during third and fourth year of program.

Detailed justification - Additional costs and equipment

Please justify why is this level funding is required?

At IITB and Monash we have Tobii Pro Eye-tracker to collect learner's reading behaviour and to predict cognition. For eye-gaze analysis and to predict learner's affective states, in IITB we have bought iMotions software (Cost: 9 Lakhs) and tobii pro studio software to analyse eye-gaze data. Similar software to analyse eye-gaze data are available in Monash. So student can work in both places using same software. To renew the license of the Eye-gaze analysis software we need Euro 1500 every year. We plan to renew the license only on Third and fourth year of the program.

	INR/\$AUD	
What is the total funding required for the entire project?	5000	(X)
How much bare minimum seed funding will be required to kick off the collaboration?	5000	(Y)
What are the additional funds that will need to be sourced?	0	(X-Y)

How will the additional funds (X-Y) be sourced?

What happens if the PIs are unsuccessful in sourcing (X-Y) and we have a student selected?

Is there any industrial partner that might fund this project that we might approach?

Educational Tech companies which provide personalized feedback to learners will be interested to fund