An Integrated Interdisciplinary Inquiry-based Applied Learning During Covid-19

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Abstract - This study describes an Integrated Interdisciplinary Inquiry-based Applied Learning approach during Covid-19 for undergraduate engineering education. Through an applied research project, faculty were seeking practical applications of new concepts and technologies by working together with an industry partner. Students were involved for applied learning by solving industry-related real-world problems. During the two years plus period, twelve related student projects were completed by addressing the well-defined sub-problems associated with the applied research project, and twenty-six students were trained with related projects. In this study, we are sharing the applied learning pedagogy we adopted in facilitating the students applied learning in solving real world problems during Covid-19.

- Adopted Inquiry-based Learning (IBL) to facilitate students' active learning through a self-directed, question-driven learning opportunity to acquire knowledge about the domain under study (Justice et al. 2009). IBL as a learning theory is rooted in constructivism, which states that humans construct their own knowledge and skills from their personal experiences, rather than being delivered by the lecturers (Friesen and Scott, 2013). For a successful IBL, students cannot be left on their own, rather active support and regular feedback are required from professors.
- Students from various programmes were pooled to work together. With the students' team mixed with different backgrounds, the effectiveness of the interdisciplinary inquiry-based applied learning is dramatically improved.
- During the Covid-19 circuit-breaker or high tightening period, students were not able to physically visit the company to collect data, 3D simulation models were developed and used to illustrate and explain the industrial processes and problems.
- The 3D simulation models connected to the company's database and real-time sensors. The simulation model not only helps students acquire industry knowledge but also enables them to analyze the current systems and experiment with new Industry 4.0 technologies for process improvements in terms of efficiency, throughput, and cost reduction (Zarte and Agnes, 2017).

Fig.1 Online discussions based on 3D simulation capturing real-time data

	Applied Research Project and students projects
AR Project	A Cyber-Physical Digital Twin System for Manufacturing
Capstone Project (SEEMS)	Manufacturing Digital Twin System (6)
FYP (ICT/CS)	Manufacturing Monitoring and Controlling System (1)
FYP (ICT/CS)	Concept and Implementation of Digital Twin System for Manufacturing (1)
FYP (ICT/CS)	Manufacturing Inventory Control System (1)
FYP (ICT/CS)	Manufacturing E-Scheduler System (1)
FYP (ICT/CS)	An Integrated Dashboard for Digital Twin (1)
FYP (ME)	LED Guiding Tool for Manufacturing (1)
FYP (EEIT)	Simulation-Based Robot Design for Manufacturing (1)
FYP (EEIT)	Universal Poka-Yoke Controller for Production Line (1)
FYP (EEIT)	Using OptQuest for Simulation Optimization of Production Schedule (1)
Capstone Project (SEEMS)	Cyber-physical Production System (6)
Capstone Project (SEEMS)	Low-power Wireless Communication for IoT Application (3)