Engaging Responsive and Responsible Learning Through Collaborative Teaching in the STEM Classroom

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EXECUTIVE SUMMARY

This chapter explores how the elements of responsive and responsible learning were adopted in the first STEM education classroom through collaborative teaching with external experts in a public university in Malaysia. The objectives for the introduction of the course were to enable students to apply the knowledge of mathematical and pedagogical aspects in the teaching of science and mathematics to solve problems in a scientific and systematic manner and to demonstrate the ability to seek new knowledge independently. Three class projects involving collaborators fulfilled 8 weeks of lectures. These included Training of Trainers (ToT), Green Energy Project – Solar Panel and the University Centre for Innovative Delivery and Learning Development (CIDL) focused on Internet of Things (IoT) content. Collaborative teaching in the STEM education classroom has successfully served the specific technical requirements of industry using the design-thinking framework into the university classroom setting.

INTRODUCTION

Along with the need to address global challenges in the 21st century, there is even a greater need for an integrated STEM (Science, Technology, Engineering, and Mathematics) education with the aim of preparing students to be competitive and ready for a workforce with deep technical and personal skills. STEM Education helps to improve critical thinking skills and help students to become creative problem solvers. STEM Education also helps to empower students with the skills to succeed and adapt to this increasingly changing in technological world. It also helps to enhance 21st Century skills through building a strong foundation in the skills of collaboration, critical thinking, communication, creativity, inquiry skills, critical analysis, teamwork and collaboration, initiative, and digital literacy in which they can apply to solve real-world challenges grounded in science, technology, engineering, and math (STEM Education) content. Thus, STEM subjects are effective means to produce competitive graduates for better global competitiveness in the 21st century ((Aydın-Günbatar, Öztay, & Ekiz-Kıran, 2021); (Seshaiyer, 2021)).

An important strategy for improving STEM education is to intentionally include various types of learning strategies, this may include responsive and responsible learning, inquiry-based learning, experiential learning, project-based learning, and challenge-based learning along with the creation of high-quality, integrated instruction and materials, as well as the placement of problems associated with grand challenges of society at the centre of study. One framework that motivates the need to employ STEM solutions to face societal challenges is the Sustainable Development Goals (SDG 2030[1]) adopted by United Nations Member States in 2015. These goals provide a shared blueprint for peace and prosperity for people and the planet, and the 17 Sustainable Development Goals (SDGs) provide a framework for important global challenges including ending poverty, improving health and education, reduce inequality, spur economic growth, tackling climate change and more ((Jamali, Ale Ebrahim, & Jamali, 2022); (Seshaiyer & McNeely, 2020)). We believe STEM education is a promising educational framework to help address these international goals.

STEM Education has been recently introduced to students majoring in Science and Mathematics at the Faculty of Education, Universiti Teknologi MARA (UiTM), a higher learning institution in Selangor with a first batch commence in September 2021. The objectives for the introduction of this course were to enable students to apply the knowledge of Mathematical and pedagogical aspects in the teaching of science and mathematics, to solve problems in a scientific and systematic manner and to demonstrate the ability to seek new knowledge independently, as students as well as future educators. An integrated STEM Education will also help to provide new frameworks for upskilling the mathematics education workforce (Seshaiyer, 2021).

One of the reasons for STEM Education being introduced in the curriculum was due to the low number of students' enrolment in the science stream in Malaysia, which later can give impact to the future of science and STEM education in Malaysia. STEM has been implemented in schools beginning 2017, it's aimed to produce students with science literacy (Ramli & Talib, 2017). Since the aim of STEM Education is to produce STEM literate students who can apply and integrate STEM concepts into the solutions, accordingly, be creative, innovative, and inventive in line with the skills needed in 21st century and Industrial Revolution 4.0, therefore, STEM Education was an added value subject and should be taught in a more interesting way. Due to this, the Science and Mathematics Departments at the Faculty of Education, UiTM decided to collaborate with three different agencies within their area of specializa-