Workshop on 'Enhancing Computational Thinking Skills for Problem Solving in Mathematics Classroom'

Facilitators:
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& Dr Warabhorn Preechaporn
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SEAMEO RECSAM, Penang, Malaysia

Rationale

Computational thinking (CT) is the thought processes involved in formulating a problem and expressing its solution in a way that a computer—human or machine can effectively carry out (Wing, 2006). It will be a fundamental skill used by everyone in the world by the middle of the 21st Century (Wing, 2012). It involves with defining, understanding, and solving problems, reasoning at multiple levels of abstraction, and analysing the appropriateness of the abstractions made (Lee, et al., 2011). The four basic strategies of CT skills are decomposition, pattern recognition, algorithms and abstraction (McNicholl, 2018). These strategies are necessarily for problem solving and help children develop better problem solving skills.

CT skills incorporated with technology can be made possible by using Scratch that is developed by the MIT Media Lab. It is a block-based visual programming language which helps children learn to think creatively, reason systematically, and work collaboratively (scratch.mit.edu).

This workshop is designed to equip participants for mathematics problems solving hands-on approach through games, puzzles, and magic tricks. Nevertheless, they also obtain practical programming skills and coding using "Scratch" to design and create mathematics teaching materials such as: interactive activities, games or animations.

Objectives

At the end of the workshop, participants will be able to:

- acquire knowledge of four basic strategies of computational thinking for mathematics problems solving; and
- acquire knowledge of Scratch and its application to design and create mathematics teaching materials.

Workshop Facilitators

Dr. Murugan Rajoo is working as a Mathematics Education Specialist at SEAMEO RECSAM. He obtained his PhD in Mathematics Education from University Utara Malaysia (UUM). He graduated with a Master's in Mathematics Education from University Malaysia Sabah (UMS) and Bachelor of Mathematics Education from University Pendidikan Sultan Idris (UPSI). Dr Murugan has experience working as a mathematics teacher at SMK Sepulut, Sabah, SMK Pengiran Omar Sipitang, Sabah, SMJK Sin Min Sungai Petani, Kedah, SMJK Heng Ee, Penang, and he had been the head of the Mathematics panel. He has also been invited as a speaker on techniques of answering the *Sijil Pelajaran Malaysia* (SPM) Additional Mathematics and Mathematics papers in various schools. Besides, he was also appointed as the head of the Olympiad Mathematics Competition (2011 – 2013) and Kangaroo Mathematics Competition (2017 – 2018). Additionally, he was also invited as a speaker to the iSTEM International Conference organised by *Universiti Sains Malaysia* (USM, 2019). Recently, he conducted a workshop on "Going Back to Fundamentals: Models and Heuristics" for mathematics teachers in East Java, Indonesia. Besides, he also coordinated and facilitated a workshop on Computational Thinking. He was involved in developing the STEM module and instrument for Teachers Professionalism Division, Ministry of Education Malaysia. His works have been published widely including the conference proceedings, the Ministry of Education Malaysia Journal, the Review of European Studies, the Australian Journal of Basic and Applied Sciences, ISI and

Scopus journal. He also contributed his expertise in reviewing the Review of European Studies Journal. He is an editor for the Journal of Science and Mathematics Education in Southeast Asia and the Journal of Learning Science and Mathematics. He had won many awards and recognitions: the Intellectualisms Award from SMK Pengiran Omar, the Excellent Service Award, the Aspiration Award from SMK Pengiran Omar, the Postgraduate Aspiration Award from Universiti Malaysia Sabah (UMS) and Best Paper Presenter in an International Conference. His areas of expertise are Mathematics Education, Assessment in Mathematics, STEM Education, Mobile Applications, and Computational Thinking. He is also a consultant for project related to mathematics education for researchers from local Universities and Polytechnics.

Ms Teh Kim Hong served in Teacher Education Institute (TEI), Penang campus for 20 years specialising in mathematics education before she was seconded to SEAMEO RECSAM as a senior specialist in mathematics education in 2016. She lectured on mathematics education courses for both the diploma and degree programmes in primary mathematics. In which, she played pivotal role in leading her team actively involved in developing course work assessment and mathematics curriculum for TEI. Currently she is conducting mathematics education regular courses for the SEAMEO and occasional in-service courses for the African teachers, both focusing in various mathematics pedagogies and STEM related approaches. She has been taking a leading role in conducting lesson study research since 2010, looking at classroom practices of mathematics teaching. Her one and a half months research fellowship programme and learning experiences in the University of Tsukuba in 2018 and practical observation in the Japanese mathematics classrooms while attending lesson study programme in Tokyo Gakugei University convinced her that promoting mathematical thinking is the most essential aspect of teaching and learning mathematics. In this workshop, she hopes to showcase how to integrate computational thinking as a part of mathematical thinking

for problem solving in mathematics classrooms. It is hoped that the relevant discussions would serve as an enhancement for the self-elevation of professional practices of mathematics teaching.

Dr. Warabhorn Preechaporn holds a doctorate degree in computational science from Walailak University, Thailand. She has 26 years of teaching experience as a mathematics teacher in Nakhon Si Thammarat, Southern Thailand. She is currently a Mathematics Education Specialist in the Training Programme Division, SEAMEO RECSAM where she has facilitated and supervised the training courses for educators from the SEAMEO member countries, countries from the African continent and the Colombo Plan member countries. She has chaired and presented papers at international conferences. Her interests are in dynamic mathematics software such as GeoGebra, Scratch, universal harmonious values integration, observation skills, Problem-Based learning the 4 Core Areas (PBL4C), Computational thinking with Scratch to create interactive activities and Mathematical Explorations through Paper Folding and the 3-D straw models.