

Project Title : Joint university collaboration to develop students' competence and leadership in promoting integrated STEM education

Leading University : The Education University of Hong Kong

Participating UGC-funded University(ies) : The Chinese University of Hong Kong, The Hong Kong Polytechnic University, The University of Hong Kong

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Summary of Proposal

With the increasing demand of Hong Kong to develop Science, Technology, Engineering and Mathematics (STEM) professionals and literates to sustain its economic prowess and solve societal and environmental problems, it is imminent to infuse STEM education into the existing school curriculum. This entails complementary efforts by the education faculties and STEM faculties to develop their graduates' competence and leadership in STEM education. This three-year project is a joint-institutional response to such an emerging need. Four university partners are involved in launching this project, namely EdUHK, HKU, CUHK and PolyU.

This project is innovative in that it facilitates STEM undergraduates and pre-service teachers to overcome the boundaries between different majors of the university partners. The collaborative learning process allows various majors (e.g. science, engineering and mathematics) to learn from each other and achieve synergy in problem solving. A three-stage model is proposed. The first stage is to enhance the university students' understanding of STEM by providing them with the opportunity of attending joint-university lectures/workshops outside their majors. The second stage involves the formation of joint-university multi-disciplinary STEM Learning Communities (SLCs) by different STEM majors from different universities. These SLCs will undertake experiential learning projects to solve problems through engineering designs. Each SLC will either partner with a social service provider to serve the needy, or work with a school to design STEM activities for school students. All of these service activities are based on their design outcomes. Finally, the university students will have the opportunity to visit overseas STEM promoting or STEM education centers to broaden their perspectives on STEM or STEM education. Evaluation of the project will be conducted by mixed methods including assessment of student projects and student reflective journals/portfolios, pre-post questionnaire surveys on students' self-perceived knowledge, motivation and confidence in learning STEM, and self-efficacy in teaching STEM (for pre-service teachers), as well as focus group interviews with course lecturers, project supervisors, mentors and students to gauge their feedback to the project as a whole. The outcomes of the project will be disseminated to other university students and other stakeholders of STEM. The impact created by this project will be sustained by the design and production of a teaching pack, a Massive Open Online Course (MOOC), and a website on STEM education that are accessible to all pre-service teachers, all UGC-funded universities that offer STEM subjects, as well as the primary and secondary school teachers responsible for STEM education.

Summary of Final Report

The increasing demand of Hong Kong to develop STEM entails complementary efforts by the education faculties and STEM faculties to develop their graduates' competence and leadership in STEM education. This three-year project was a joint-institutional response to this emergent need. Four university partners were involved in launching this project, namely EdUHK, HKU, CUHK and PolyU.

This project is innovative in that it facilitated STEM undergraduates and pre-service teachers to collaborate by crossing their subject boundaries. This collaborative learning

process allowed various majors (e.g. science, engineering and mathematics) to work in collaboration with each other to solve problems, mimicking the real-world situation that entails similar kind of teamwork. Two rounds of U-STEMist schemes were conducted, in which different majors from different universities were grouped into U-STEMist teams to initiate projects in partnership with community organizations, including schools, Non-Governmental Organisations, welfare organizations, government departments, and business enterprises. These projects aimed to provide service to the clients of those community partners such as students and the disadvantaged. After completing each round of the Scheme, the U-STEMists presented their outcomes and shared their learning experience with their peers and schoolteachers in a final exhibition. Awards were presented to U-STEMist teams showing outstanding performance in their projects.

The U-STEMist schemes were well received by the participants, who treasured the opportunities of experiential learning in STEM through conducting relevant STEM projects to serve the community. They also valued the chances to learn through working with their peers and community partners, which helped to extend their expertise and networking with the community.

The impact created by this project is sustained by the design and production of a MOOC freely accessible to all. This MOOC aims to provide a basic theoretical and practical grounding for novice STEM educators. Selected U-STEMist projects are used to illustrate how STEM knowledge and skills could be integrated across the school curriculum to solve real-world problems. Although the MOOC intends to target pre-service and serving teachers involved in the promotion of STEM education, it is also expected to provide useful reference for other professionals working in STEM education-related fields.