

Project Title : Establishment of Ubiquitous Learning in Teaching and Learning Science for Knowledge Integration (Chemistry and Life Science)

Leading University : The Chinese University of Hong Kong

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

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### **Summary of Proposal**

Traditional single-discipline education is gradually facing the scientific and social challenges in the 21<sup>st</sup> century. Graduates from institutions of higher education are expected to possess multi-disciplinary knowledge and skills. The importance of this requirement is exemplified by the STEM (Science, Technology, Engineering and Mathematics) education introduced by the Education Bureau in 2015. Furthermore, non-science major students can also be benefited from learning science concepts which can strengthen their learning and research in their own areas of expertise. However, the educational structure of academic organizations nowadays is usually planned based on academic disciplines.

With the support of eight science teachers with different expertise in teaching and learning development, a new paradigm of learning is to be explored and developed in this project to promote students to learn science across the boundaries of disciplines. This project focuses on ubiquitous learning to promote knowledge integration from different sub-disciplines in Chemistry and Biology. It also shows the connections between fundamental science concepts and the applications of scientific technologies in science and non-science situations. Ubiquitous learning emphasizes on instant learning in real-world. A vast number of learning objects in various media formats (video, photos, textual descriptions, and webpages) will be produced under six important themes in Chemistry and Biology. The learning objects will cover a wide range of contents including fundamental scientific concepts and phenomena, scientific information about materials and applications of scientific technologies in various

situations. The objects will be embedded into different learning pathways. It allows students to appreciate the connections between scientific concepts and applications. Items related to the learning objects will be selected from teaching facilities and daily-life situations. QR code and RFID (radio-frequency identification) tags readable by mobile device will be put on these objects for students to access the relevant information instantly.

The learning materials will be hosted in a Learning Management System server for teachers and students to track the learning progress with mobile apps.

### **Summary of Final Report**

“Science Mobile” is developed as a portable learning platform to facilitate students learning science concepts across different science disciplines in daily life. All learning objects are hosted by a web-based learning management platform. “Science Mobile” has been launched in App Store in iOS system and Google Play in Android system since April 2019. Students can install the apps into their smartphones to view the learning objects for ubiquitous learning. They can also access the learning objects by scanning the corresponding barcodes, QR codes and RFID, or by searching with relevant keywords and hash tags. The learning objects are displayed with textual descriptions, images, videos, and hyperlinks. Hash tags and in-text-hyperlinks allow students to explore the relationship among different learning objects. The topics are categorized into different learning modules to allow students to explore more about the objects in which modules are available for connecting the learning objects to build a learning pathway. This helps in facilitating self-directed learning of students as they are allowed to search topics that they are interested in. Teachers can create and edit the learning materials and the related assessment items through the web-based content editor panel. In some courses, students are engaged to create learning objects through the content editor panel to encourage the active participation of the students and promote interactive learning. Assessment can be assigned to students for assessing their understanding on certain learning objects. Students’ performance can be viewed by generating reports on the assessment using the web-based panel. Positive feedbacks are received from both teachers and students that the learning platform is convenient to use and helpful in enhancing the learning process. Until March 2021, over 1 600 learning items, with topics related to Chemistry and Life Sciences, have been created. The learning platform is already fully developed with a large variety of items and functions available. It is predicted that the apps can be further expanded to cover more themes and different science subjects, and also be promoted to different tertiary institutions,

hence providing a comprehensive science learning experience to students in the near future and arouse their interest towards science.