Project Title :	Blended Learning for Building Student-Teachers' Capacity to Learn and Teach Science-related Interdisciplinary Subjects
Leading University :	The Education University of Hong Kong
Participating UGC-funded University(ies) :	The Chinese University of Hong Kong, The University of Hong Kong
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Layman Summary of Proposal

The proposed project will develop a new set of foundation science modules that will be shared among three institutions: The Education University of Hong Kong, The Chinese University of Hong Kong and The University of Hong Kong. The modules will equip student teachers who lack foundational knowledge in science with the knowledge that they need to possess to fully benefit from existing science-related courses in the teacher education programmes of these institutions. The project addresses the problems that the three institutions have encountered when training non-science students to be teachers of science-related interdisciplinary school subjects. These science modules will add basic scientific knowledge to the existing science-related teacher education courses that equip student teachers with the content and pedagogical knowledge they need to teach science-related subjects in primary or secondary schools. These school subjects include Primary General Studies (GS), Junior Secondary Integrated Science (IS) and Senior Secondary Liberal Studies (LS). These modules will be designed for integration into existing courses in a flexible way to meet the requirements of individual courses. The pedagogical design of these modules will be based on a blended learning mode that combines the advantages of

e-learning and face-to-face contact. The e-learning or online-learning components will be delivered through a Learning Management System (LMS) such as Moodle. This learning environment allows for self-pacing under the guidance of the course tutor.

Students can work toward different goals by building on their own background knowledge. This project, the first of its kind, will involve inter-institutional collaboration in designing, piloting and evaluating the modules delivered through blended learning to meet the common needs of the education faculties. It will contribute to the capacity of science education faculties to design and implement creative and innovative curriculum designs and pedagogy to address curriculum and learning issues in teacher education.

Layman Summary of Final Report

This project is entitled “Blended Learning for Building Student-Teachers’ Capacity to Learn and Teach Science-related Interdisciplinary Subjects”. The project is a response of the science education faculty of three Hong Kong tertiary institutes to the challenge of catering to the diversity of academic backgrounds among student teachers, particularly those without a sound science background at the senior secondary level.

A number of E-learning modules have been produced covering four content domains of science. These modules are designed based on the 5E learning model and are delivered to students using the LMS provided by Moodle. The design of the modules is iterative, based on the evaluation of three consecutive rounds of trials through student surveys, and focus group interviews with students and course lecturers. The outcomes of the project inevitably vary with the degree of blending of the e-modules with the courses, which is dependent on the background of individual student cohorts and the nature of courses in different programmes. The emphasis of the project did vary among different programmes such as PGDE and BEd, BA, BEd-BSc and EdD. Nevertheless, evaluation findings indicate positive outcomes for the development of certain attributes such as conceptual understanding, eagerness and confidence in learning science, and metacognitive reflection on students’ own learning, particularly among those BEd students that lacked an adequate science background. For PGDE programmes where the modules were mainly used to support methods courses, the impact has been to develop pre-service teachers’ understanding of the nature of science and scientific inquiry rather than subject knowledge, and to provide role models to induct them into the use of e-learning strategies in science teaching.

However, there remain a number of challenges to be met to fully achieve our objectives. These challenges are not solely technical ones in terms of transforming teaching content into digital forms delivered through the LMS; they also involve applying sound pedagogical designs underpinned by evidence-based learning theories to facilitate students' construction of foundational science knowledge in a progressive and self-directed way. Hungwe and Dagada (2013) have argued that blended learning will not be successful if the lecturers involved fail to integrate "technological content knowledge" with "pedagogical knowledge" (p. 1). Another important issue to address is the motivation of students to learn science content in a self-directed way. Students' recognition of their own difficulties in learning undergraduate science does not necessarily lead to increased motivation to engage in the self-directed learning of more basic science. Our experience from the trials shows that students' motivation in engaging in self-directed learning could be enhanced by pegging it to the formal assessment of the course with which the module is blended. Both the lecturers and the students suggested measures for the more effective blending of the self-directed and face-to-face learning approaches such that more effective learning could take place by lowering the cognitive barrier for students to overcome. This echoes the findings of Condie and Livingston (2007) that the effect of blended learning on students' achievement could be increased if lecturers actively engage students in the learning process.

Apart from an increased degree of blending of self-directed e-learning and face-to-face lectures, the effectiveness of student learning can be improved by pitching the module content at a level of complexity appropriate to our target groups, identifying and supporting students in need, using a broader range of e-learning tools to cater to diverse abilities and learning styles, making learning activities more interactive and interesting, incorporating more inquiry activities to enhance students' understanding of concepts and their capacity for scientific thinking, encouraging students to reflect on their learning and learning difficulties, strengthening the provision of feedback and support to students in need, and enhancing the integration of the e-learning modules into the courses. The last point could possibly be addressed by setting aside class time for e-learning, holding quizzes in class to assess self-directed learning, and having the course lecturer provide a greater degree of facilitation to guide students through concepts that are difficult to master.

In summary, the success of the project hinges on whether student-teachers can be motivated to learn basic science content in addition to the content covered by their major courses and whether more effective blended learning approaches can be

designed to boost students' confidence in learning science, a subject which most of them had opted out in their senior secondary school years. Nevertheless, the project represents a conscious effort for the science teacher education faculty of different universities to pull together their resources and expertise to tackle teaching and learning issues through both technological and pedagogical means. The outcomes of this project have provided important insights into possible ways of blending e-learning with face-to-face learning approaches to create maximal synergy in catering to the needs of science learners with insufficient science backgrounds so as to prepare them for teaching science and other interdisciplinary subjects.