Title: E-learning design for higher skill acquisition in the undergraduate biomedical sciences

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Abstract:

Scholar literature suggests that alignment between success factors in Instructional Design, Pedagogy and Technology are key to e-Learning efficacy. We applied those success factors in a backward design strategy to develop active-learning resources that comply with good practice in pedagogy. Five e-Learning activities that aim at higher skills (e.g. 'Apply', 'Analyze', and 'Evaluate' from Bloom's Taxonomy) were designed and served as frameworks to further implement up to 50 e-Learning activities in a large-size Biochemistry class.

Description:

Adapting higher education to modern practices such as e-Learning is becoming increasingly important, as technology gains traction and provides novel alternatives to traditional instruction. Experts have studied the elements contributing to well-designed e-Learning resources and offered insight as to which are most crucial for instructional design practitioners. The goal of this project is to apply the most relevant e-Learning success factors reported in the literature to the context of an intermediate-level undergraduate biochemistry class at McGill University through the development of pedagogical resources. As such, we identified ten e-Learning success factors and divided them into three categories. The first, **Instructional Design**, includes student-centeredness, perceived usefulness, clear instructions, and varied material. Second, for **Pedagogy,** factors such as adequate learning conditions, interactivity, fair assessment practices, and coherent course alignment must be considered. For the third category, namely **Technology**, the important factors contributing to e-Learning success are proper IT infrastructure and technical support availability.

A backward design approach was used to develop five useful e-Learning activities that aim at higher skills in students (e.g. 'Apply', 'Analyze', and 'Evaluate' from Bloom's Taxonomy) and that incorporate the most relevant parameters for successful e-Learning. This iterative design task involved careful metacognition along the way to ensure that no aspect was left behind so that the activities truly reflect the state of modern educational research as it pertains to e-Learning. The final products took the form of five activities, each complemented by their respective rubric: 1) Answering a student email, 2) Creating concept maps, 3) Applying knowledge to another context, 4) Refuting pseudoscience claims, and 5) Audience-dependent scientific communication. They were all tested for compliance to the success factors and desired learning objectives before being finalized.

In the Fall 2020 semester, the developed activities were used as models for course teaching assistants, as they developed ~50 sample problems for use in McGill's BIOC311 - Metabolic Biochemistry. The design of these activities was greatly appreciated by students, as seen through comments from the end-of-semester course evaluation. This scholar strategy can be transposed to other biomedical disciplines beyond biochemistry to foster e-Learning success. A follow-up project would be comparing a diagnosis test taken at the beginning of the semester with answers on the final exam to formally assess whether students have acquired higher skills following the implementation of these e-Learning activities.