The Department of Chemistry is evaluating all chemistry courses offered in the University of Ottawa in order to improve teaching quality and offer students the best academic experience. Accordingly, a Curriculum Mapping Project (Phase 2) has been applied to assess the course structures, learning objectives, and teaching techniques of all physical/theoretical chemistry courses offered in recent academic years (Figure 1). Integrated with student performance, the research involves a clear overview of the current undergraduate chemistry programs (physical chemistry section) to an appropriate depth. This project also suggests any possible improvements or revisions such as identifying any discrepancies between English and French sections, removing redundancies in course materials, and proposing changes in some course structures. Correspondingly, these recommendations will help the Department construct a reinforced program for future undergraduate chemistry education.

The main research methodologies include three stages. The first stage involves building a database containing course materials (courseware, available textbooks, evaluation methods, etc.) from the most recent course syllabi mainly academic year 2014-15. Based on the information in the database, the second stage investigates the course structures in detail, analyzing any connectivity and discrepancies between courses, preparing questionnaires and conducting interviews for chemistry instructors for their teaching experience. Eventually, in stage three, the final curriculum map will be built from the results in the first two stages. In addition, this project also takes into account the evaluation of teaching and course results (5 reports) and student academic performance to analyze students' perspective of chemistry. (Figure 2)

Introduction 1

Figure 1: The concept map of all physical/theoretical chemistry courses offered in the past academic years.

Methodology 2

Figure 2: The main topics in CHM2311, their corresponding replacement courses, and the order of courses in CHM2311 and CHM2312.

Proposal 1: CHM2311: Intro to Structure and Bonding

All students in specialization in chemistry are required to complete CHM2311 in their studies. However, some course contents contain significant overlap with their other compulsory courses, and the redundancies can be suitably covered in the replacement courses shown in Figure 3.

Proposal 2: CHM3373: Molecular Spectroscopy and Statistical Mechanics

CHM3373 covers important topics in molecular spectroscopy and statistical mechanics which are essential for fourth-year advanced physical chemistry courses. This course is also a supplement to symmetry and group theory covered in CHM2133. It is highly recommended that all students in chemistry programs take this course so that they have a wider selection of optional courses at the 4000 level. Correspondingly, the Department will be motivated to offer more courses at senior levels once the demand and enrollment of these courses are filled. (Figure 3)

Results 3

The principal current challenge is the limited enrollment of students in chemistry programs. In some cases, the Department of Chemistry does not have sufficient resources to offer some specialized courses for chemistry students. From Figure 1, only 2/3 of courses in this stream are offered annually or biannually, and this issue is particularly apparent in the Francophone section.

Figure 3: Class size of some courses at 3000 and 4300 level (2015-16).

Figure 4: Average GPA and average course rating of CHM programs.

Conclusion 4

The Department of Chemistry demonstrates a dynamic progression in education. We can still establish a higher level of education, and a better incorporation of teaching resources by proactively identifying any adjustments in the course structures and teaching methods. Self-evaluation and inter-department coordination are essential to fulfill the demands of all science students. The next step of this research involves a comprehensive integration of all three components (General, Analytical, Inorganic, Organic, and Bio-organic streams) of this curriculum mapping project, thereby illustrating a full vision of the Department.

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