Progress (Results) Report

ASSESSMENT MINIGRANT

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1. What Was Our Project About?

The objective of the assessment minigrant was to determine whether and how a shift from a two-semester General Chemistry sequence (CHEM 115–116) to a one-semester, biology-related sequence (CHEM 109) affects student performance in subsequent organic chemistry courses (MCMP 204 and 205). We used the population of prepharmacy students affected by this change in our study. This pilot study would lay the groundwork for the possible use of CHEM 109 (in the future to be numbered CHEM 129) as a general chemistry offering for Biology students as well. The reason for considering this change originally was to allow prepharmacy students to complete their prepharmacy preparation in two years, which would not have been possible with the new pharmacy curriculum and a two-semester general chemistry requirement. Furthermore, this change aligns with Purdue’s (and the State of Indiana’s) concerns with the student cost of education. A two-year prepharmacy curriculum is quite unique to Purdue (most Pharmacy Colleges require a B.S.) These changes in effect save our students the cost of TWO YEARS of university education.

2. What Did We Learn?

We studied the performance of prepharmacy students in MCMP 204-205 (Organic Chemistry) during the prior 10 years in which they took Chemistry 115–116 as their general chemistry preparation. We then studied the most recent class of prepharmacy students (2010) and compared their performance in MCMP 204-205 with that of the CHEM 115–116 students of previous years. Control analyses showed that there were no significant demographic differences in the two populations, including SAT scores. We found that the performance of the two cohorts of students in MCMP 204-205 was virtually identical. This outcome should lay to rest any concern that the more compact and accelerated CHEM 109/129 does not prepare students as well as the longer CHEM 115–116 sequence. One can speculate about the factors that are involved in this result. First, CHEM 109/129 is focused specifically on material that is foundationally important to MCMP 204-205 and the Pharmacy Curriculum. This curricular design was ensured by lengthy consultations between the instructor for CHEM 109 and the Pharmacy faculty. Therefore, material covered in CHEM 115–116 but not covered in CHEM 109 was not likely to be critical for success in MCMP 204-205. Secondly, the prepharmacy students generally have excellent secondary-school chemistry preparation, and these students probably needed less of the lengthier foundational material presented in CHEM 115. They were able to “hit the ground running” in CHEM 109.
We also studied the CHEM 109 student performance on the relevant questions of the American Chemical Society (ACS) standardized general chemistry examination. We coded each question on the Chemistry 109 final and the questions on the ACS exam using the learning outcomes defined in the SFFP. This coding allowed us to sort the questions into six learning outcome areas and to explore student performance. We found that all questions (except for one on the Chemistry 109 final) had excellent discrimination values. This means that the questions were able to distinguish between those who were knowledgeable and those who were not. Thus, both exams are functioning as they should indicating that students in Chemistry 109 are achieving key learning outcomes related to developing their knowledge of fundamental principles in chemistry.

In the most recent course cycle (following the grant period), we correlated the performance in MCMP 204 with the performance in CHEM 109. If CHEM 109 is providing adequate foundational material, we would expect the two to be correlated. In fact, there was a strong correlation ($r^2 = 0.56$).

These studies show that CHEM 109 is meeting the objectives for which it was designed, and that students are performing well on the relevant parts of the American Chemical Society General Chemistry Examination.

3. The Impact on Our Program

The results of this study give us the confidence that the prepharmacy curriculum change is achieving the desired result. As noted above, it allows students to complete their University education in two years’ shorter time, thus saving them the cost of two years of education. We are assured that CHEM 109 is adequately preparing our students for their subsequent study in chemistry and success in the pre-pharmacy program.

4. Future Impact

We are participants in an HHMI-sponsored Experiment Grant, and our role is to design and assess outcome-based curricula in chemistry for pre-health professional education. This grant is a four-university consortium. We will likely export aspects of our CHEM 109/129 sequence, as well as our organic chemistry offerings, to these and other universities. This work is an important piece of that project.

Moreover, the Department of Biological Sciences at Purdue has been following this project with interest, and plans are being made to offer CHEM 129 to Biological Science students instead of CHEM 115–116. This change will allow these students to be better prepared for advanced work in biology, particularly undergraduate research, in a shorter time.