

IPESL Final Report Minnesota State University, Mankato

1. Title of Project: Linking General Chemistry Principles to Critical Thinking Skills in an Introductory Chemistry Course via the Utilization of Assessment Techniques
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2. Purpose: The purpose of this project was to enhance this intellectual development of higher-order thinking skills. To meet this goal, CHEM 106 was redesigned to incorporate both support mechanisms and new assessments of critical thinking.
3. Results: New curriculum material was developed to challenge students to demonstrate that they have learned the general principles that were considered foundation knowledge. These principles were usually learned by memorization. As a result of this project, the new material should have positioned the students to “practice” the principles as they were taught. While the principles were learned, this material challenged students to answer questions and perform exercises through procedural learning.

The support mechanism of a Classroom Performance System (“clickers” or CPS*) was implemented for immediate assessment feedback allowing student comprehension to be tracked.

The table below summarizes the quantitative results that were obtained as a result of this project. Exam scores obtained when the students were taught by the same instructor during the Spring 2006 semester were used as the baseline for comparison. Comparisons were then made with the students enrolled in CHEM 106 during the Spring 2007 semester. Students that participated in the CPS exercises exclude those students that missed four or more CPS exercises. The exam averages were calculated for each student who completed the respective course. Then the average was taken for the entire class for each semester. This is reported as the Average Score. It should be noted that the exam average was the same for the entire class when comparing students from 2006 and 2007. However, those students who participated in the CPS exercises scored an average of 1.9% higher on the exams that were utilized as an assessment tool. The lecture materials and the lecture style was consistent between the two semesters. Both semesters also incorporated weekly assignments. An additional variable that needs to be accounted for is classroom attendance. There were 17 students that did not miss any of the CPS exercises (out of 11), and they had an average score of 77.9.

Table 1. Data Demonstrating the Increase in Exam Scores Observed that Correlates to Students who Participated in the CPS Activities

Year	Assessment Tool Used	Number of Students	Average Score out of 100
2006	Exam Average	64	73.2
2007	Exam Average (entire class)	76	73.2
2007	Exam Average (CPS*)	58	75.1

4. Issues: The study was planned and implemented during a short time-frame. This is being addressed by the collection of data from another class in which CPS exercises are being introduced this semester. An additional variable that needs to be accounted for is classroom attendance. It was also challenging to only change one variable so that a conclusive correlation could be drawn from the correlation.

5. Dissemination: Additional results are being collected from a new class in which the only change is the implementation of CPS exercises. It is anticipated that the results will be disseminated at a professional conference (American Chemical Society national meeting) and/or a university-wide colloquium.