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IPESL Grant Application
(Initiative to Promote Excellence in Student Learning)
Minnesota State University, Mankato

PROPOSAL COVER PAGE

Title of Project: Linking General Chemistry Principles to Critical Thinking Skills in an Introductory Chemistry Course via the Utilization of Assessment Techniques

Name: Danaè R. Quirk Dorr

Are you full-time faculty in 2006-2007? **X** Yes No
(fixed-term faculty are not eligible to apply)

Do you plan to return to MSU in 2007-2008? **X** Yes No

e-mail: **danae.quirk-dorr@mnsu.edu**

Campus Address: **Trafton North 242**

Campus Phone: **(507)389-2141**

College: **College of Science, Engineering and Technology (CSET)**

Department: **Chemistry and Geology**

Spring Semester Schedule:

List times when available to participate in Learning Communities and workshops.

Mondays: 10am until 4pm, after 5pm

Tuesdays: 8am until 3pm

Wednesdays: 10am -1 pm, after 5pm

Thursdays: _____

Fridays: after 10 am

Danae R. Quirk Dorr
Signature of Applicant

Brian Lush
Signature of Department Chair/Director/Supervisor

[Signature]
Signature of College Dean/Vice President

Proposal Details

[Please do not use your name(s) in the proposal for purposes of blind review.]

Please address the following in your proposal:

1. Title of Project: Linking General Chemistry Principles to Critical Thinking Skills in an Introductory Chemistry Course via the Utilization of Assessment Techniques
2. Explain the purpose of your project (e.g., need, project goals or outcomes, significance, affected student population) and include a definition of “critical thinking” as appropriate to your project.
(maximum 250 words)

Foundation courses in chemistry require that students memorize massive amounts of knowledge. In addition to learning the general principles that are required, it is also necessary that the students grow intellectually and acquire the skills that allow them to analyze data and think critically. The purpose of this project is to enhance this intellectual development of higher-order thinking skills. To meet this goal, CHEM 106 will be redesigned to incorporate both support mechanisms and new assessments of critical thinking. Critical thinking skills are developed when students can utilize the foundation knowledge (general principles) as a tool in analyzing bridging information and solving more advanced problems.

This project will affect approximately 80 students that are preparing for professions in the fields of Allied Health and Nursing. The course, Introduction to Chemistry (CHEM 106), is designed to prepare students for subsequent science courses. This course also meets general education (category 3) requirements. If students develop enhanced critical thinking skills in this foundation course, they will be more successful in their professional endeavors.

For the purpose of this project, critical thinking is defined as the ability to gather and analyze (or evaluate) information. This analysis includes application and conceptualization. The analysis is consistent with the elements implicit in all reasoning and is responsive to the specific problem.

3. Describe your project and how it will enhance students’ critical thinking through one or more of the following activities:
(maximum of 250 words)
 - development, implementation, and assessment of new instructional or curriculum materials
 - development, implementation, and assessment of new support mechanisms
 - development and implementation of new assessments

This project incorporates several activities into CHEM 106. First, new curriculum material will be developed to challenge students to demonstrate that they have learned the general principles that are considered foundation knowledge. These principles are usually learned by memorization. As a result of this project, the new material should position the students to “practice” the principles as they are taught. While the principles are learned, this material will challenge students to answer questions and perform exercises through procedural learning.

Next, the support mechanism of a Classroom Performance System (“clickers”) will be implemented for immediate assessment feedback allowing student comprehension to be tracked. Several reports have demonstrated that the “clickers” provide an environment of interactive learning that illicit responses from every student.

Additional methods of new assessments will also be implemented. These include the Classroom Assessment Techniques “Categorizing Grid” and “Content, Form and Function Outlines.” “Categorizing Grid” reinforces effective categorization and recall and provides students with important organizational tools. This technique presents students with a grid containing important categories along with a list of scrambled items that belong in one of the categories. Another important feature of this technique, besides developing analytic skills, is that it can help the learner develop the ability to draw inferences from observations. In “Content, Form and Function Outlines”, students analyze the “what” (content), “how” (form), and “why” (function) by writing notes that answer questions in an outline format. In addition to developing critical thinking skills, this technique can also improve reading and writing skills.

4. How will you assess the results of your completed project?
(maximum of 150 words)

Assessment data will be collected throughout the semester that will show if an improvement in critical thinking skills have been made as a result of this project. This data should provide meaningful information as there will be at least three instances (week two, week eight, and week fifteen) in which an in-class exercise utilizing the “content, form and function outline” technique will be administered. During week one, the technique will be introduced to allow for a learning tool baseline to account for possible misunderstanding of the techniques objectives. Results from this project will be analyzed to assess the understanding and appropriate use of chemical principles in solving problem tasks.

In addition, this course was taught last year in the traditional lecture style by the same instructor. It is proposed that the same final exam will be given so that a comparison of exam scores can also be made.

5. How will you disseminate your project and its results? (e.g., department colloquium, professional conference, college colloquium, university-wide colloquium,

publication, IPESL website)
(maximum of 100 words)

The project details and its direct results on critical thinking in the specified student population will be disseminated through both a presentation at the American Chemical Society National Meeting and through a manuscript that will be submitted for publication in a peer reviewed journal, the Journal of Chemical Education. If the opportunity is available, results will also be presented at a university-wide colloquium and/or the IPESL website.

6. How will your project support department/university goals?
(maximum of 50 words)

The goals identified by Chemistry/Geology states “the department will continue its commitment to improvement of teaching effectiveness and curriculum enhancement.” This project meets these goals because students will demonstrate what they learn by performing satisfactory on tasks assigned, and students will leave this course with the requisite critical thinking skills.

Submit proposals no later than noon, Monday, November 27, 2006, to

Stewart Ross
MH 267
IPESL Project Manager
Mankato, MN 56001

Questions? Contact:

- Dan Cronn-Mills, IPESL Steering Committee, Chair
- John Banschbach, IPESL Steering Committee
- Candace Black, IPESL Steering Committee
- Brandon Cooke, IPESL Steering Committee
- James Rife, IPESL Steering Committee
- Stewart Ross, IPESL Project Manager for Learning Communities
- Tracy Pellett, IPESL Project Manager for Assessment
- Wayne Sharp, IPESL Project Manager for Technology
- Brenda Flannery, IPESL Project Manager