

Final Report for ACS Mellon Foundation Faculty Renewal Grants

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Institution: Southwestern University

Name of project: "Integration of Research into Teaching Laboratory for Inorganic Chemistry"

Date(s) of Project: 5/1/2009 – 6/30/2010

Amount Awarded: \$5000

The overall goal of this project is to redesign the traditional laboratory curriculum of Inorganic Chemistry using a new model that engages the students enrolled in the course in rigorous publishable quality research. The specific objectives of this Faculty Renewal Grant were two-fold: to identify suitable mini-projects from current scientific literature in Inorganic and Bioinorganic Chemistry, and to conduct preliminary laboratory studies to determine if these mini-projects have the potential to be developed into research projects that could be sustained through part or whole of the semester and include all or most of the laboratory techniques covered under the traditional curriculum.

The stated objectives for the grant were for most part achieved in that suitable mini-projects were identified by a thorough search of the current literature and preliminary laboratory testing was conducted on only a couple of promising ones. A slight modification was required due to time constraints and only one project was developed for implementation this fall. Other identified mini-projects will be explored future implementation.

As proposed in the grant application, I performed the required literature search, and the laboratory work was conducted in collaboration with a student researcher. A project with considerable breadth and depth was developed through laboratory testing. Since the course usually has less than ten students, the entire class will be able to work as one team. This will also allow significant progress to be made in the actual research the students will conduct. The research project that has been developed has the potential to engage the students in the course in rigorous and meaningful laboratory research. While the students would work as a team on the overall project, each would conduct research on an assigned portion. Their investigations have the potential to generate original results and to open new and interesting directions to pursue in the future.

Due to the nature of project for this grant, no impact beyond that on the student collaborator can be expected at this point. While the specific elements of the new research-based model have been identified and tested, actual implementation is essential for its overall evaluation and assessment. In principle, this teaching model is adaptable to other courses and transferrable to other institutions. Thus, after implementation and evaluation, it will be disseminated through appropriate avenues such as presentation at the American Chemical Society National Meeting and the ACS website.

The new research-based model will be implemented during the next academic year in Inorganic Chemistry, and evaluated during the implementation process through periodic surveys as well as journal records that students will be asked to maintain. The surveys will be designed to assess the value this pedagogical approach to student learning as compared to the more traditional one that it is supposed to replace. Some sample survey questions are provided at the end of this report. For their journals, the students will be asked to record their experience with the new approach. For example, instead of being provided with a specific experiment and the procedure to conduct it, under the new approach the students will be presented with a research problem and will have to devise a plan for the experiments based on the literature. It will require the students understand the goals of the project, explore alternative approaches, and plan specific experiments. They will also have to work as team and individually depending on the task at hand. In other words, they will have to be thoroughly engage in the whole process.

Sample survey questions

Sample questions are included to show how the new teaching model will be assessed for its impact on student learning. A complete survey is not provided because new questions will be added as the situation demands, and some questions will be asked several times during the semester.

I. Survey to be conducted at the beginning of the semester:

You will be provided with a research problem and its objectives. The class will work as a team on the overall project and each student will be assigned a part of the research that s/he will conduct individually or in pairs. Once you understand the research problem to be solved and what aspect of it you will contribute, you will be required to plan specific experiments, analyze the results, share them with the team, and plan for the next step to advance the project. The feedback from this survey will be used to make necessary changes during the semester so that all students have a positive learning experience and are able to contribute to the overall project. A scale of 1 to 3 (1 = a lot; 2 = some; 3 = none) should be used in responding to the questions.

1. How much experience do you have in general in working independently in the laboratory?
2. How much experience do you have in using the literature?
3. How much experience do you have planning experiments using the literature?
4. How confident are you of your ability to conduct your share of the research independently?

II. Survey to be conducted during the semester:

This part of the survey elicits your reactions to various procedural aspects of how the laboratory is conducted. It is designed to identify problem areas so that the necessary changes

can be made during the semester in order to improve your learning experience. Answer the questions with brief description or explanation.

1. Has your ability to work independently improved over the course of this semester?
 2. Have your skills in using the literature for planning your laboratory worked improved? If not, describe the problem areas.
 3. Are you able to keep pace with the team? If not, briefly explain why. For example: Are you too slow? Are others slowing you down?
 4. Is everyone on the team contributing their fair share to the project?
 5. Are the team members cooperative and helpful?
 6. What would you like to see changed with regards to team work?
 7. Is your overall experience so far positive?
 8. Are you more or less confident of your ability to apply the knowledge acquired in the lecture part of the course to the practice in the laboratory?
- III. The survey at the end of the semester will be designed to explore if the student acquired the knowledge and specific skills that are appropriate for this course. In other words, it will content-based and specific to the project the students work on.