

# **COMBINING THEORY AND PRACTICE IN THE TEACHING OF SCIENCE: A COLLABORATIVE PROGRAM BETWEEN THE CITY UNIVERSITY OF NEW YORK AND THE AMERICAN MUSEUM OF NATURAL HISTORY**

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The National Science Education Standards contain several mandates that share the use of alternative and creative experiences in the teaching of science at all levels. An important feature of these standards is the call for learning settings and environments different from the traditional classroom in order to enhance student interest and participation in the learning process. New York City is rich in institutions that are ideal for the implementation of effective science teaching through the use of informal resources. This article uses the American Museum of Natural History as a prime example of this.

## **Introduction**

The American Museum of Natural History is not only an important cultural resource, it is perhaps the most integrated, informal educational resource in the city, since its exhibits and collections deal with many scientific disciplines. This makes it an ideal integral component of a science teacher preparation program. Its use provides a great opportunity for stimulative and interactive explorations as a means to develop and practice inquiry in the teaching of science, in response to the mandates of the National Science Education Standards [1].

The Museum's new halls and exhibits contain activities that fit perfectly in the implementation of hands-on tasks advocated by the standards. Among the activities in the Gottesman Hall of Planet Earth are interactive opportunities to learn difficult concepts in physical science not typically found in a school setting [2].

## **A Collaborative Opportunity**

The alarming prediction of shortages of science teachers in New York City has prompted the City University of New York to develop a joint program with the New York City Board of Education. The Teaching Opportunity Program Scholarship (TOPS) was designed to bring individuals with outstanding science content preparation into the classrooms of the largest school system in the country. Applicants were chosen based on

their academic records, recommendations, and a short presentation of their teaching interests and styles.

The incentives for attracting qualified applicants have included a paid summer internship, assured employment in a public school beginning in the fall semester, and a tuition-free masters degree offered through a CUNY college.

Lehman College is one of the three participating colleges in the program; our commitment has been to help the public school system by placing our science teacher-scholars in the Bronx and Manhattan. The three phases of the program at Lehman College have consisted of participants' preparation at various levels:

- An intense summer program combining pedagogical preparation with field experience in teaching.
- A series of workshops during the fall semester to discuss issues in classroom management, lesson planning, professional development, and teaching strategies.
- A carefully designed graduate program leading to a masters degree and New York State certification in teaching various sciences.

The need to combine theory and practice has been addressed from the earliest stages of the program. During the summer internship, the participants were actively engaged in developing lesson plans through the use of technology, such as the internet, and software integration of content.

The participation in a three-day institute at The American Museum of Natural History during the summer internship paved the way for a collaborative effort between the museum and the City University of New York. Some examples of student work produced during this institute contain lesson plans that actively incorporated use of the halls. Among them were: open-ended expeditions dealing with extinction; others were about uncertainties in our knowledge about dinosaurs; and, others were structured expeditions about adaptation.

## **Curriculum Development Using the Museum**

The first result of the collaboration has been the development of a course utilizing the Museum as a resource for teaching life, earth, and space science. This course has been incorporated into the academic preparation of the participants by becoming a required course for their masters degree.

The course is designed to introduce the teacher-scholars to the use of the Museum as a place for learning science as professionals and for teaching science to their students. It is divided into three modules that are aligned with New York State Standards for the Living Environment (Life Science), and the Physical Setting (Earth and Space Science).

The course is being taught by a group of teacher educators and Museum scientists who have designed sessions that include curriculum resources, laboratory activities, study in specific exhibit halls, and responses to teacher's guides and films. The Museum is ideally equipped to serve as a resource for curriculum development in various scientific disciplines. The participants select the module that most closely supports their current teaching situation. Presentations of their resource file and a portfolio are required, in addition to the planning and execution of a Museum field trip with a small group of their students. The portfolio includes entries that illustrate the teaching unit selected and presented at the end of one of the modules. For example, biology and environmental science teachers might select the Life Science module to develop their teaching project. The Life Science module contains guided study in the Hall of Vertebrate Origins to study fossils as evidence of the historical record. The teacher can use the exhibits of fossil excavation to introduce fossil classification according to the way they are formed. The teacher can also use a cladistics activity from the teacher's guide to the Hall of Invertebrate Origins to demonstrate the principles of classification used by systematic biologists. Another lesson can use research in biodiversity to answer questions such as: What is biodiversity? What have we lost, what are we losing? What are some conservation strategies and solutions?

Each module is taught over a period of four sessions. The module begins with a content session taught by a teacher educator and a Museum scientist in the field of science of the particular module. The second and third sessions are taught by instructors

from the Museum Education Department, and the Board of Education who have implemented or developed Museum support curriculum labs, or Regents level courses. All instructors participate in the final session of each module and in the evaluation and assessment of the participants' work at the end of the course.

### **Additional Incorporation of the Museum in Teacher Preparation**

The second outcome of the collaboration with the Museum has been the restructuring of the research component of the Masters degree in science education at Lehman College. As the graduate advisor in science education, I have been exposed to various types of theses prepared by students in the traditional setting of our program. The majority of the topics have to do with statistical analyses of performance, or with the influence of societal factors on student achievement in science, etc. Although these studies may all have scholarly merit, they have seemed somewhat esoteric, and to lack a measure of relevance to our student population.

The first part of the thesis can be done in the traditional setting, although the students involved would only be science education majors, as opposed to being part of a larger group. The students will demonstrate competence in implementing principles of research by successfully completing the introduction to a project of proposed research in their chosen field of science (chapter I). The desired project is one that actively and creatively utilizes the Museum as the means to develop science instruction having the following features: a) it is standards-based; b) it encourages exploration; c) it is interactive.

The students will demonstrate familiarity with the background research in science education by successfully producing a review of the literature (chapter II of the thesis). The second part of the two-course sequence involves the completion by each student of the research project begun in the previous course, related to teaching science at intermediate and secondary school levels. The students will develop curriculum and instructional practices using the exhibit halls, the Museum library, the private collections, and Museum expeditions (an area where the Museum has expressed interest in increasing the participation and involvement of science teachers).

### **Benefits of Utilizing the Museum as a Resource in Thesis Design**

- The students enjoy considerable flexibility in their research design since the number of resources is indeed large and varied.
- The addition of new exhibits provides the means to remain current in their chosen field of research.
- The opportunities for fieldwork that involves empirical observations are vastly superior to what they can do in the traditional setting. This greatly helps the individual to become a representative of the scientific community in the classroom, as called for by the standards.
- The opportunities to engage in expeditions will stimulate the intellectual and exploratory tendencies of the candidates.
- The use of the Museum as a teaching resource will enhance its relevance to the public as a tool for active learning rather than as a repository for human knowledge.

### **Conclusion**

There are many partnerships between museums and other institutions, such as the Institute of Museum and Library Services [3]. Some have been developed to introduce contemporary art and multicultural education into high school curricula, while others, like the New Museum [4], are designed to integrate contemporary art into curricula for English, science, social studies, and other disciplines. Unlike most of the collaborations that exist between museums and schools [5], the innovative aspect of the CUNY-AMNH program is that it incorporates the Museum into a science teacher preparation program. Similar approaches have been recently implemented through a partnership of the Virginia Collaborative for Excellence in the Preparation of Teachers and the Science Museum of Virginia, resulting in a course entitled, *Experiencing Science* [6]. These courses are examples of what can be accomplished by such partnerships. We hope that with this initiative, the goal of reaching more students and thus enabling them to become scientifically literate can be more realistically attained. At the same time, the University and the Museum can expand their service to the student population in New York City.

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## Bio

Fernando Espinoza is Assistant Professor and Program Director of Science Education at Lehman College. He has been responsible for revising the science education program at Lehman to meet the standards, and to incorporate technology and inquiry in the preparation of teachers. He has received grants to develop science instruction and to implement an interdisciplinary approach linking the sciences with the arts and humanities. He has taught college and secondary school physical science since 1981. He earned a Bachelor's degree and a Master's degree in physics from Queens College, and received his doctorate in science education from Teachers College, Columbia University in 1996.

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