

BRIDGING THE GAP BETWEEN SCHOOLS AND NON-FORMAL SCIENCE INSTITUTIONS: USING NEW YORK CITY'S NON-FORMAL RESOURCES TO TEACH SCIENCE

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Effective science teaching and learning needs to take place in an environment in which the formal and non-formal worlds of science combine their expertise and resources. Science learning and ultimately, scientific literacy for all depends on the teaching that occurs both in schools and in non-formal settings. As we move towards the attainment of scientific literacy for all, it is becoming more imperative that we recognize and utilize the media, industry education programs, non-formal science centers, museums, and other science learning outlets as valuable segments of our nation's science education infrastructure. This paper describes the context, rationale, and outline of the non-formal science education course developed at New York University under the auspices of New York Collaborative for Excellence in Teacher Preparation (NYCETP) and the subsequently developed non-formal science education specialization.

Introduction

Non-formal science education sites encompass unique settings where information, stimulation, and experiences are provided almost entirely through objects, their interpretative display and more recently, manipulation of these objects. Science learning and ultimately scientific literacy for all depends on the teaching that occurs both in schools and in non-formal settings. As we move towards the attainment of scientific literacy for all, it is becoming more imperative that we recognize and utilize the media, industry education programs, non-formal science centers, museums and other science learning outlets as valuable segments of our nation's science education infrastructure [1,2]. Serious gaps currently exist in our educational infrastructure that limit the attainment of scientific literacy. A major gap is the lack of communication and collaboration between the many agents that are involved in teaching science. As educators, we need to form strategic partnerships between schools and institutions that offer non-formal learning of science and to view non-formal learning resources as a key

part of the educational system, systematically incorporating them into our science education infrastructure [1,2].

In spite of our focus on standards and inquiry learning, students often do not get first hand experience of natural phenomena. The out of school community is often rich in the resources to provide such exposure. Science museums, zoos, etc. present phenomena in the form of exhibits that are interactive, with a focus on enabling visitors to explore, manipulate, and experiment. Science teachers are often overwhelmed with the demands of covering a curriculum full of abstract principles. As a result, and regardless of what the state or national standards dictate, students are rarely given an opportunity to learn science in context. Non-formal institutions can rectify this situation.

Over the past 10 years and through my involvement with the New York City museums and science centers, I realized that these non-formal science sites had rich educational programs and resources that could be made use of by public school science and mathematics teachers to supplement and enhance their classroom teaching. Using my relationship with these institutions and with the support of the New York Collaborative in Teacher Preparation (NYCTEP), I developed and began to teach a course that would introduce future science and mathematics teachers to this rich educational resource and the educational programs and staff involved.

Initially, NYCETP and New York University faculty compiled a list of Non-formal Science Education sites in New York City with a description of their education programs, locations, and accessibility to schools and the public. This information was then published as a sourcebook to use in the course entitled, *Using New York City's Non-formal Science Resources to Teach Science*, which is now taken by pre- and in-service teachers and forms part of our non-formal specialization. This sourcebook is continuously updated and expanded in cooperation with faculty, students, and teachers who are currently involved in this project. Concurrent with the development of the sourcebook, we conducted a national survey to determine the need for training in non-formal science education, the availability of current and future jobs in the area, and the required components of a graduate program in Non-formal Science Education as perceived by personnel presently involved in Non-formal Science.

We felt that it was time to take advantage of the non-formal educational resources that surround us. Doing so would bridge the formal and non-formal, non-intersecting systems to provide our populace with access to science and technology, an understanding of their influence on our daily lives, and thus make some inroads in achieving scientific and technological literacy for all. The course, *E14.2050: Using New York City's Non-Formal Resources to Teach Science*, was developed under the auspices of the NYCETP. This is an optional course in the Master's Program for science and mathematics education. In this class, students are able to take advantage of the multitude of scientific resources in New York City. The course is offered both during the academic year and in summer.

The course involves three components that are equally supportive:

- Structured group workshops during which the students meet with a member of the site's educational staff to learn how the resources and programs can be utilized by classroom teachers;
- Non-formal, non-structured visits to selected sites to see the educational exhibits and programs that are offered to the general public; and,
- Seminars at NYU during which the students and their instructor can discuss and individually reflect upon their visits to the sites, their programs and resources, and their usefulness to classroom teachers.

The first component of the course requires structured visits to various non-formal sites throughout the city, such as: the New York Hall of Science, Bronx Zoo, New York botanical Gardens, Children's Museum, Museum of Natural History, Prospect Park Zoo, Liberty Science Center, Wildlife Conservation Society Aquarium, and the Intrepid. Each visit exposes the student to the rich educational resources that can be used by classroom teachers to facilitate hands-on mathematics and science learning in their own classrooms. Students are required to spend 4-6 hours participating in a workshop and visiting various exhibits at each site. During the workshops, a member of the site's educational staff:

- instructs students on how the resources and programs can be utilized by classroom teachers;

- provides handouts and vital information regarding each exhibit;
- proposes ideas for pre- and post-visit activities;
- gives a one year membership to each student in the class.

The second component requires students to make at least one non-structured visit to a non-formal site. During this visit, students are asked to look for ways in which they can effectively use the information presented at the site in a grade 7-12 science or math classroom. Students are asked to share their findings with the rest of the class, thus exposing the students in the class to at least 10 additional non-formal sites.

The final component of the course requires each student to conduct research on non-formal science education. Students administer a set of questionnaires to either grade 7-12 students, parents, or grade 7-12 science teachers, and in a group, conduct an in-depth literature review regarding their specific population, as well as analyze the group's data. Previous research topics included: *"Improving the Educational Quality at Non-formal Education Sites," "The Value of Non-Formal Science Resources to Teachers of Science,"* and, *"Non-formal Educational Facilities Effect on and the Use by the Adult Learner and the Family."* One of our outstanding students presented her group's research at the annual meeting of the Association for the Education of Teachers of Science in Austin, Texas in 1999. Her topic was, *"The Educational and Social Value of Non-formal Science Education."* Exceptional research groups will be asked to present their work at the Sharing Our Success (SOS) Conference at NYU on May 24, 2000.

Combining theory, practical application, and using the city as a "living lab," teeming with educational and instructional resources, is the focus of the course. Allowing future teachers to make connections with the educational staff at these institutions, so that they can make personal contact once they are full-time teachers and want to make use of these resources, helps to bridge the gap between public schools and non-formal institutions.

As a result of the immense interest generated by this course and the results of our survey, we subsequently developed a masters program that includes the following elements:

- a) A rigorous New York State approved certification program for pre-service and in-service teachers of Biology, Chemistry, or Physics, grades 7 – 12.
- b) Visits to various science institutions in the metropolitan area to become familiar with non-formal educational programs for:
 - Possible inclusion in classroom curriculum, and;
 - Information on how to plan an effective and educational trip, whether by using the institution's educational workshops or by composing self-guided tours.
- c) A six-week, full-time or a six-month, part-time internship at a science institution that will allow the teacher to focus on the daily activities of the institution's education or exhibit departments.
- d) A museum education seminar.
- e) A course on measuring the outcomes of science teaching.
- f) A content course taken simultaneously with a hands-on workshop at a science institution in the same subject.

By providing training in both formal and non-formal environments, graduates will have the skills necessary to bridge both educational systems. Whatever environment they decide to work in, these graduates will be trained in the required content, pedagogy, and non-formal science research and evaluation required by both systems.

Where Do We Go From Here?

We view this as the first step in the development of an academic home for non-formal science education. Future developments still require careful study and analysis. We need the kind of input provided by Friedman [1], Honeyman [2], and others as we expand our vision to train leaders for the rapidly growing field of museums, science and technology centers, zoos, aquariums, community activity centers, and multimedia and mass-media educational enterprises.

Our future plans include:

- a. Further discussion with faculty in science, psychology, education, museum studies, communications, and visual and graphic arts to

develop a doctoral program to be taught by faculty from all these disciplines.

- b. Strengthening relationships with non-formal institutions both globally and in New York City. It is anticipated that the institutions in New York City will provide daily research sites, “real world” experiences through practicum and internships, part-time employment, and avenues for the evaluation of teaching and learning in non-formal science. They will be a focal point for research, and formative and summative evaluation as we develop the curriculum. Faculty in institutions outside of New York City will be consulted for input, serving as readers and advisors on doctoral committees, and as consultants as we advance our research, evaluation and funding agenda for non-formal science education. ■

Bio

Pamela Fraser-Abder is Associate Professor and Director of the Program in Science Education in the Department of Teaching and Learning at New York University School of Education. She has written extensively in a variety of scholarly journals and published several books. Her research focus is on gender and cultural issues in science education and the learning of science in non-formal settings.

References

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