

**Explorers of the Universe: Interactive Electronic Network**

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### **Abstract**

This paper details how the Interactive Electronic Network is being utilized by secondary and postsecondary students, and their teachers and professors, to facilitate learning and understanding. The Interactive Electronic Network is couched within the Explorers of the Universe web site in a restricted portion entitled Gateway.

### **Introduction**

The Explorers of the Universe (<http://explorers.tsuniv.edu>) is a scientific/literacy project designed for students to actively participate and learn science and literacy skills in a collaborative format with classroom teachers, university educators, community members, and practicing scientists (see Alvarez, 1998a, Alvarez, 1995; Alvarez & Busby, 1999; Alvarez & Rodriguez, 1995).

A unique aspect of the project presents students with authentic problem-oriented tasks that encourage the incorporation of related subject disciplines as they engage in self-directed case-based research. During their research students are guided by the Action Research Strategy and use the Interactive Electronic Network to communicate and keep records in their electronic notebook, develop concept maps and interactive vee diagrams, and store information on their individual electronic portfolio.

### **Interactive Electronic Network**

The Explorers of the Universe Project is headquartered at the Center of Excellence in Information Systems, Tennessee State University. Dr. Marino Alvarez designed the web site for this project and the restricted Gateway portion is unique to this program. Goli Sotoohi manages the web site and is responsible for posting information, analyzing incoming data (e.g., concept maps, interactive vee diagrams, and notebook entries).

This management portion of the web site is divided into three consoles: Student, Teacher, and Researcher. Teachers at affiliated schools and professors at TSU manage their own respective students. They assign passwords and usernames, control incoming and outgoing communications between students, and have access to student concept maps, vee diagrams, electronic notebook entries, and portfolios. Students, once given a

password and username by their teacher, are able to construct concept maps, vee diagrams, enter notations and thoughts into their electronic notebook, and enter video clips, photographs, journal articles, drawings, simulations, and any other relevant information (print or graphic) into their own portfolio. Any portion of a portfolio can be shared with other students within a given school or with students at another affiliated schools if their teacher gives permission. When students want to submit their concept maps or vee diagrams for review by their teacher and researchers they submit them directly electronically via the Internet. Students also have a biographic file to enter any pertinent information about themselves including a photograph. The researcher console enables university educators, researchers, and scientists to access student entries, and respond by giving feedback to student maps, vee diagrams, notebook entry questions, and E-mails. When students log onto the Gateway portion of the web site, they are alerted to feedback responses. They click on concept map or interactive vee diagram and download the incoming information. When reviewing their vee, they simply highlight each epistemic element arrayed and a bubble appears with comments by their teacher and/or researcher.

Notebook entries and timed writings are analyzed using qualitative analyses. Once coded by the researchers and/or teachers, the information is entered into NU\*DIST 4, a software program, for analysis. Likewise, concept maps and vee diagrams are analyzed and scored using protocols developed by Alvarez (1998b). This aids both the teacher and researcher to determine the degree of conceptual understanding being achieved by students as they pursue their respective case investigations.

### **Action Research Strategy**

The Action Research Strategy (ARS) is displayed on the Library section of the Interactive Electronic Network. Students follow sequential stages of the Action Research Strategy: (1) problem/situation, (2) plan/strategy, (3) course of action, (4) resolution, and (5) action. Each stage corresponds to the epistemic elements arrayed on the vee diagram. The stages are designed for the learner to be the center of the learning process. The purpose of the ARS is to provide a conceptual framework for the student to think about, plan, implement, and reach closure with the case investigation.

### **Teacher and Student Investigations and Presentations**

During the past academic year, 1998-1999, high school students and their teachers presented their case research at national, international, and state conferences. University of School of Nashville students and their teacher presented at the Satellites in Education Conference, West Chester, Pennsylvania. Seventeen students and three teachers from the University School of Nashville, Hunters Lane High School of Nashville, and George Washington High School Campus, in New York City (a MU-SPIN affiliated school) presented papers at the International Reading Association in San Diego, California. Two high school students and their teacher joined Stephanie Stockman and Marino Alvarez in making a research presentation at the American Educational Research Association

Annual Meeting held in Montreal, Canada (Alvarez, Stockman, Rodriguez, Davidson, & Schwartz, 1999).

### **TSU Summer Institute**

This past summer a high school and undergraduate summer institute was held at TSU's Center of Excellence in Information Systems. High school students participated in self-directed research projects using the Interactive Electronic Network. Likewise, undergraduate students, under the direction of Ms. Montanez Wade, became engaged in projects affiliated with the educational and research objectives of NASA's Center for Automated Space Science (CASS) and NSF's Center for Research Excellence in Science and Technology (CREST). The high school and undergraduate students continue with their case research during this academic school year.

The CASS and CREST programs are funded by NASA and NSF to encourage underrepresented minorities to pursue advance degrees in science and engineering. One of the goals is to expose the targeted population for research careers in science and engineering. The CASS and CREST programs provide students with activities during the school year and in a summer institute.

During the eight-week session, undergraduate students became involved in several research projects. Students selected a variety of topics that included: designing a computer accessible remote weather station for installation at TSU's robotic observatory, composing web designs, developing interactive data bases, crafting system identification of modal parameters of a flexible beam system, designing a controller for a slewing beam system, and constructing robotic designs. Students attended seminars on various topics. These seminars included such topics as selecting a graduate school, developing critical thinking skills, C++ programming, enhancing oral and written communication skills and effective problem solving. The students used the Interactive Electronic Network to construct, communicate, and receive feedback on their vee diagrams and concept maps. These tools aided them in organizing and resolving their research topics. The Electronic Notebook was also used to record major milestones, and to develop a plan of attack to solve their particular problems.

Tiffani Cannon, a senior majoring in electrical and computer engineering, chose to design a C/C++ web site. Ms. Cannon used the metacognitive tools to plan and carry out her design of a web site for the C/C++ programming class. The program involved designing a tutorial for students enrolled in the C/C++ programming class to follow during their course of study.

### **Enhancing University Teaching and Learning Practices**

The Explorers of the Universe Interactive Electronic Network is being used in the College of Education and the College of Arts and Sciences. Goli Sotoohi has assigned accounts for Dr. Alvarez's graduate students enrolled in "Strategies for Developing Reading/Study Skills in Secondary Schools," and for undergraduate students enrolled in Dr. Busby's "College Physics I" and Dr. Burks', "Introduction to Astronomy" classes.

NU\*DIST 4, a qualitative assessment, is being used to analyze notebook entries in these classes as well as high school student journal entries. The concept map and vee diagramming scoring protocols are used to analyze student constructions of these metacognitive tools.

The aim is to involve other faculty members to use innovative teaching strategies with their students beyond lecture. Simultaneously, using the Interactive Electronic Network as a tool so that students and professors may better negotiate the curriculum. We foresee this Interactive Electronic Network becoming a model for other colleges and universities, space installations, museums, and so forth, where interactive negotiations take place.

## **Conclusion**

This interactivity between students (advanced, standard, and learning disabled), teachers, and researchers provide a forum for meaningful exchanges of ideas and a venue for these students to “show” what they can do in both visual displays and written form. Students with similar case topics have the option to share their ideas displayed on their respective maps and vee diagrams with others at remote locations. Even though the case topic may be the same, how they resolve their case is divergent. They collaborate with others, make entries, and notations, construct knowledge, and share this knowledge in ways that learning is meant to occur. The process is monitored and evaluated by their teachers and also by the researchers. This type of management approach lends itself to learning more about the learning process, and provides insight into ways that meaningful learning occurs with diverse learning and cultural populations.

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