PARTNERS IN EDUCATION
CHANGING THE WAY STUDENTS LEARN

Michael D. Williams
Naval Air Warfare Center Training Systems Division
Orlando, Florida

Marsha C. Vandivort
Edgewater High School
Chairman, Visual Arts Department

Jason Ahmanson
Edgewater High School
Student

ABSTRACT

The overwhelming ills faced by education today will never be cured by using outdated traditional processes for education. Worn-out lectures, tests and homework fall far short in challenging high school students to learn the skills they desperately need to face their rapidly changing future. The process is changing in Orange County, Florida, where the Naval Air Warfare Center Training Systems Division (TSD) and Edgewater High School, supported by Apple Computer, Inc., have joined under the *Partners in Education Agreement* to provide a new learning paradigm in one classroom environment.

The Training Systems Division needed a method to explain the underlying concepts of Distributed Interactive Simulation (DIS) and Edgewater High School was looking for ways to utilize their computer animation lab. Edgewater and NAWCTSD jointly planned a learning venture for the students to produce the DIS Instructional Animation. This project provided a "real-world" multi-media production which would enrich students' skills in visual arts, group dynamics, computer operation, and problem solving in a multi-disciplined team environment.

Students were encouraged to learn to structure a task from conception to completion, work in groups and independently, communicate ideas verbally and visually, manage time and set priorities. Students reported learning important skills from participation in this project such as: cooperation, drawing, color theory, organization, public speaking, advertising, brainstorming, animation, working with others, problem solving and business planning. What started as a simple classroom project, evolved in into a revolutionary teaching and learning experience.

ABOUT THE AUTHORS

Michael D. Williams is the DIS Lead Engineer in the Systems Simulation Branch at the Naval Air Warfare Center Training Systems Division. He has specialized in real-time simulation modeling and Distributed Interactive Simulation. Mr. Williams has a Masters Degree in Computer Engineering from the University of Central Florida in Orlando, Florida. His Bachelors Degree in Electrical Engineering is from Old Dominion University in Norfolk, Virginia. Email: williamsm@ntsc.navy.mil

Marsha C. Vandivort is a producing artist, fine arts administrator, and visual arts instructor. Her formal education includes painting studies in Germany, graduation from Northeast Missouri State University, post-graduate work at the University of Missouri, Southern Illinois Artists Workshop, Savannah College of Art and Design, and Internships with William Unger and Trevor Southey. She is currently Visual Arts Chairman and computer graphics instructor at Edgewater High School (Orlando, Florida) and a computer graphics curriculum/assessment writer for the Florida Educational Technology Quarterly.

Jason Ahmanson is currently a student at Edgewater High School and was one the student corporate presidents.

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"We are moving in a new direction to create an educational and training system that challenges American workers to match their skills to the demands of a fast-paced economy and challenges our students to reach for resources beyond their classrooms."

President William J. Clinton
"Technology for America's Economic Growth", Feb. 22, 1993

INTRODUCTION

Naval Air Warfare Center Training Systems Division (formerly the Naval Training Systems Center) develops, acquires, and maintains training systems for the Navy and Marine Corps. The Training Systems Division, in Orlando, Florida is a leader in Department of Defense Distributed Interactive Simulation (DIS) research and development efforts and serves as the DIS Agent for the Navy. DIS is a new and unique method of connecting dissimilar simulators, strategic planning systems, and instrumented equipment over an electronic network for combined exercises.

Edgewater High School (EHS) has been a part of Florida's Orange County Public School system since 1952. In response to an awareness of the high caliber of students in its community and throughout Orange County, EHS created the Engineering Science and Technology (EST) Program in August, 1991. With the success of the EST program, Edgewater has continued to embrace opportunities to challenge its students using innovative programs and by developing educational partnerships with community organizations. Educational partnerships between public schools, students, parents, and business can provide experiences, including those outside the formal classroom, that empower student learning through mentorships, cross-disciplinary studies and collaborative projects centered around advanced technology topics.

Naval Air Warfare Center Training Systems Division (TSD) initially joined Edgewater High School when the *Partners in Education Agreement* was signed with the Orange County Public School System in December, 1991. The original agreement provided for speakers, demonstrations and field trips to the TSD. As an outgrowth of this partnership, the Distributed Interactive Simulation Instructional Animation Project was conceived in January, 1993. This project was designed to provide EHS students with an opportunity to participate in "real-world" multi-media production which would enrich their skills in visual arts, group dynamics, computer operation, and problem solving in a multi-disciplined team environment. To facilitate communication, Edgewater was provided with a computer account on the TSD research VAX computer for an electronic mail link with the TSD engineer and access to the Internet.

BENEFITS OF OUR EDUCATIONAL PARTNERSHIPS

This animation project was facilitated through the joint efforts of professionals from TSD, Orange County Public Schools, Edgewater High School, and Apple Computer, Inc®. Even though facilitators provided technical advice, it was an important objective of this project that students be responsible for all creative aspects as well as the technical production of the Instructional Animation.

The students were introduced to many technical concepts of DIS during a formal presentation at the TSD. This meeting allowed Michael Williams to explain his needs and meet the student participants. The students were provided with information regarding the mission of the TSD, the concepts of training and simulation, and the principles of DIS. A timeline was presented to the students including several incremental milestones and a delivery date for the final product. Following the presentation, students discussed the feasibility of an animation project and decided to commit their time and creative efforts to it. The meeting concluded with a student brainstorming session to conceptualize the animation.

The success of this project was due, in part, to the contributions and efforts of many people. Throughout the project's lifespan, the students were assisted by subject matter experts in the areas of engineering and DIS, computer technology, creative writing, theater, and visual arts. *Parents volunteered clerical skills,* transportation, food, technical skills, equipment, and family time. Their support was invaluable.

The *Partners in Education* program transformed a classroom learning environment at Edgewater High School into a "real world" workplace. This program also benefited the Training Systems Division by providing a method of explaining abstract aspects of networking and Distributed Interactive Simulation. What started as a simple classroom project, evolved in into a revolutionary teaching and learning experience.

DISTRIBUTED INTERACTIVE SIMULATION

The Department of Defense has invested many resources in a wide variety of simulators currently located throughout the world. This investment of technology has provided our military with exceptional training in realistic, but simulated, situations. However, as the different military agencies have begun to operate in combined efforts, the need for training in coordinated missions has become essential. The Department of Defense wanted a way to interconnect these existing simulators and allow them to interact with one another in the same way that an air wing of F-18s interacts with an aircraft carrier in a battle group. The Defense Advanced Research Projects Agency (DARPA) began investigating Simulation Networking (SIMNET) in the late 1980s. Out of the SIMNET effort grew Distributed Interactive Simulation in 1990.

The primary mission of Distributed Interactive Simulation (DIS) is to create synthetic, virtual representations of warfare environments by systematically connecting separate subcomponents of simulation which reside at distributed, multiple locations. Basically, this means that simulation systems located at many different remote sites can interact with one another as if they were located in the same building. F/A-18 pilots training on a flight simulator at NAS Oceana, Virginia can train with other F/A-18 pilots training on simulators in Mayport, Florida. Within the simulation, each pilot can see the other aircraft. These simulations can also be linked and coordinated with training being conducted at other locations such as NAS North Island, in San Diego or any where else.

Distributed Interactive Simulation spans several vital issues: (1) the simulation systems connected on the network, (2) Protocol Data Units for information transfer via the network, (3) the network used to connect simulation systems, (4) the virtual environment in which the simulation takes place. The simulation systems which are being connected on the network are used to generate aircraft, ships, tanks, and infantry. These objects are given the generic name entities.

Protocol Data Units (PDUs) are used to package the information sent between the simulation systems. Each PDU contains information identifying the sender, receiver, and other information based on the type of PDU. For example, the Entity State PDU, the most frequently used PDU, includes the sender's network address, type of entity (F-14, M1, etc), XYZ location, XYZ velocities, and other critical information.

Simulation systems are connected via computer networks. The most common type used today is the Ethernet Local Area Network because of its widespread use, low cost, reliability, and ease of use. The local area network (LAN) is used to connect computer systems which are located within close proximity to one another (in the same

building). Other network architectures are used to allow simulation systems to communicate more information faster or over longer distances. Fiber optic cable is currently being used to connect computer systems which need to pass larger amounts of data faster. The Internet and the Defense Systems Internet (DSI) allow computers to communicate across the United States and farther.

In order to structure a training exercise, all entities must come together in the same area of the world. This area is referred to as the virtual environment. The virtual environment is a computer database modeled after a real place in the world. For the 1992 and 1993 Interservice/Industry Training Systems and Education Conferences, (I/ITSEC) we used a 100 square mile area on the coast of California called Fort Hunter Liggett. This database outlined the California shoreline, the terrain elevations, and terrain features such as roads, trees, and buildings existing on the real Fort Hunter Liggett area.

DIS has some key features which increase the useability, interoperability, and fidelity of simulation exercises: (1) There is no central computer controlling the simulation. Each entity must bring its own processing power or computer capability. (2) Each entity, or node, is autonomous and is responsible for maintaining the state of its entity(ies). (3) There is a standard protocol for communication with the DIS environment. (4) Each entity, or node, is responsible for determining what part of the simulation it perceives. (5) Dead reckoning is used to reduce the amount of network communication necessary.[2]

THE INSTRUCTIONAL ANIMATION PROJECT

For many years the Navy has relied on standard media to communicate ideas, projects, and designs. While video is being used more frequently, the standard presentation tools are overhead projectors, brochures, and documents. As the technology being communicated has grown increasingly more complex, the methods of communication have remained the same. Distributed Interactive Simulation is an example of one of those new technologies which usually requires hours of explanation for new users to visualize entities, simulators, and virtual battlefields.

Edgewater High School was exploring possibilities of computer animation via an educational grant from Apple Computer, Inc®. When Marsha Vandivort and Michael Williams sat down and began discussing the feasibility of communicating the complex ideas of DIS through animation, the two technologies seemed a perfect match.

The DIS Instructional Animation Project employed computer animated sequences and voice clips to explain the underlying concepts of DIS. The Edgewater student group created two characters, a blob and a janitor, who interact through a cartoon format to explain DIS Entities, the DIS communication protocol, and the different methods of networking. The animated cartoon depicts the blob leading the janitor on a journey around the DIS system while explaining three main areas of DIS. This journey takes the characters into the network cables, out to a real battlefield with simulated aircraft, and inside of a computer system.

This project provided a unique learning platform, giving the students insight into a current Department of Defense research effort, the operation of Apple computers, and the dynamics of multi-media. The primary objective of this project's founders was to make this entire production as true to the real world as possible.

Students were encouraged to work in groups as well as independently, learn to structure a task from conception to completion, communicate ideas verbally and visually, manage time, set priorities, and master computer skills. To provide the students with a non-traditional, highly effective learning environment, the organization of this student team was modeled after that of a real corporation. The corporate structure included the customer, employees, management and executive officers.

The customer was the TSD. The president of the corporation was the visual arts instructor, Marsha Vandivort. The students made up the employee population with four of them serving as vice presidents. Student executive responsibilities included communicating information, such as corporate and client meetings and delegating assignments from the president. Although all

students were involved with the design process, certain student management teams provided Quality Control, Sound Editing, and Scripting.

The real-world business organization of work allowed students scheduled in different classes at different times of day to coordinate their work. Because they scheduled their own deadlines according to a production delivery date, their abilities grew rapidly in totally new learning areas. Virtually every skill needed for the entire project was a new one for the group.

The fact that the corporation had the capability to interview, hire, promote, or dismiss employees based on production needs and work performance, helped motivate all students to carry their share of the workload. Regular corporate meetings were held to make work assignments, prioritize time, delegate project responsibility, critique the animation, and evaluate progress. Student communication and organizational skills improved rapidly as they assumed their full corporate responsibilities.

STUDENT DEMOGRAPHICS

This student corporation provided a unique and diverse learning environment. While student ages ranged from 13 to 17 years old, most students were 15 or under at the start of the project. They were born in six different states and hailed from five countries. Their native languages included English, Hungarian, Popumentu, Vietnamese, French, Spanish and Farsi.

Although a few students were first introduced to the Macintosh computer as early as 1988, most had their first computer experience just a few months prior to starting work on this animation project. Only two members of the group had any experience with the software used to create the animation or with sound editing. In addition, most students had a minimum of art study and some had none at all. Because students' abilities varied throughout the group, students rapidly learned that they needed to share their knowledge with one another. This peer-level instruction maximized student expertise and became a valuable component of this learning process.

Emerging visual arts technology today provides an expansive opportunity for personalizing study to meet the specific needs of each student, from exceptional and learning disabled to gifted and talented. In this project, traditional teaching and learning methods were abandoned in favor of more efficient roles for both teacher and student. The teach was no longer the "expert", but rather became the "stage manager" in a theater where students became problem-solvers and developed skills for life-long learning.

In addition to the established partners in the project, the expertise of a wide variety of professional in the community was utilized: a children's author/illustrator taught storyline development, a film-maker showed students how to sequence video, a businessman calibrated the color printer and a local musician helped students learn to compose music on a computer.

Students said they learned the following important skills from participation in this project: cooperation, drawing, color theory, digital sound, organization, public speaking, advertising, brainstorming, animation, working with others, problem solving and business planning. They said developing imagination, flexibility, leadership, and responsibility were real world competencies which were gained.

The most dramatic changes came in the growth of students as individuals. The girl who started the project with red dreadlocks, blue combat boots and a nose ring developed enough self-esteem to buy a business dress and speak before the school board. A learning-disabled student became a specialist in mechanical illustration and was sought out by other students when they had drawing problems. And a student on probation for gang-related violence apologized when he had to leave group work to do community service. The proof, in this case, is more **in the process** than **in the product**. Combining the know-how of the professional business world and government with the strengths of traditional education and packaging it in a project-driven format can change both the scope of education and the futures of the students involved.

The students carry a normal academic workload, spend their spare time painting, running, skating, performing music as well as working on computers. However, they have devoted countless hours for the successful completion of

this project They anticipate careers in engineering, military aviation, computer repair, fine arts, physical therapy, advertising, design, and animation. No matter what their vocational choices, clearly this experience will contribute to their future success.

Students say that they have "re-approached coursework by learning how to accomplish, instead of simply learning how to retain." According to one student, he will "know how to work in tough situations, about down time and short deadlines" and "to share what [he's] learned with others and to learn from them in order to get a job done." When students express the impact the project has had on their futures, they site "develop[ing] personality traits like patience, cooperation, self-confidence and flexibility" as important things the project provided.

By having input into what they learn and do each day, students maintain that they have mastered far more skills than they would have in a traditional classroom and have definitely worked harder and had more fun. In forecasting the corporation's future, they see their corporation as an ongoing concern, continuing to seek new clients, with new projects, offering new challenges as the years pass. They hope that their student successors will have the same opportunities to innovate and excel with future projects.

A STUDENT VIEW

When asked to describe this learning experience, Jason Ahmanson responded with the following:

"This project has helped me learn how a corporation works. We were divided into groups, each having a 'vice president'. I began as a worker, but then, the vice president of my group couldn't attend our summer class, so we decided to vote on a new vice president. We had one of our many corporate meetings and whomever wanted to be a vice president, including me, made a statement of our qualifications and then left the room. The remaining people took a vote and I was chosen to be the new vice president. This experience helped me to become a better leader rather than a follower.

I've since better learned how to work in a group along with increasing my communication skills, which I needed since a major part of this project was continuity. It was quite hard to keep the characters and background looking the same since we had many different artists, each with different skills and ideas, who didn't draw the same.

We had to solve many problems to accomplish this animation. For example, the greatest one was the technology we had to work with. While our computers were great, they couldn't stand up to this big project. We were constantly running out of memory and files were being lost for reasons still unknown.

Another problem, sound editing, just ate up our limited memory even more and forced us to employ another entire team. We had one of Macintosh's best computers, the Centrus 650, and we still filled it up. So it's safe to say that technology was one of our greatest barriers. However, with hard work and perseverance, we have overcome most of these obstacles.

We were not all artists when we first got involved. In fact, some of us didn't know the first thing about art. Then again, others didn't know the first thing about computers. We first learned a little about each other, and shared our ideas about the subject we knew best with the 'professionals' in the other areas. I think we all turned out being good artists, and computer technicians while learning to put all of our skills together toward a single goal.

In conclusion, I found this project to be hard at times, but then again, nothing's rewarding unless you work for it."

LOGISTICS

The DIS Instructional Animation project began during the spring semester of the 1992-93 school year. As the school administration began to see the importance and scale of this project's undertaking, a decision was made to introduce a three-week summer school program specifically geared to this project. The students met seven and a half hours a day to work on this project and received one hour of fine arts credit in Advanced Computer Graphics. This contiguous working time allowed the students time to create and draw large segments of the animation. The

accomplishments of the summer program laid the essential foundation for the completion of the project.

As the fall semester of the 1993-94 school year commenced, student schedules were rearranged so that most of the corporation could have one class period a day to work together. The interaction of students sharing work assignments required that they be in the computer lab in the same time block.

Designing and rendering computer animation is an extremely time consuming process and is difficult in the framework of a standard school schedule. Students volunteered many Saturdays and evenings mastering animation software, producing storyboards, and drawing frame-by-frame animation on the computer.

As the students echoed frequently, computer capability was a continuous design challenge. Performance and quality began to decrease because within the school budget we were unable to purchase high performance computer animation hardware and specialized equipment. High-grade multi-media animation and rendering requires tremendous amounts of computer memory and storage space. This problem was partially solved when Apple Computer, Inc.® was invited to join the partnership and lend the students the high-end computer resources necessary to complete this project.

IMPACT OF THE PROGRAM

The Project Manager's Perspective:

At the initial meeting, in April 1993, the project students from Edgewater High School were not initially impressive. They listened to the DIS presentation with polite interest. They seemed like a typical cross section of high school students and DIS was not as interesting as skateboarding, track, or music. However, after two weeks, the storyboard presentation for the animation was amazing. The students had researched the concepts of DIS, formed their corporation structure, sketched and colored a storyboard, and constructed a script for the two characters.

Over the next few months, I worked directly with the students through Saturday workshops on the animation software, visits to the school, and telephone calls. Initially the students wanted to give-up at every hurdle; however, slowly, as they became aware that problems would not be simply solved by me, their teacher, or some other outside force, they began to research the issues, work through some of the problems, and decide on alternative plans when a problem could not be solved completely. This group of students gained a new perspective on learning and worked through many of the corporate problems which we deal with on a daily basis.

Teacher's Perspective:

Attempting to produce a high-tech product for a client on a deadline, with neither expertise nor equipment was both challenging and frustrating, but throwing out traditional educational lecture, demonstration and testing methods was a joy!

We are all best motivated by what we see as *valuable and applicable to our own lives.* Providing students with the opportunity to structure their own goals, through a hands-on project that they have helped design, definitely raises the learning curve - and not only for the student. We know that solid new curricula must be designed to incorporate the best foundations of the past, yet be responsive to what we find crucial for the future--that means re-evaluating not only what is taught, but also how it is learned. Validating assessment of learning (non-traditional grading) and managing special travel and working arrangements for students outside the routine classroom setting required the commitment of everyone involved.

The wide variety of skills these students learned are every bit as valid as the "time in seat" skills of traditional education. The corporation format we used allows students to master skills in a real-world setting, using the expertise of a wide variety of professionals in our community. These students consistently rose to meet challenges that would have frustrated professionals in the graphic arts world and became individually and collectively responsible for their actions.

CONCLUSIONS

When we began this project we never anticipated the intense amount of effort which would be required to bring it to fruition. The time and

equipment requirements of this type of multi-media production are foreign to today's public school curriculum. The collaboration needed to utilize experts from throughout the community requires a new attitude about volunteerism and innovative structuring.

As a prototype program, the Instructional Animation project encountered unforeseen problems. Many aspects of the project were more difficult because the technical resources were not readily available. Better access to necessary resources will greatly benefit future projects. Secondly, the visual arts lab was a multi-purpose lab used thoughout the day. For future projects it would be helpful if a dedicated, open-access lab space could be provided so that students could utilize other free periods of the day to continue unfinished tasks. The continuous support of Orange County Public Schools and Edgewater High School administrations dramatically aided this project in overcoming many obstacles.

The benefits derived by the students from this project are basically a result of their active participation in the teaching and learning process. A tremendous amount of the knowledge and skills which the students gained surfaced on a need-to-know basis as the skills became necessary to the students' effort. The students then saw their direct application and remembered the concepts. Additionally, a marked increase in self esteem was noted with each incremental success. Finally, the students gained a respect for the abilities of their peers and the school gained a respect for these students.

Even though the TSD benefits directly from the use of this product, there is a far greater gain. These students are the decision makers and problem solvers of tomorrow. The abilities that they carry from this project will benefit us all.

LAURELS

The students have been recognized for their work by the Organization for Parents and Educators Networking (OPEN) and the Orange County School Board. In addition the project was chosen for presentation at the 1994 World Hyper- and Multi-media Conference, Vancouver, Canada and for publication in the annual School report of Orange County to the State of Florida.

The Naval Air Warfare Center Training Systems Division was also awarded Government Partner of the Year for this project by the 1993/94 Orange County Partners In Education Committee.

REFERENCES

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