COMPUTER GRAPHICS, BUSINESS, AND EDUCATION: MAKING THE CONNECTION

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ABSTRACT

Professional educators cannot be isolated in their professions as simply conveyers of information who direct curriculum materials toward their students. The fact is that within our profession teaching very often occupies the smallest portion of our workday. In an effort to maintain a high standard of technological excellence in our programs we are responsible for continually reviewing and updating curricula. Indeed, our instructional materials must reflect the high standards that business and industry will demand of our students once they graduate and enter the world of work. An effort must also be made to recruit and encourage the perpetuation of our field by actively seeking out students at the public school level as a means of guiding future scholars toward a career in computer graphics. All these efforts require concentrated efforts and plans that have been well thought out so our programs may continue to grow and prosper. An idle approach to recruiting and securing continual support from business and industry will sound the death knell for any computer graphics program regardless of how well its curriculum may be laid out.

Keywords: Computer graphics, business, education, summer camp, cooperative, internship.

1. INTRODUCTION

As professional computer graphics educators we are faced with many challenges and responsibilities that demand our time outside of our teaching duties. There are always curriculum issues to deal with, committee meetings to attend, publishing demands, fund raising, or grant writing. Indeed, our time spent in the classroom is often the thing we do least as teachers. It seems with each successive year the need to meet new technological standards, stay within budget constraints, or expand our research agenda diminishes the time that we have to spend with our students. If we are to be able to reach the professional goals that we have set for ourselves and our programs it is essential that we pursue diverse or new strategies to accomplish the tasks laid before us. If computer graphics programs are to move forward and stay current with the new technologies that our students will need to understand, and indeed become proficient in their execution, then we must look to sources outside of the formal educational systems as companion sources of support. You will notice that I do not refer to alternate sources of support, but rather stated the need by using the term “companion”. To be sure, education can no longer be viewed by any society as a “stand alone” enterprise that can prepare the raising generations to meet the needs of both society and the work force of the future. While education may once have been viewed as a system where the young went to sit at the feet of master teachers, there to glean the knowledge needed for a productive and fulfilling life, the demands of a technologically rich global environment have long since created a work place that demands more than instructional theory and practice. Those educational systems or programs that still rely on teaching information in the traditional manner, that is, as it has always been done are destined to go the way of the dinosaurs; those who cannot tolerate the evolving environment in which they live will ultimately perish under the weight of change. As Dahl (1990) wrote, such an educator is identified as an educator that “…does it [teaching] by the numbers in the classroom and often incorporates ubiquitous cardiovascular (“I know in my heart it is right”) and gastro-intestinal (“The kids really eat this project up”) decision making strategies.” Teaching as we have been taught will no longer satisfy the goals of the future.

If the demands of the work place have changed, and education is still holding onto out dated ideas of delivering knowledge to students, then what must be done to rectify the situation? The realistic solution may not be clear to everyone, as it too, at first, appears to create even further demands on the time of educators. However, it can be conceded, more often than not, that the only viable solution is not an easy one to put in place. Also, that once the solution is identified and put into motion, it will not simply govern itself without careful nurturing. It is a strategy that requires educators treat the solution like a newborn baby. Very often educators, like a concerned parent, watch anxiously over a program in a manner much akin to how the loving parent protects the infant who at first is helpless. It is a solution that requires feeding and changing, one that must be taught how to stand and become mobile. In truth, it is a solution that will demand constant attention in the beginning, but eventually grow into a mature being that will find its own destiny and drive itself forward. The solution is to answer face-to-face the object making the demands – in short, the demands of business and the work place.

The wishes of business and industry must be listened to seriously, and in fact, welcomed as a part of the new curriculum. But, this is not all, business and industry must not simply stand around shouting orders. They must be welcomed as partners in the educational process. They must become as involved in sponsoring change within computer graphics programs as the educators themselves.

2. ADDRESSING THE DEMANDS OF BUSINESS AND THE WORK PLACE

If the needs of business and industry are to be met through education then each must commit to become a partner in the students learning. As Feldhaus (1995) said, "We do not offer education for education's sake alone, but for specific occupations…". [Rowe95a] Paralleling this view, Lovejoy (1995) wrote that, "…education is to teach students the skills they need today as well as the ability to assimilate and apply new information to new situations that inevitably arise in the work place". [Lovej95a] Who will identify the specific skills needed by students? It will not be education to be sure, but instead must be business, industry, and the work place.

How then can business and industry address the needs of its employees and translate them into the experiences students will have in formal education settings? There may be several roads to this destination. Those of us who have been educators in universities, community colleges, and proprietary schools should recognize that not all educational opportunities exist in the classroom. There are many avenues that we can travel in an effort to have our students be as well prepared for using their of computer graphics skills and problem solving abilities in a wide range or business and industrial enterprises. Perhaps the first step in making business and industry a partner in education is to simply invite them to be such.

Industrial Advisory Boards

Partnerships begin with the organization of an Industrial Advisory Board (IAB). The mission of the IAB is to meet periodically with a program and review their curriculum, enrollment statistics and graduation requirements of the program with which they are involved. The board must be composed of members from businesses and industries that have a vested interest in the students as potential employees. This is not to say that the IAB is used for the sole purpose of providing employment venues for students (although this does happen simply based on need). The IAB is established to advise and guide the computer graphics program on staying current with technological and current practices within the work place. Their recommendations may be in the form of suggestions in regards to the sequence and scheduling of course work, credit hour requirements, the need for external work and study experiences, or the adoption of new technologies.

Members of the IAB should be invited from companies that have the ability to meet market demands and serve the interests of the community at large. The idea that local business concerns should be an active player in education as the member of an IAB is not a new one. What is new however is the teaching of computer graphics, like all other disciplines of technology, is too important to leave solely to professional educators. While teachers at all levels must balance their time between the demands of carefully prepared instruction and the political concerns of universities and colleges, the IAB can act as a concerned third party whose expertise in the work place can lend support to the need for new policies and practices. In response to the need for well constituted IABs we are reminded that:

> For the first time in history, the business of education to prepare everyone for successful living has become too important to leave only to educators. We now must form partnerships that involve every sector in developing an education process that is meaningful and relevant…Whether we are educators at the elementary, secondary, community college, or

> university level; leaders of business, industry or labor; parents or community leaders; we all have a vested interest in the economic futures of our young people. [Hoern95a]

Further on this subject, the IAB has the ability to remind teachers in which direction the subjects they teach are pointing. While at a conference in London on one occasion, our department promoted the view that all computer graphics curricula should be based on teaching the 3D paradigm as the foundational component of all graphical areas of study concerned with computer generated imaging. Such a thought to many of those present was a step in the wrong direction. I encountered questions from bewildered colleagues as to the need of students who have chosen careers in digital publishing or WWW development to study solid modeling and geometry. We must now view graphical data, not as a stand-alone series of bits and bytes, but in the context of the database's interactivity of all other forms of digital communication. How are we to escape requiring our students to understand the need to be comfortable in the 3-dimensional world of the computer's mind and to understand how it sees data if they themselves have no spatial skills? Of course the answer is, we can't! When we approach the teaching of computer graphics we must remind ourselves of the words of Smith (1995), "We must stop asking ourselves, "Are we doing things right?", and ask ourselves, "Are we doing the right things?" The IAB is there is assist our programs to grasp what the right things are that we must be teaching. [Smith95a]

Cooperative Education and Internships

We would be remiss if we believed that only the addition of well placed advice from of an IAB would be all that is required to have our students become technologically proficient. The fact is that a well-balanced education is founded on the principles of theory *and* practice. While teachers may be expert in presenting their charges the material that has been incorporated into their curriculum, there is also the matter of practical experience. In 1908, President Theodore Roosevelt, wrote to the National Society for the Promotion of Industrial Education supporting the idea of that technical education must be a "…combination of school and shop [practical] instruction". [Roose08a]

Speaking in support of students being well acquainted with industrial and business practices as part of their educational careers, Kennedy (1990) also reminded us of the social aspects of combining technology and practical experience when he wrote:

> Ignorance of important aspects of American industry has high costs. In the broad sense, it creates a citizenry that lacks the understanding or an appreciation for the industry and technology that provide the necessities and comforts of life. It produces voters and government that are poorly equipped to deal with changes in industrial practices and demands. Such ignorance leads to fuzzy objectives and misplaced priorities in laws drafted and money spent. [Kenne90a]

In an effort to provide students with practical experiences in industry and business while they are yet pursuing their degrees, two plans have found success in some measure: Cooperative placement, and Internships.

Co-operative placement is a study option offered at a community colleges or universities that provide students with an opportunity to break their formal studies at the school and work in industrial or business settings. "Co-ops", as they are commonly called, may follow several scheduling formats. The most popular format is the "2 plus 1" plan, where the student attends their college or university for two semesters and then leaves their formal studies to work on real world projects at his or her host placement company for one semester. The cycle continues until the student has completed 5 semesters their host.

While coops may be an excellent opportunity to gain practical experience they are particularly well suited to "non-traditional" (sometime called "mature") students, who have families to support and cannot bear the weight of the financial strain created by being a full-time student. Younger students do not always take advantage of the coop opportunity as it lengths the traditional 4 year plan of study to at least 5 years. Most traditional students are anxious to finish school as quickly as possible. During the coop a host company must enter into an agreement with the college or university detailing exactly what the student will be doing during their placement. In addition, teachers for the program must visit to student on-site at the host company and speak with them and their supervisors to ensure the terms of the coop are being met. At the conclusion of each coop period an evaluation by the student's supervisor is forwarded to the attending teacher for their consideration. In addition, the student is required to write a detailed report of their experiences.

Internship

Internships also provide students with the opportunity to gain valuable practical "on the job" experience. However, they do differ in some aspects from that of the cooperative education experience:

1. The internship will usually last no longer than 12 weeks and take place in the summer months when the student's formal studies have been concluded.
2. The internship may be a paid position, or may be taken without pay just for the experience. (Coops are always paid!)
3. The internship provides a valuable opportunity for students who have never had a full time job to gain real world experience.
4. Internships may also allow students to live in foreign countries and therefore gain a view of the world that they have never had before. In the last ten years many agencies that specialize in finding students foreign placements have sprung up.

As a professor who teaches "Professional Practices" (a course that deals with teaching students how to prepare a proper resume, negotiate their first employment contract, etc), it has been my experience that most students have only their course work from the university to offer a company. The lack of any practical experience in their chosen filed is a serious deficit. In brief, course work alone just isn't enough to make a student valuable to a company. Business enterprises exist to make money by solving the problems clients bring them. Companies therefore need employees that have some experience in the real world of work before they hire them. The internship meets such criteria.

In this section we have explored options available to us by using external resources to support or diversify our computer graphics programs. As we have only mentioned a few here we could explore many additional ideas that may particularly well suited for our individual circumstances. Support could be expressed in regards to expanding the usefulness of the IAB by having its members instruct courses in professional conduct, become members on graduate student committees, or review and judge the senior design projects of graduating students. But, let us now turn our attention to how we can promote and strengthen our programs by looking to education itself.

3. PROMOTING COMPUTER GRAPHICS WITHIN EDUCATION

If we are keeping an eye on the future of our programs, we must be on the lookout for new students. Speaking visits to high schools to make presentations about our programs is a common way of alerting potential students of what options in graphics are available to them when they enter higher education. There are also "Days On Campus" events where high schools visit the campus with students who wish the chance to investigate the various programs in place. All of these are good in and of themselves, and provide a valuable recruiting tool for identifying students. However, more can be done to not only promote the study of computer graphics earlier in high school course work, but also the teaching of graphics.

At Purdue University the semester system is used to schedule class work. This means that the various schools within the university are all very busy from late August until mid December, and from mid January until the middle of May. In some cases summer classes are taught for one additional month in the summer concluding by the middle of June. This leaves faculty free, and computer labs empty, until August each year. (A survey of institutions similar to Purdue reveals those computer graphics programs usually have little course work scheduled the summer months.) Traditionally, summer months in graphics programs have been used by faculty members to revise curriculum, create new courses, attend conferences, and of course, enjoy their vacation time.

Beginning in June 1998, the Department of Computer Graphics at Purdue sponsored a one-week "Computer Graphics Summer Camp" aimed at providing an intensive overview of the areas of concentration offered within the department. The camp targeted high school students in the 10^{th} and 11^{th} grades who were interested in computer graphics. The camp was organized as a "on site" experience. Students attending the camp were housed in the university dormitories and provided with rooms, meals, transportation, laboratory privileges (which included access to the Internet), an animation film festival, demonstrations by the physics and chemistry departments, and free use of the universities sport and entertainment facilities as part of their stay. While it would not be practical to detail every aspect of the camp in this paper, the major concepts on which the camps are organized and the principle goals of each camp should be mentioned.

Camp Objectives and Activities

The idea for the computer graphics camp was initially prompted by the faculty's desire to try and recruit talented students to our program. The camp also appeared to be a practical venture due to the open availability during summer months of the facilities and services of the university had to offer. The objective of the camp was to provide a venue that would allow students and parents the opportunity to visit and participate in a graphics program that would allow them to use software packages unavailable at their home schools, enhance skills they already possessed, experience campus life at a university, and get a taste of what the university and program could offer them when they were ready to enter higher education. The camp would also allow the faculty to maintain a closer tie to the public school system.

The camp allows students to explore software packages through assignments and demonstrations. Each student is assigned to a group of no more than 20 attendees, and rotate through the laboratory sessions with faculty acting as instructors. The camp laboratory activities centre on the software that the department has adopted in its program. Sessions are held which use AutoCAD, PhotoShop, Rhino, FrontPage, FreeHand, 3D Studio Max, and a variety of design software packages. Laboratory sessions are held in the morning and afternoon sessions of the camp leaving the evenings for activities like the animation film festival, science shows, and entertainment. One day during the week is also dedicated to field trips where the students travel to business and cultural exhibits to view the practical application of computer graphics. Tours have included television broadcast facilities, museums, IMAX theartres, scientific laboratories, and entertainment centres.
Due to the diverse level of computer literacy within the student groups, several exercises and activities are planned to accommodate the skill level of each student. As t he camp has been designed as an exploratory experience care must be taken to ensure that each student does not feel that they have been placed in a technological situation that is beyond their computer abilities. If such a circumstance happens the goals of the camp would be immediately defeated.

While the main objective of the camp is to expose students to the possibilities that lie ahead of them, there are other ways to use the camp idea to benefit computer graphics education. Workshops for professional educators have also been planned. In this setting, colleagues from the public school system may attend 3 days of intensive training in their teaching filed. Teachers spend their time at the workshop in one area and receive in-depth exercises in a particular software. Instruction is provided by university faculty members and by representatives from the software companies. Teachers are able to use the camp as a means to upgrade their teaching certification, upgrade their skill level, or to simply become acquainted with a new software package. The benefit to the workshop setting for educators is the short time period in which it may take place. Workshops can also be offered during vacation time throughout the school year. The cost is low due to the short period of training, and time spent away from their personal duties is minimal.

4. CONCLUSION

In this paper an opinion has been forwarded that lays some of the courses of action available to promote, improve, and deliver better instruction in computer graphics education. It is clear that it is no longer possible to meet the technological needs of society, business or industry without widening the circle of stakeholders who must become actively involved in our profession.

We have only begun to explore the possibilities of how cooperative education courses, internships, camps, and workshops can be used to strengthen and expand our programs in computer graphics. We have not even discussed the use of graduate education programs, international or domestic faculty and student exchange programs, research agreements between institutions, recruitment at conferences, external committee work in professional organizations, and consulting activities. There are opportunities to closely link business and industry to our programs through directed projects where students provide their skills on real projects while still attending their home institutions. At Purdue, the Department of Computer Graphics has been active in providing products and services to corporations such as Caterpillar and Bethlehem Steel that centre on student groups. Students have also generated digital products for broadcast media centres and cultural organizations that have approached the department to assist in finding unique solutions to their peculiar graphics needs.

The field is wide open and shows no end of slowing down in terms of the types of activities and resources that can be used to support our programs. The future has never been brighter, or provided more opportunities to enhance our programs. Computer graphics is not a road that we can travel alone any longer.

5. REFERENCES

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