

# Developing a Digital Media Curriculum at a Regional Liberal Arts University: A Case Study

Cher Cornett, Peter Hriso  
East Tennessee State University

## Abstract

Faculty and administrators at state supported, liberal arts universities face significant challenges when designing, implementing and maintaining digital media or computer graphics programs. Computer graphics have a place in nearly every discipline from entertainment to engineering, education to research science, communications and the arts. Therefore, it is no surprise that computer graphics programs have developed from various disciplines within the university, with similar programs housed in diverse academic units. This fact alone indicates one of the challenges: balancing the need for cross disciplinary instruction within the structure of a traditional university where disciplines tend to be segregated. Our challenge was to create a computer graphics curriculum that provides a balance and a clear connection between these multiple disciplines, and which can function successfully within the structure of a traditional liberal arts university.

At East Tennessee State University (ETSU), the rapid evolution of digital media as a concentration in the Department of Technology & Geomatics, new directives from the Tennessee Board of Regents regarding general education requirements and the statewide standardization of hours required for degrees, and an influx of new faculty, created an environment in which a major reconstruction of the digital media curriculum became necessary. It also provided an opportunity to take lessons learned from the faculty's various industry experiences, research into industry expectations and desires for the education of computer graphics specialists, and discussions generated by presentations at various computer graphics educators programs, (including ACM SIGGRAPH conferences) and apply them to the redesign of the Digital Media curriculum.

The goal of this presentation is to both share an account of the ETSU faculty's experiences and lessons learned from the program development with those who are also in the process of developing or revamping a digital media curriculum, and to generate feedback from the academic and professional community.

## The Case

The Digital Media Program at ETSU began as the Engineering Design Graphics (EDG) program in the Department of Technology. Initially, training in CAD for manufacturing and architectural construction was the extent of the program. In 1994, the program was expanded to emphasize computer visualization, especially high-end 3D modeling and animation, and quickly broadened to include character animation and special effects. Courses in interactive media and Web site design and development were later added to support applications of computer mediated communication in business and industry.

In 2000, EDG faculty proposed a new program to replace the Engineering Design Graphics program. By fall 2002, a Bachelor of Science in Digital Media, with four areas of concentration in the undergraduate program—Visualization, Product Design, Hypermedia and Multimedia—

was approved, and a new concentration in Digital Media was added to the Master of Science in Technology.

The student population within the Digital Media program is currently over 300 majors (undergraduate and graduate). Recent registration of incoming Technology students revealed that more than 50% were planning to pursue a concentration in Digital Media making it the fastest growing area of study within the Department of Technology.

As in other universities with digital media or computer graphics programs, the rapid development and evolution of this program presented some difficult challenges. These challenges included (but certainly weren't limited to)

- designing a curriculum that balances technical skills with conceptual and aesthetic skills, while making the best use of available faculty expertise,
- keeping up with the rapid developments in computer graphics technology,
- battling increasing funding requirements for support of the program,
- managing rapid growth of student enrollment with too few full-time faculty,
- coping with frequent and often significant changes in the curriculum resulting in advisement problems, inconsistent and “mixed-bag” programs of study for students, and duplication and inconsistency in the delivery of course content,
- attracting and retaining qualified faculty,
- difficulty in establishing and maintaining cross-disciplinary relationships with other departments and programs on campus,
- and managing a profound culture change resulting from the transition from traditional engineering graphics roots to a much broader emphasis encompassing 2D and 3D visualization, animation and interactive multimedia.

In 2001, the university recognized the necessity to increase the number of full-time faculty for the program from the current two, and six new faculty lines were approved, including a new program coordinator. Requirements for these positions included not only teaching experience in digital media related subjects, but also significant industry experience, a decision that later proved to be invaluable. In fall 2002, the newly hired faculty was charged with evaluating a newly implemented Digital Media curriculum, and making revisions and additions as necessary to provide an appropriate education for the students with a vision of creating a “world class” digital media program.

The new faculty team was faced immediately with a large task. The brand-new curriculum, which had not yet been tested, had to be implemented. Many of the courses were at the “new development” phase. At the same time, students were in a state of uncertainty and frustration due to the recent program changes and the unfamiliar faculty. Severe budget cuts statewide and dwindling external support had already eroded the state of the computer labs, which were quickly becoming outdated. Software was several versions behind in some cases, and multiple software packages in the 3D concentrations were being used, forcing students to start over with different software in successive courses, making it difficult to get to a reasonable level of expertise in any of them. At the same time, a substantial technology fee specifically for the digital media major was approved by the Tennessee Board of Regents to offset the high costs of the program which, when announced, further exacerbated student's frustrations.

During this first semester, it became evident that there was still a tremendous amount of work to be done to develop the curriculum if it was to meet industry expectations.

### **Evaluation of the existing curriculum**

As the faculty began the process of familiarizing themselves with the curriculum and analyzing the curriculum structure, significant problems were immediately identified. Foundation courses that should have been required for freshman or sophomores were only offered as senior-level electives. Some courses duplicated content. Courses from the engineering technology curriculum that had little or no relevance to the educational needs of digital media students were still required as part of the core curriculum. Courses required for each of the concentrations included many non-relevant courses, while courses that should be an absolute “must” for each of the areas were not listed at all. There was no course material dedicated to preparation of portfolios, so graduates were leaving with no understanding of industry requirements for presenting themselves and their work. Also, two of the concentration areas—Multimedia and Hypermedia—were too closely related to truly be separate concentrations of study.

There were other issues discovered in this first semester. Many entry level classes were predominantly occupied by senior level students who, though generally satisfied with the content, structure, and delivery of the courses, had to seek out advanced projects that allowed more sophisticated work to be developed for their portfolios. When we looked at our graduates, particularly those employed in our region, we found that a large number of graduates who had been trained in one concentration were not working in their desired field (for most, 3D visualization or animation), but in another (print media primarily). Having previously worked in the commercial sector, each colleague immediately recognized the need to reset the established curriculum to meet current industry standards.

Acknowledging that the program would require more significant modification than originally supposed, the faculty elected to approach the redesign of the curriculum as if we were starting from scratch. We set an aggressive working schedule, meeting every other Friday for over a year to work out the details. Each faculty member took responsibility for part of the curriculum, reworking existing courses, and creating new courses as needed. Politically, this was a risky move for new, non-tenured faculty, so great care was taken to be able to justify the changes

We began the evaluation process by looking at programs from which industry giants such as PIXAR, Digital Domain, ILM and EA consistently recruited new talent. We used these programs as our initial benchmarks, evaluating the various curriculums, and noting pros and cons of each program.

We sought advice from professional organizations such as ACM SIGGRAPH and the International Game Developers Association (IGDA). Although neither organization reviews education curriculums, both had published guidelines for the development of digital media curricula. SIGGRAPH published Bertoline and Laxer’s “*Guidelines for Curricula in Computer Graphics in Visual Arts.*” [2002] This was a preliminary report outlining proposed guidelines for curricula in computer graphics in the visual arts. In 2003, the IGDA education committee published a modular curriculum framework for universities interested in designing programs for game related study. This framework was not a single detailed curriculum, but a set of

recommendations that described the knowledge areas and practical skills required for making and studying games. The ACM SIGGRAPH education committee held several sessions between 2001 and 2003 involving computer graphics educators in the pursuit of drafting an ideal curriculum related specifically to computer graphics in the visual arts, and material discussed at these sessions was included in our considerations.

Our next step in the evaluation process involved recruiting an industry advisory board of digital media professionals from both our east coast community and from the west coast. Included were nationally recognized experts currently working within the digital media field and regional professionals who could speak to the needs of our own community. We enlisted individuals from web and multimedia development, game development, video and film production and post production, and from the 3D visualization and animation fields. We met informally and individually with members of the board as we started working on a revamp of the curriculum. We held our first formal Advisory Board meeting with the east coast advisors at the start of the 2003 fall semester to discuss changes we had already made, and how we could continue to re-engineer the program to better prepare our graduates to enter the workplace. We now have two scheduled Advisory Board meetings each year—one in the fall for our regional advisors, and one for our west coast/national advisors held in conjunction with the SIGGRAPH conference.

Finally, the faculty looked at courses offered in related programs within the university such as Art, Broadcasting, Computer Science, Advertising, Theatre and others in order to familiarize ourselves with these curriculums, learn what courses would be available to our students as possible electives, and avoid duplication of courses. To this end, we met extensively with faculty and chairs of the related programs, and discussed the potential for opportunities to work together in the future as we developed our program.

### **Redesigning the curriculum**

How do you design a curriculum that can provide students with a solid foundation of technical, aesthetic and conceptual skills, give students a wide range of choices for specialization within their areas of concentration, and be flexible enough to adapt to changes in technology and the industry?

We started with the “givens”. In Tennessee, all undergraduate programs are limited to 120 hours unless specific professional accreditation requirements demand otherwise. 41 of these hours must be taken from general education courses required for all liberal arts students in Bacchalaureate programs. For the Bachelor of Science in Technology, some specific general education courses are required at ETSU, such as Probability and Statistics, Physics and a second science course limited to those for science majors only. This left us 79 hours for the digital media curriculum. In our design, we elected to continue the practice of offering 4 credit hour lecture + laboratory courses for the majority of our production-based courses as this allowed lecture, demo and in-class practice to take place simultaneously.

We agreed that the Digital Media program (DIGM) focus should be on 3D visualization, animation and interaction design as these were areas not emphasized in the other programs.

We then looked at basic skill sets and principles that should be required for all students entering the digital media field that would cross over our program's areas of concentration. Essential areas of study were determined to include critical thinking, concept development, and visual workflow, 2-D design concepts and principles, color theory, mathematics (at minimum pre-calculus), raster- and vector-based image manipulation and illustration techniques using industry standard software, an understanding of graphics file formats, computer graphics terminology, and a basic knowledge of the history of computer graphics. Good written and oral communication skills, the ability to function well in teams and across disciplines, project management skills, an understanding of ethics and professional practices for the arts, and portfolio development were also deemed to be essential, based on our research and on industry advice.

We needed to inform our students about career choices available while they were still at the beginning of their academic training. Too many students were entering the program with a vision of working for PIXAR (for example) without fully understanding the reality and requirements of an animation production position. To broaden our students' awareness of real world employment opportunities, and to give them hands-on experience in a cross-section of skills within our program's concentration areas, we developed two required foundations-based courses—Principles of Visualization and Principles of Interaction. These classes cover design and development of web and multimedia products and 3D visualization and animation production. Both courses introduce related computer graphics history, an overview of the basic concepts and skills required, and an introduction to the career possibilities available to them in each discipline.

As we set up the order in which students would take courses, we considered how each course would thread to the next. First year students are introduced to rendering techniques and visual perception as well as concept visualization and design process techniques in the DIGM Visual Thinking course, and take Color Theory and 2D design offered in the Art department. Students continue to learn and apply color, composition and design principles in the Vector-Based and Raster-Based Imaging courses. These courses use applications such as Adobe Photoshop and Illustrator, standard design and illustration programs used in the digital media industry. These courses were also designed to meet "using information technology intensive" requirements. Since we are in a department of Technology, we decided to differentiate all of the DIGM courses from similar courses offered in other programs by emphasizing technical skills, while still stressing good aesthetics and creativity. Students then enter the Principles courses where they apply the technical and artistic skills learned to the creation of interactive and 3D applications. These core digital media and art courses were designed to be completed by the end of the sophomore year.

Upon completion of these core requirements, students elect to focus on an area of concentration: Digital Animation, Digital Visualization or Digital Interaction. Each concentration includes its own set of requirements which work to shape and refine the student's direction and skill sets.

In the Digital Interaction concentration we wanted students to have both strong visual design and computer programming skills. We found a thorough understanding of typography and graphic design to be fundamental and essential skills for Interactive design students, and in this concentration, a good knowledge of print production is an advantage. Industry advisors indicate that today's graphic designers must have Web interaction skills to compete, and Web designers

often have to produce print components to their interactive works. Students in this concentration begin to learn programming fundamentals through a basic procedural scripting course offered in the Computer Science program. The Web Design and Interaction Design courses further develop design and scripting skills as they are applied to interactive interface design, and HCI usability principles are stressed. Elective courses in web programming and development offered by the Computer Science program are encouraged.

In both the Digital Visualization and Digital Animation concentrations, Drawing Fundamentals (and the 3D Model Design courses were required. In Visualization, CADD was included as a requirement since many of these students find work in the Product and Industrial Design fields. In the Animation concentration, a new DIGM Animation Fundamentals course was developed as a requirement, and Acting and Figure Drawing were also required. Elective courses in Engineering Technology were encouraged for students wishing to find careers in Industrial Design fields, and electives in art were encouraged for Animation students. Intermediate and advanced elective courses in DIGM were developed for both of these concentrations to include Lighting and Rendering, Product Design, 3D Animation, 3D effects, Character Animation and Technical Direction. A senior level Digital Media Production course was developed to give students in the various disciplines an opportunity to work as a class team on a single, semester long professional project.

Digital video courses were also added to support all of the concentration areas. These included instruction in non-linear editing, motion graphics, 3D to video compositing, streaming media, and sound production. An interesting result of this series of courses has been an increasing number of our students entering the work force as digital video specialists. This has caused us to look at Motion Graphics as a potential new area of concentration.

In all concentrations, students are encouraged to take courses from the entire Digital Media course inventory as electives in order to broaden their range of skills. We also acknowledge the importance of engaging students in interdisciplinary study for a broader based education. With the significant amount of overlap in the digital media fields, a wide array of options both within and outside of the DIGM curriculum is available to the digital media student, so required advising in every semester is necessary to guide students in the selection of an appropriate mix of courses.

Finally, students take a Portfolio Development course in the last semester of their senior year, where they are required to produce both a print and an electronic (demo reel or website) portfolio. This class also covers professional practices, copyright law basics and how to perform an effective job search in the digital media arena.

As a result of the program redesign, the old Visualization concentration was divided into 2 concentrations: Digital Visualization and Digital Animation. The Multimedia and Hypermedia concentrations were collapsed into one: Digital Interaction. 19 courses were deleted, 20 new courses added, and 7 courses were substantially redesigned. With this extensive a change, a plan had to be designed to help transition existing students into the new program since it was impractical to continue to offer all of the old courses until these students had graduated. This took working closely with the records office to work out appropriate substitutions for all of the

previously required courses, and advising students became a larger than normal part of the faculty's duties during this time. This transition plan had to be submitted to the curriculum committees as part of the approval process.

The revised curriculum was approved by the Tennessee Board of Regents in 2003, and offered in its updated form in the 2004-05 catalog. Work continues in the refinement of this curriculum. We worked with the Engineering Technology side of our department to develop the Product Design Concentration for which we will provide the digital media service courses; and a 24 credit hour minor in Digital Media has now been designed. Both are currently going through the approval process and we expect to be able to offer both in the 2006-07 catalog. We are currently working with Computer Science to develop a collaborative program specific to game design and development.

### **Updating and Funding the Infrastructure**

From the program's beginning 12 years ago, it was recognized that the maintenance of a digital media program was an expensive endeavor. Many universities that offer a digital media program, or even just digital media courses, have discovered the difficulty in maintaining these programs on state support alone. At ETSU, initial funding came through the sponsorship of Alias Wavefront and Silicon Graphics, who between them donated in excess of \$15.5 million in equipment and software. At the time a single copy of the Alias software was approximately \$250,000, and only operated on a Unix computer. This sponsorship was a direct result of faculty research with Alias Wavefront to develop the first degree program to use this innovative new software. A private philanthropist, Scott Niswonger, followed this up with a donation to the university of \$1 million to update facilities and equipment. Even with this support, and additional grants for software tied to research being done by digital media faculty, there was no continuity of funding. When these initial funds were spent, faculty and other university officials had to spend a considerable amount of time trying to find additional sources of donated funding. Fortunately, software and equipment costs have come down considerably, but with three 19-seat labs that must be replaced every three years in order to meet university information technology standards, and with the need to keep software updated, annual costs for a program the size of ETSU's Digital Media program have averaged in excess of \$130,000 in the past 3 years for computers and software alone. As the program has grown, we are now looking at adding a 4<sup>th</sup> lab for the fall 2006 semester, which will increase the overall annual costs.

In Tennessee, budgets for education are lower than in most states, and tuition is also relatively low, making requests for more than the usual amount of funding for a program very difficult to justify and have approved. At ETSU, when private funding became less available, funds were reallocated from other programs at the university to help support Digital Media, which by this time had become a flagship program. This created corresponding problems with the relationship between the Digital Media program and other programs that provided the necessary support courses needed by DIGM students. Often these programs were denied funds needed for their own growth at the expense of the more visible Digital Media program.

When the new faculty came on board in 2002, we found a great facility, thanks to the Niswonger funding, but the equipment was reaching the end of its lifespan, much of the software was outdated, and there was little available in the way of teaching resources that students could use to

develop projects (printers, scanners, cameras, light kits, graphics tablets, animation stands, media resources, etc.). A proposal was made to the Board of Regents to allow for a dedicated program enhancement fee of \$100 per credit hour for each Digital Media course, over and above tuition. The fee was implemented for the first time in the spring 2003 semester. This was a necessary, but very unpopular development with the students for reasons that extended beyond the rather substantial increase in the cost of their education. The new fee had not been announced to students ahead of time, and was implemented in the middle of the academic year when it was too late for students and parents to restructure financial aid. Furthermore, the increase was implemented without any kind of transition plan for students who were already enrolled in the program. The burden on the students was too much, too soon, and offered little chance that those currently enrolled in the program would see the benefits prior to graduation. Protests by parents and students resulted in the president of the university working with us to establish a phase-in period for the fee for current students, while assessing the full fee for new students effective in summer 2003. Even so, student morale was very low during this period, and the fee resulted in a significant drop in enrollment.

It took over 2 years to raise enough money from the fee to replace equipment and software in the 3 labs. Now, the Digital Media Center is able to offer state-of-the-art labs and excellent resources to our students. Students who were enrolled during the transition are now able to see the benefits of the fee and are no longer opposed to the changes to cost or curriculum. Enrollment has reached its former levels, and when compared with programs we have benchmarked ourselves against, the cost for a digital media education at ETSU has proven to be a good value, even with the fee. We now have a sustainable source of income that allows us to ensure better than average facilities, equipment, and resources, as well as improved professional development for faculty, a dedicated program advisor, and support for student research and independent development activities. Also, faculty grant writing efforts can now be focused on research, creative activity and entrepreneurship rather than on securing funding for needed software and equipment.

### **Continuing challenges for growth and evolution of the digital media curriculum**

We are now at the end of year 4 in the restructuring of our program. Much has been accomplished, but with the continuing growth of career opportunities requiring digital media skills, and rapid changes in the associated technology, continuing assessment of instruction and the commitment to adapt both program and infrastructure in order to meet current and future industry needs is essential. We have defined a mission for our program, have established instructional goals and learning objectives, and have started designing instruments for evaluating and assessing how well we are accomplishing these goals and objectives, but to truly be able to assess our program against our benchmark programs and according to commonly accepted standards for digital media programs, external review is needed.

Our position as a program within the Department of Technology in the College of Business & Technology (CBAT) presents some unique challenges in this regard. Our program is at its core, a visual arts program, even though we have an emphasis in the applied use of “technology” to create digital media. We are the only program within our college that has a visual arts focus. CBAT administrators, and even our colleagues within our own department, are unfamiliar with the unique learning conditions required by students in the visual arts, and many decisions that affect our program are made by those with little or no in-depth understanding of art and design.

Digital Media program needs are sometimes sacrificed to the requirements for a degree in science.

At present, the Digital Media program is not professionally accredited, so external program review and the benefits and protections of accreditation are currently unavailable to us. This includes the ability to justify and enforce standards common to other programs of our type— student/teacher ratios for studio and laboratory courses, and the ability to specify general education or graduate program requirements that may differ from the requirements of the other disciplines within our department (Engineering Technologies). Accreditation would also provide external and unbiased assessment of our curriculum to insure that we stay accountable to national standards. We must therefore seek other ways of informing CBAT decision makers of our specific needs, such as expanded involvement of industry advisors, and external review panels recruited from other programs of our type. We are currently seeking accreditation, but have not yet been able to identify an appropriate organization that can fully accredit us. We are currently referencing NASAD (National Association of Schools of Art & Design) standards as a guide, and have started the process to be included as a “related” program and reviewed along with the Art Department in 2007. Our administration is however, strongly encouraging us to find an accrediting body within the engineering or computer science disciplines.

Expanding and improving opportunities for interdisciplinary study is a challenge at ETSU since we are separated from most of our potential interdisciplinary partners by college. Our ability to work effectively with Art, Broadcasting, Theatre, Advertising, Education, and other areas in the College of Arts & Sciences is considerably more difficult due to the inevitable political differences and philosophies between colleges. As a result, we have had to make a concerted effort to develop relationships with faculty in the arts disciplines while trying to avoid conflicts within our own college.

### **Lessons learned in this process**

Due to the perceived “crisis” situation encountered by the new faculty and the immediate difficulties that had to be addressed in the first year of this process, much of the development began on the new curriculum before we had firmly established a coherent set of goals for the program. We have since discovered that it is far easier to design a coherent curriculum when you take the time to define a program mission, establish assessable goals and learning objectives, and develop a strategic plan for growth and maintenance of the program beforehand. We have since done this, and have had to make subsequent changes to the original plan. One backlash result of this has been a refusal by our College to allow us to bring forward new changes for nearly 2 years.

Some of the faculty has since gone through assessment training for instruction, which has proven to be extremely helpful as we prepare for future accreditation. Since program assessment should be an integral part of the curriculum design process, assessment training is helpful for any program undergoing new program development and is well worth the money spent.

Allow for much more time than you think it will take. We were extremely lucky to have been able to fast-track a lot of this development (in part due to statewide changes that coincided with our new development), but under normal circumstances it would be impossible to move as quickly as we did. The faculty must be willing to commit to the time needed to build a good

program. It takes a lot of collaboration, a willingness to continue working toward consensus when colleagues disagree, and to compromise personal views when necessary in order to design a program in which all can be confident.

A substantial level of industry advisement is essential for more than just the advice they give. Since we are not an accredited program, we do not have the leverage accreditation standards give us to justify programmatic changes, teacher/student class ratios, credit hour requirements, and even funding requests. The recorded feedback from the advisory board meetings helps to offset the lack of formal accreditation as we evolve the program.

Get student feedback and support for curriculum and program revisions, and keep them informed well in advance of changes. We now have an online bulletin board (the Digital Media Forum) to give students a way to communicate with us and each other. We also have a general meeting for our students every year to report on how their dedicated fees are being spent, and to update them on curricular changes. This gives them an opportunity to make requests and ask questions, and allows them the opportunity to manage their educational plan more effectively with no unnecessary surprises. We have discovered that student involvement and support has made a big difference in our ability to implement needed changes.

Continually work with interdisciplinary partner programs to maintain a good level of communication and support. This is an ongoing process, and takes a huge commitment from all involved, but the advantages are equally huge. University approval of curriculum when supported by partner programs is easier, and awareness of issues across programs breeds more collaboration and expands opportunities for both faculty and students.

Finally, when restructuring an existing program, carefully craft a plan to help students transition smoothly into the new program as they are the ones most affected by ongoing changes. Required advising every semester helps to eliminate potential problems and minimize uncertainty during these times.

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