2006-1728: ISSUES IN TEACHING AND ASSESSMENT OF COURSES IN RAPIDLY CHANGING AREAS

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Issues in Teaching and Assessment of Courses in Rapidly Changing Areas

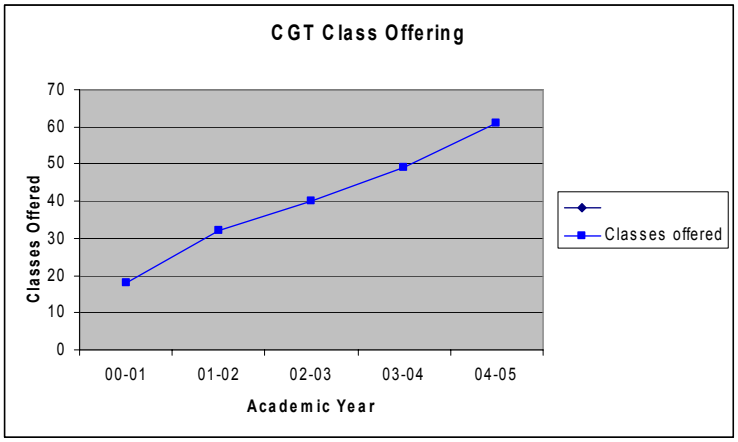
Abstract

The past decade has shown an exponential growth in technology in all areas of the academic curriculum, and especially in the technology based fields. This growth has put great pressure on the academic community to preserve learning objectives and outcomes while still maintaining assessment criteria in the areas of current technology. Technology changes rapidly in the Computer Graphics field and the faculty find themselves continually updating and changing their courses to keep step with current changes in the technology, both in hardware and software. Course consistency in the form of learning objectives and outcomes is an important assessment measure. Many problems can arise in assessment while keeping up with the technology, to the point where some assessment measures may become obsolete. In response to that, this paper will explore a number of questions that deal with the issue of rapidly changing technology within the learning environment. This paper will explore teaching and learning styles, technology issues and how to develop a base for measuring and assessing courses in a rapidly changing environment as well as developing a standard for course consistency. A number of questions will be addressed including: How does an educator keep up, and what is the significance in teaching the "old" technology verses the "new" or "upgraded" technology? Which teaching styles lend themselves to this type of rapid change, and how do these styles affect student knowledge retention? How does an educator assess the technology skill level and set a base for continued course assessment? While examples specific to Computer Graphics Technology programs will be examined, comparisons to other technology programs will be presented as well.

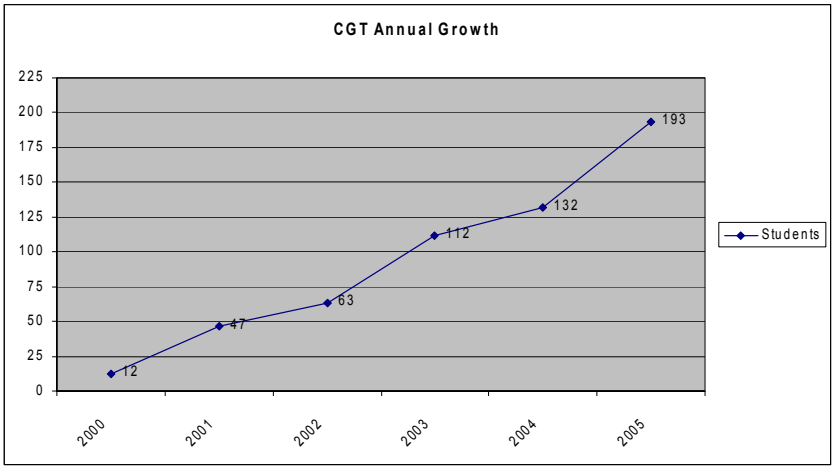
Introduction

For our Computer Graphics Technology Program at Purdue University Calumet, we use assessment measures which include faculty evaluation, class critiques and written peer evaluations that individually addresses each level of technical, aesthetic and creative aspects of each project or assignment. Discussions or critiques first address the success of technical aspects, then move to the aesthetic aspects, and then the overall creative attributes of the students' work. This type of evaluation is not only valuable for the students to comprehend each level and put their soft skills to work, but also provides valuable assessment feedback to the faculty.

The CGT program is relatively new, having been started in the year 2000 with 18 students, and having grown to its present size of about 200 majors. The program has faced many challenges, not only with the rapid growth of the program, but with the large number of updates and technological advances in that time period.



How does an educator keep up, and what is the significance in teaching the "old" technology verses the "new" or "upgraded" technology?



The nature of Computer Graphics requires continual upgrading of one's skills. There are many avenues for keeping current in the field. These avenues include joining professional organizations such as ACM SIGGRAPH, IGDA and others where new technologies are introduced, dissected and explored. These organizations also provide opportunities to meet other professionals with the same interests and concerns. These relationships can be very beneficial when upgrading to new technologies. User groups are another area where the latest technologies are examined and explained. Many of these user groups provide forums, discussion boards and help centers to provide tutorials, explanations and advice on new technologies. Academic institutions, both classroom and online, can also be a mechanism for educational opportunities.

There are specific elements within Computer Graphics that are fundamental regardless of the technology employed. The earliest animations to the latest CG masterpieces all employed to one degree or another many of the following techniques.

- Squash and Stretch
- Timing and motion
- Anticipation
- Staging
- Follow through
- Straight ahead action
- Exaggeration
- Appeal
- Personality

Without the traditional concepts, an animation would be very unappealing. Along with the fundamental concepts that should be foundational within a curriculum, older and simpler technologies are a good beginning for introducing the student to new ideas and concepts. Simple hand-drawn cell animation can provide an excellent launching point for the introduction of more complex animation technologies. As the professional educator ponders the many options with the expanding technologies available, there are basic concepts and fundamentals that should not be discarded or minimized in the Computer Graphics field.

Teaching styles which lend themselves to rapid change: Rapidly changing technology requires lower level learning in all levels

One of the major problems in rapidly changing technology is the requirement of some form of "lower level" learning such as comprehending and remembering basic information and concepts. The faculty need to make sure that learning goes beyond the "lower level" and includes problem solving, decision making, critical thinking, and creative thinking proficiency within each course, while "keeping up" with the new technology. Courses within a technology degree focus on the hard-core technology where new technological changes are incorporated and updated frequently. Thus, technology degree courses require a certain amount of "lower level" learning or new concept technical skills within all courses of a degree from the 100 to 400 levels, along with the inclusion of problem solving, decision making, critical thinking, and creative thinking proficiency. Technical change affects course consistency and delivery on a regular basis. Soft skills, technical skills and aesthetic expertise are essential in setting the stage for life-long learning and aid in setting a base for course consistency and assessment.

Proposed teaching and leaning styles which lend themselves to rapid change in technology

A student learns more effectively when information is presented in a manner consistent with their favored method of acquiring and processing information. Keeping in mind that technology students have a propensity to be kinesthetic and visual learners, faculty teaching in technology needs to deliver new materials in the favored method. Auditory learning will be enhanced with hands-on demonstrations and discussions. Thus auditory learning will be enhanced by kinesthetic and visual learning. A teaching style that incorporates open class discussions, verbal participation, and active demonstrations (where students participate with the lecture) will enhance learning and discovery of new technology. This will open the door to active participation in group projects, critiques and peer discussions. Teaching styles which incorporate active learning aid in self-discovery, which is not only valuable to students in the class room, but also to faculty who must also keep up with the new technology.

Susan M. Montgomery points out the learning styles of today's students in her paper "Addressing Diverse Learning Styles Through the Use of Multimedia." [1] She states that the current college students grew up with television, movies, video, and video-games. Visually displayed information is prominent in our society. She also points out that "these people have developed an intuitive "feel" for the new media, along with heightened impatience". The following table exhibits the learning styles of today's students' favored teaching formats, other than lecture. [1]

Table 1 - Learning Styles vs. Lecture

Learning Styles	**Lecture Characteristics**
67% Active	32% Reflective (Passive)
57% Sensing	42% Intuitive
69% Visual	30% Verbal
28% Global	71% Sequential

Students need guidance, leadership and delivery of new technology concepts as well as soft skills and aesthetic expertise. Delivery of these concepts often puts faculty in the role of "teaching". Self-discovery and practice with application of these concepts is enhanced through research, comprehensive projects and group projects. With students actively learning, and experiencing self-discovery of new concepts, they can claim ownership of their accomplishments and creative

application. This is important in student retention, helping the student discover in steps, integrate and participate in the exciting new technology. Continued assessment of soft skills, aesthetic, and technology helps the student discover strengths and weaknesses, providing a platform for continued improvement and discovery. Continued assessment of soft skills, aesthetic and technology aids in course and program evaluation as well as defining successful teaching styles.

Soft skills can help with course consistency in rapidly changing technology and set a base for continued course assessment

The soft skills such as communication, teamwork, decision making, critical thinking and problem solving skills are important concepts. They are so important that most of the TAC of ABET "a-k" criteria are "soft skills" [2]. A rapidly changing technology course can be evaluated through assessment measures by incorporating and evaluating specific soft skills. These soft skills can be put into practice and applied within the specific technical course degree offering. Each consecutive course will build on the soft skills "put-them-to-work" within a specific technology genre. A good avenue for practicing and assessing soft skills within a specific technology degree is through group projects, critiques, discussions and "real-world" projects, including issues of ethics, and allowing students to practice critical thinking, problem solving, creativity, and communication skills.

Evaluating Aesthetic Expertise; another level to assessment of rapidly changing technology

The need for creativity and professional aesthetic competence is prominent in Computer Graphics and should be addressed and built upon in each sequential course. This also provides a basis for establishing course consistency through assessment. Aesthetic competence is acquired though an understanding of the composition and design principles as well as hands-on practice with each, using traditional and technological tools. Good assessment measures begin with weekly class assignments, both group and individual, which apply the composition and design principles in small concepts. In the lower level courses composition and design principles are heavily addressed and practiced on a new concept level. In the upper level course they are still addressed, but combined and built upon to aid in design maturity among the students. Weekly assessments include quizzes, research, and historical and contemporary observation, as well as written and oral discussions of others works to gain an understanding of the application of compositional and design concepts.

Projects and comprehensive exams should build and combine the aesthetic skills sequentially throughout the semester. Thus the 100 level courses will teach beginning technical skills and the upper level a combination of advanced technical skills, aesthetic skills, and creative application of composition and design principles. Critiques, class discussions and group project discussions should involve more advanced design and composition vocabulary and relay a deeper understanding of technical and aesthetic resolve. This teaches not only the technological skills but the soft skills mentioned above. Projects emphasize portfolio material and faculty at various levels in the degree evaluates student portfolios. By including aesthetic evaluation and assessment measures, a faculty can evaluate the student as well as the course progress, alongside the technology requirements. For example, if a specific course has undergone a major technology change and new graphical interface concepts are being taught, (lower-level learning), the faculty can assess the students continued maturity in aesthetic concepts regardless of the class level.

Traditional art classes have always incorporated lab and hands-on practice to master their craft in their choice of medium. Critiques and open class discussions historically have been valuable

assessment tools for faculty and student. The onset of rapidly changing technology and the computer as a new medium has added a new layer to the quest for creative maturity and an understanding aesthetic resolve. Faculty in their quest to keep-up and learn new technology have had to give-way to pure creative "studio" time, now called lab time. Teaching styles which incorporated open discussion and creative studio time have been divided into more demonstration of computer interface and new technology concepts.

Programs which do not change as often do not face the need to assess in the same way. A more routine type of assessment may work for that program. One program which does not face this type of ongoing technological change, Organizational Leadership and Supervision, makes great use of industrial advisory boards to keep the curriculum current and responsive to current market requirements, but does not need to update on an annual or biennial basis. Their assessment measures are done on a course and program basis and reviewed periodically, but the type of program and course assessment remains more stable over time. There is more opportunity for the program to test what works over a relatively long period of time, without factoring in the high level of content change faced by programs such as CG.

Many engineering technology programs exhibit a mix of constant, basic skills along with rapidly changing skills. For instance, in Mechanical Engineering Technology (MET), topics such as statics, dynamics, strength of materials, etc. remain relatively consistent from year to year. Advances in computer slowly change these course, but not to a drastic degree. Engineering drawing, on the other hand, has undergone a drastic change from two-dimensional paper drawings to computerized, three-dimensional parametric models. This has radically changed how mechanical design is done, and much research has been done and continues to be done in this area [3]. Consequently, assessment measures in these areas have received much attention as well [4].

Evaluating and assessing technical skills within rapidly changing technology

Technical skills are easier to assess within a specific course, but the overall program assessment is much more difficult due to the continual change. One hundred level technology courses may have changed drastically by the time a student reaches the 400 level. Basic skills such as saving or archiving files for frequent use, compression and delivery methods do have some consistencies. Once learned, they can be adapted to the change. Software, hardware and coding also have consistencies, but graphical user interface and options from various programs or upgrades to similar programs often require lower level learning in upper level courses. This is where students need self-assessment, self-discovery, active learning and problem-based learning skills to continue to progress to a mature learning level. As faculty, always learning the new technological concepts, it is easy to fall into the trap of only teaching lower level learning to "keep-up" with new technology advancements in upper level courses. Communication among faculty and continued assessment of soft skills, technical skills and aesthetic expertise are key.

Assessment: assessing the technology skill level and setting a base for continued course assessment

Feedback from students and among faculty within their specific degree option is essential to assess course consistency. This can be documented through assessment measures and addressed by faculty on a semester-to-semester basis. Frequent and immediate feedback from students within the classroom is necessary on a weekly basis to make sure the technical "craft" or "hands-on" skills are being integrated into cognitive learning. A base of soft skills, technical skills and

aesthetic expertise needs to be established through objectives and outcomes on assignment, project, course, and degree program level. The assignment and project level objectives and outcomes can be evaluated through quizzes, critiques and presentations. Often it is found that the students did not cognitively integrate important concepts and they need to be repeated in the next assignment, discussion, lecture or project. The course objectives and outcomes will be more accessible when they are addressed on a weekly basis. This assessment then trickles up the ladder to a comprehensive project, course and degree program evaluation of objectives and outcomes.

When faculty at Purdue Calumet meet to discuss the progress of project and course assessment, we often find that on congruent course offerings where the same group of students are in both courses, similar skills in different courses are lacking. As most seasoned faculty know, classes have a personality of their own, and flexibility in course offerings is necessary to implement the overall course and program objectives. By breaking up the evaluations into sections, a specific skill can be addressed in consecutive courses. An example of this would be where a group of core students taking two or three Computer Graphics courses may be lacking in aesthetic skills, even after they have been addressed and taught. By addressing this with other faculty in congruent and consecutive courses, a program can emphasize the aesthetic skills and push for a more cognitive understanding of them, while advancing the students in the technical and soft skills.

Making sure that all faculty are on board the assessment evaluation process can sometimes be a challenge, especially with new faculty and guest lecturers. Having a map of the assignments, course objectives, program objectives and outcomes, along with meetings to discuss them on a mid-semester and semester-end basis helps in the evaluation understanding.

Conclusion

Computer graphics and engineering technology students are often visual and kinesthetic learners requiring learning methods that are more active or hands-on rather than passive or lecture based. Immediate feedback is provided by hands-on demonstrations where faculty require students to work along with them as they demonstrate new technology skills. (We call these “democipations”; demonstrations with student participation). To integrate cognitive thinking and combine these hands-on demonstrations and assessment on a class basis, class assignments are assigned on the specific democipation skills. Students then have notes and assignment experience to refer back to when working on comprehensive projects.

Students can also have small successes throughout the learning process, through weekly assignments and assessments, thus helping with student retention within the program. By providing weekly assessments they have time to improve and integrate new concepts before major projects are assigned.

On a program assessment level, the flexibility for students to repeat courses due to technical updates and need to revisit aesthetic and soft skill requirements is necessary. This is done in the Purdue University Calumet Computer Graphics Program through selectives and special interest course offerings. Therefore a senior level student can take an overhauled 100 or 200 level course and apply new technical concepts along with the ability to refresh aesthetic concepts and improve portfolio material.

Bibliography

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