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A CASE STUDY OF IMPLEMENTING COMPUTER GRAPHICS TECHNOLOGY FOR THE VISUAL ARTS PROGRAM IN A SMALL COLLEGE: A DESCRIPTIVE RECORD OF HISTORICAL DEVELOPMENTS AND PROCEDURE FROM INITIATION TO REALIZATION

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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* * * * *

The Ohio State University
2002

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ABSTRACT

As our society witnesses more use of computers than ever, the field of computer graphics has grown into a part of the main stream in visual communications. Recently, in visual art programs across the nation, more institutions in higher education than ever have searched the way of integrating the computer graphics technology into their existing art programs. Depending on the goals and available resources of the institutions, the levels of developments vary from one institution to another. As more and more colleges and universities are searching for the way to develop a computer graphics program for their students, understanding what issues and factors are involved with the development is important.

One example is the recent development of a Computer Arts major at the University of Saint Francis. The detailed description of the development at the USF portrays what was involved with when a small college decided to (re)develop a program. At the outset, the institution must search for the well-being of the institution in addition to the goal of providing a quality education. The program should be relevant to the mission and goal of the institution. Implicated issues include practical concerns for developments such as developing curriculum, finding available resources, and promoting the program.
Some of the practical concerns of the developments focus on the quantitative elements such as number of computers, the physical space, and expected incoming students. More importantly, the development should be economically justifiable for the continued existence of the institution.

The actual decision-making, however, is a qualitative process that involves the social and cultural aspects of the institution. An academic institution is a social organization, which is bounded by its own rationale and values. The dynamic organizational culture and decision-making are forces in command of the development. However great the needs are or how good the quantitative figures sound, the actual interpretation is up to each member of the institution. In the end, it is the dynamics of culture of the institution and its influence on its members that made the decisions.
Dedicated to my parents and family
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CHAPTER 1

INTRODUCTION TO THE STUDY

Background To The Problem

If we want to allow visual digital technology to evolve into a mature medium in its own right, we are going to have to work on it, and education is the key . . . This is the major problem facing art and design education in these closing decades of the twentieth century. It's an intriguing and exciting problem and there are no precedents. The whole world of art and design is going to change dramatically in a very short space of time (Brown in Kitson, 1991, p. 541).

Computers have changed many facets of our society, and artists are exposed to new aesthetic opportunities as computer technology becomes more widely available. Our society has witnessed the dramatic changes that computer technology has brought to many aspects of our daily life. Computers have reshaped the way people live, from basic communication to extravagant entertainment. Through using e-mail, shopping and investing online, more and more people are getting into the Internet and World Wide
Web (WWW) everyday. In the field of art and design, advances and developments in technology continuously reshape the structure of art by promoting the creation of new art forms, challenging the traditional notion of creativity and art-making processes. Many artists and designers have utilized computers for new artistic expressions, creating everything from commercials to fine art pieces in the gallery to dazzling special effects for feature films. More importantly, however, computers have opened new doors for artists and designers by providing not just a new tool or medium but a new way of communication, suggesting a synthesis of human sensory elements. While traditional notions of visual art and design appeal heavily to the two-dimensional visual sensor, computer technology has prompted multi-sensory experiences for both creators and audiences. This new paradigm has challenged the way artists and designers think, create, and appreciate.

It is the responsibility of educators in the field of art to assess and meet the needs of students by investigating the implications of new aesthetics, artistic expressions, and interactive applications involved in teaching and learning computer art. It is also the responsibility of educators to provide artists and designers with the theoretical understanding of the integration of new technologies in the art and design process. Educators in art and design need to deal with the issues of computer art and suggest possible solutions to practical problems, including curriculum design.

Until the early 1990s many educators in art and design had to search for two main aspects of teaching computers for art. One was the practical use of computers in the art and design classrooms such as hardware, software, and approaches to the medium. The
other was a better understanding of computer art necessary to convince the art community whose attitude toward computer art was still somewhat perplexing (Emmett, 1988). At that time, computer graphics was still in its early development, and the artistic community was at an even earlier stage in its development of a theoretical understanding of the revolutionary role of computers (Jones, 1991). While advances in computer graphics technology provided artists with a powerful pliable medium, the powers and capabilities of computers alone did not necessarily guarantee acceptance of these tools as a legitimate art medium. During the last five or six years, however, the field of computer graphics in art and design has grown so enormously that the legitimacy of computers as an art medium becomes hardly an issue. Today almost all works of commercial art and design, and a considerable number of works in fine art, are processed digitally in some way so that using a computer does not carry a crucial significance. Spalter (1999) points out that artists and designers are routinely submitting their works without labeling them as computer arts or indicating the use of computers (p. 33).

The recent explosion of computer graphics education for art and design in higher education in the United States reflects the current status of computers in the field. Arts Wire Current, the online newsletter of the New York Foundation for the Arts (NYFA), clearly illustrates the academic developments in the article, “Electronic arts/new media departments flourish across the country” (2001). The article points out that most universities either support a department that has a special interest in the electronic arts or at least offer some courses in the area. New facilities are being built to accommodate more students along with wide-ranging curriculum and collaborations.
One example of successful implementation of computer technology into the existing art program recently happened at the Department of Art and Visual Communication of the University of Saint Francis (USF) in Fort Wayne, Indiana. USF (which until 1998 was named Saint Francis College), founded in 1890, is a small private (Catholic) coeducational institution of higher education in the liberal arts tradition, offering undergraduate and graduate programs to a student body of 1500 as of fall 2000. The Department of Art and Visual Communication at USF is well known in the region for its strong programs for both fine and commercial arts. In 1995, the Department hired a new faculty member in computer graphics. During the period between fall 1995 and spring 2000 there were major changes in the computer graphics program. In 1996 the (former) Art Department initiated a computer graphics concentration for its degree programs. This concentration was for the degrees of Associate in Commercial Art, Bachelor in Fine Art, and Bachelor in Fine/Commercial Arts. The development was immediately followed by the initiation of a new major in Computer Arts in 1997. The new computer arts program was realized in the fall semester of 1998. During the same period of time the Art Department itself changed to the Department of Art and Visual Communication, merging the Art Department and the Communication program. These new developments in USF reflected the current trend of thriving computer graphics education in higher education in the United States.
Statement of the Problem

More and more academic institutions in higher education are eager to expand their computer graphics programs in the visual arts, as the technology is more widely available. The adoption of ever-evolving computer technology for the field of art and design, however, does not come without hurdles. Those eager colleges and universities must answer many important questions before employing computer technology in the visual arts, including theoretical and practical issues. First, the schools should provide the rationale and goals of the new program along with detailed information about curriculum. Much effort needs to be focused on developing a meaningful program to meet the increased student interest and to prepare them for the future market. The goals and objectives of the programs and courses must be clearly established. The fundamental issues of promoting new media in art need to be examined historically and critically in a broad context. Then, the institutions should consider many practical aspects of implementing the computer technology to the visual arts, including finding the resources, implementing developed curriculum, and recruiting students. Before and during the development there must be a mutual agreement among the people in the campus community about the needs of a new program and the possible means of realization.

Developing meaningful education in computer art has been proven not an easy task for many reasons. Until very recent years, the efforts of adding computer graphics technology into visual art programs had faced many obstacles from unproven technology to limited resources to internal resistance against changes. At the beginning, computer graphics was an interesting subject that had very limited functions and applications. The
technology suggested many possibilities for the visual arts and design. But the promises were not realized until the later developments of practical means of access and delivery. For example, it was not until the introduction of laser printers and Postscript that desktop publishing became practical and got its popularity. In fact, a large part of the current dramatic changes that contribute to computer graphics' maturity as an hub cab of many art and design fields directly results from the advances in both hardware and software technology. The limited resources for utilizing computer graphics technology also prevent many education institutions from jumping onto the bandwagon. The financial burden of obtaining highly expensive technology without any guarantee for success has always been considered too risky. Besides, there has been a shortage of qualified educators who can lead and organize the computer graphics education.

Curriculum development and evaluation for computer art education also require painstaking endeavors. The initiation and development of a new program involve many things, including the assessment of the need, research, analysis, and evaluation. While it is still difficult, implementing the current or new technology to the existing program is not a new thing. In fact, it is a part of the promise for the academic institutions to provide their students with meaningful education. Without this necessary process of adaptation, the institution will soon be outdated. Visual art programs in higher education, whether big or small, have to choose without exception to adopt the new developments including computer graphics technology or they will fade out.

Perhaps a more difficult part of the problem of implementing computer graphics technology to art and design education has been the complexity of decision-making
processes within the institutions. In "Computer graphics in art and design education: The Problem of planning for change," Kitson (1991) discusses that most educational institutions have not been able to create new courses or adopt existing ones to meet rapid technological changes, even though successful design is dependent on up-to-the-minute technologies. He argues that the problem mainly stems from structural defects of many academic bureaucracies, including slow decision-making, emphasis on precedents, rigidity and aversion to change. Such internal obstructions are much harder to deal with because they tend to root in a much deeper layer of the culture and dynamics of a complex social entity. For example, while the members of an institution may understand that any innovation in education will be accompanied by various challenges and risks, they still can make things more difficult or terminate the efforts by asking for a foolproof plan and guarantee for success. The concerns could be a financially motivated one as the stake is high when it comes to the use of limited resources in various levels of an institution. The real reasons for such disagreement on the proposal often are not clear. While both advocators and challengers may provide legitimate arguments, the same arguments can hold hidden agendas or logical fallacies. The disagreements could stem from ideological issues among or within the departments. The members of faculty involved with the developments do not always share the same ideology or approach to the subject. In such cases of conflicts of interests, the advocators of new technology have to overcome much harder obstacles to reach consensus even though they strongly feel the development is a necessary step for the future of the institution.
In addition to providing the validity, effectiveness, and sustainability of the computer graphics technology, the educators in the field of art and design have been dealing with many hidden but critical issues of implementation. This is the time to review the history of computer graphics and investigate current practices and developments of computer graphics education to prepare for the future. In this research, the question of what really happened when the Art Department in a small college decided to implement computer graphics technology for its visual art program is pursued. The research focuses on the chronological description of the process: where the program was, where it wanted to be and how it got there. How was the program developed? Who initiated the program? What kinds of resources were available? In addition to a detailed description, this study searches for understanding of the dynamics the academic institution as a social entity, including the culture and the process of decision-making. From locating resources to establishing the academic standard, what issues were considered and what factors played important roles? What kinds of interactions were exchanged among faculty members and administrators? These are some of the questions I propose to address in this research.

**Purpose of the Study**

The purpose of this research is to examine the current adoption of computer graphics education for visual arts in a small college. The research attempts to reflect the series of practical and theoretical concerns about preparation and implementation of computer graphics technology in the visual art program by accurately describing the
actual developments and processes that occurred over a period time. The goals and purposes of the program and curricular contents are examined. The environments, pedagogy, methods, practices and resources for the educational developments are also evaluated to find underlying factors that shaped the education. In addition, the research is also expected to identify and assess what cultural, social, economical, and educational factors have influenced the development in current computer graphics education in an academic institution as a dynamic social setting. Through this analysis of the cultural and social aspects of an educational institution the research attempts to illustrate the more complete picture of what is involved in the computer graphics education for the visual arts. Thus, this study fosters awareness of the complexity of education in general, which suggests a sensitive and insightful approach.

Significance of the Study

The significance of this research lies in its potential to provide insight into the contextual, economic, political, and cultural factors that shape the outline of the computer graphics education in a small college. The emphasis of the study is placed on the process and context rather than the final outcomes and specifics in order to depict the holistic picture of how a small college implements computer graphics technology in its visual arts program. The study can also provide insight into theoretical, practical, and pedagogical strategies employed in technology teaching, and how the various aspects of today's technology influence these strategies. The role of technology in art also is scrutinized in a broader context rather than the potentially limited vision of only considering the
technical and technological aspects of computer graphics. It is also hoped that this research will provide an opportunity to observe the dynamics of policy-making and decision-making in a social unit.

Equally important is that this research could serve as a framework for the future development and evaluation of computer graphics education in various academic settings. While each academic setting has its own unique challenges and goals, this research can be beneficial to the field of computer graphics education, providing an opportunity to see a different perspective and details of how one institution has worked on its program. Comparative in nature, this study will be beneficial not only to computer graphics education in particular, but also art education in general.

Summary

As our society witnesses more use of computers than ever, the field of computer graphics has grown into a part of the main stream in visual communications. In the field of art, computers have provided not only a medium but also a new set of artistic possibilities. As more and more colleges and universities are searching for the way to develop a the computer graphics program for their students, understanding what issues and factors are involved with the development is important. One example is the recent development of a Computer Arts major at the University of Saint Francis. By examining the implementation process of computer graphics technology in the visual art program, this study attempts to illustrate the development and the academic institution in a holistic view.
Research Methodology: Qualitative Case Study

Case studies get as close to the subject of interest as they possibly can, partly by their access to subjective factors (thoughts, feelings, and desires), whereas experiments and surveys often use convenient derivative data, e.g. test results, official records. Also, case studies tend to spread the net for evidence widely, whereas experiments and surveys usually have a narrow focus (Bromley in Merriam, 1990, p.29).

Qualitative case study method is utilized for this research as case study method is specialized in searching for the particularity and uniqueness within a complex social unit. Qualitative case study research can generate in-depth data within a complexity of a single social unit. Stake (1988) says that a case study in education is a "bounded study" focused on "a particular problem in a particular circumstance of the unity or totality of a system with some kind of outlines or boundaries" (p. 255). Case study methods can address such issues by examining and analyzing all potential aspects of them as a dynamic, complex
whole. There are interactions in various levels of the social entity. For example, when it comes to making decisions for controlling resources, including the funding for new programs, the whole campus community may be involved in the process and decision. The administration has the power of approval while the academic department makes plans and recommendations. Other academic departments can participate, as the stakes are high in terms of sharing the limited resources. There must be negotiations and compromises, as every participant wants the best possible arrangement. The complex process and decision-making may reflect the culture of the academic institution.

Hubbard and Power (1993) argue that one of the purposes of qualitative methods is the discovery of “questions, processes, and relationships but not necessarily to test them” (p. 23). The researcher in a qualitative case study is more interested in process and factors than outcomes and confirmation. Thus, qualitative case study research can provide the clues and direction to understand the social unit through detailed description and interpretation. Noah (1986) emphasizes the importance of description in research. He says, “there is nothing ‘mere’ about the tremendous amount of effort that has to be exerted simply to acquire systematic, parallel data on educational systems that differ in the particulars of their structure” (p. 154). Qualitative case study methodology is appropriate for this study as the emphasis is placed on the process and context rather than the final outcomes and specifics in order to depict the holistic picture of how a small college implements computer graphics technology in its visual arts program.
Specific Procedures Utilized in the Study

A qualitative case study in education is often initiated by the questions that the researcher develops from the educational phenomenon that he/she may face in real life. In this research, the question of what really happened when the art department in a small college decided to implement computer graphics technology for its visual art program is pursued. There are two major parts that I have focused on this research. The first one is the actual teaching and learning of computer graphics in classrooms. Since 1984 the Department of Art and Visual Communication of the University of Saint Francis (USF) had implemented computer graphics technology for its visual arts program. After the initial development and a period of deterioration, the computer graphics program was redeveloped especially during the period of 1995 to 2000. I was involved with the whole development process from creating new classes to designing a new major in Computer Arts between 1995 and 2000. As a teacher, I was interested in improving the environment and practices of teaching and learning computer graphics at USF. I endeavor to understand the practical and theoretical issues of incorporating computer education in a naturalistic setting. As a researchers, I attempted to articulate real issues in the classes included contents, practices, course materials, environment, pedagogy, structures, and assessments. Participant observation was conducted for all computer graphics courses that I taught. Also, surveys were given in the same courses to increase the accuracy of the findings. Along with official questionnaires of students’ class evaluation at the end of each semester, this research tried to triangulate the findings for teaching and learning in computer graphics.
The second focus of the research is understanding the development process of the computer graphics program in the USF. The research starts with the chronological description of the process: where the program was, where it wanted to be and how it got there. As a part, I tried to find out what happened to the computer graphics program during the period of 1984 to 1995. By comparing the two different periods, I expected that some contrasts and similarities might emerge. As the development of the computer graphics program continued, the research focus gradually moved to the process and context of the development, more than specifying the needs and outcomes of the program. In order to develop any educational program, it was essential to understand the educational environment. The educational environment means more than the physical settings such as existing facilities, support, and available resources. An academic institution is a social entity with its own unique social and cultural characteristics. For example, the willingness, readiness, and commitment of the administrators of the Department and the University may play a significant role for its development. The research attempts to reflect the culture of an academic institution and its effects in decision-making for the developments in its computer graphics program. Participant observation was conducted in various meetings to monitor the dynamic exchanges among the members of the Department and other campus communities. Document analysis for various materials was done to look for clues, key events and activities of the institution in the detailed information. I also conducted semi-structured interviews with all full time faculties at the Department in order to reinforce the findings from other methods.
Instrumentation and Data Collection

Case studies for qualitative research utilize various methods for collecting and analyzing the data. In the frame of searching and analyzing qualitative data about USF and the Department of Art and Visual Communication, observation, interview, surveys, and document analysis were utilized. While each data collection method can provide valuable data, it is essential to employ multiple qualitative research methods to triangulate the findings. By employing multiple qualitative methods, the research tries to heighten the accuracy and reliability of the data and analysis. With the triangulation this study attempts to avoid the pitfalls of a one-legged stool.

Observation

Beginning in 1995 I taught four computer graphics classes each semester, in which I conducted participant observation. In 1995, as a new faculty member in the Department, my initial focus was finding the concerns of the students and addressing their needs in the classrooms. At the beginning of the semester, main concentration of the observation went to the students' responses to the curriculum and the contents of the specific courses including the choice of hardware and software. There was a question of when the students actually started to touch or use computers at the beginning of the semester. In many computer graphics courses, the attitudes and approaches to the contents of the course were critical for the success of the students in the class, as many students were afraid to use a ‘machine’ for the art-making process. Later, the attention of the observation expanded to more broad subjects, including the students' responses and...
reactions to class critiques and discussions. In order to understand the patterns of students' behavior in the classroom, their responses to various educational materials and pedagogical changes were observed. The questions to address such concerns include: 

With what part of the course does the class have most difficulty? Which part of the class instruction do students follow most easily? With what teaching method do students feel most comfortable? How do students participate in the class critique (with ease or difficulty)? What are the responses of the students about the reading/writing assignment? What do students want the most from the class and the instructor? Both verbal and nonverbal reactions of students were recorded. Nonverbal reactions were especially important during the demonstration, as students who were lost in the middle of it tended not to speak up. Instead, their body language spoke loudly with frustrated facial expressions, sitting in their chairs with their arms folded.

Participant observation was also conducted for a variety of events and activities in the Department and the University in order to understand the culture and dynamics of human exchanges in naturalistic settings. An ordinary working environment was part of the observation even though more concentrated efforts were made in meetings for the development of a computer graphics program, of which both faculty and administrators were part. Questions were raised to identify the issues and factors for the development in cultural, social, and economic contexts. What were the objectives, goals, and required resources for the development? Who made the plan and provided the rationale? Who brought the issues and why? How were the differences and disagreements in approaches overcome? What was the process of the decision-making? Who was involved with the
decision-making? What was the role of each participant for a particular decision? Were there any roles assumed among the participants? Did the participants respond differently for the same subject in different occasions?

Survey

In addition to the participant observation, a survey for each class was conducted in the middle of the semester. There were also official mandatory end-of-semester student class evaluation given by the University. However, the results were usually unavailable until the following semester. In addition, the findings from the questionnaires alone did not provide significant meaning or understanding unlike those for the quantitative studies. While the data (results) form the official questionnaire were eventually used to compare with other data from observations and surveys, they were too late to make any correction or adjustments for the current courses for which the evaluations were done. In order to find out and address the students' concerns while the classes were still in session, I carried out surveys for midterm class evaluation. The semi-structured survey (Appendix E) asked participants to voluntarily evaluate the class in an open-ended essay form with a list of possible topics including: 1. Covering the syllabus. 2. Knowledge, performance. (presentation), enthusiasm of instructor. 3. Course materials, resources, contents, organization, assignments, critiques, and grades. The survey also asked if the students were challenged in the class.
Interview

An interview method was also utilized to get the insights of the informants, which could add more understanding to the observed education phenomenon. Several members of the full time faculty of the Department of Art and Visual Communication were interviewed to discover their involvement and points of view about the development of the computer graphics program and related issues. Grandy (1998) points out that there are three basic types of interview: structured, semi-structured, and unstructured. He argues that semi-structured interviews are frequently used in qualitative research because of the added flexibility based on the established set of questions. The interviews for this study were conducted in a semi-structured format. Two sets of questions were formed based on the periods of the development. The first period was defined as the development of the computer graphics program at the Department between 1984 and 1995 while the second was defined as the years 1995 to 2000. Questions were concentrated on the interviewees' reflection of the history and roles in the development. Their personal approaches, understandings, expectations, evaluations, and afterthoughts about the development were sought as well.

In addition to the semi-structured interviews, unstructured interviews were also carried out whenever possible. Even though the unstructured interviews were rather like casual conversations, learning the insight of the interviewees was not insignificant especially when they were accompanied with observation. The key strength was the naturalness of the responses in face-to-face communication.
Literature Review and Document Analysis

Throughout the whole research process literature review has provided the foundation and direction. Written materials, including articles, dissertations, theses, books and conference papers were reviewed throughout the research. This was pursued to keep redefining and organizing the research concepts, problems, comparisons, and approaches. As the field of computer graphics experiences the blazing speed of technological advances, recognizing such phenomena becomes the least thing that the professional must do in order to stay current. Some written materials on the evolving literature list, such as articles from computer graphics magazines and chapters of computer books, were also shared with students for reading/writing assignments.

Document analysis is also used to acquire detailed information about events, meetings, classes, issues, and ideas. It can also provide the insights, as a wealth of information is stored in the various written materials such as syllabi, policy documents, proposals, meeting minutes, reports, official brochures, and notes. Bogdan and Biklen (1992) address the issue of the use of official documents and contend that while many researchers view the materials as subjective and biased for external consumption, qualitative researchers are not interested in “the truth” but “official perspective”, trying to comprehend “how the school is defined by various people” as well as “the ways various school personnel communicate” (p. 136). Grady (1998) also points out that documents in education are “seldom created for the purpose of misleading some future researcher” (p. 24). While the official transcripts of department meetings or University-wide Faculty
Forum meetings may not reveal much of actual actions or the minority opinions. Interviews and participant observations can address issues other than what are officially described.

Summary

Case study in qualitative inquiry can be defined as the methodology for this study. Several methods were utilized to collect qualitative data, including participant observation, survey, interview, and literature review and document analysis. The procedures of the research were designed and carried out by two major purposes. The first one was improving the teaching and learning computer graphics in the classroom. The second was understanding the development of a computer graphics program in holistic view, analyzing the issues and factors in social, economical, cultural and educational contexts. By employing multiple qualitative inquiry methods, this study attempted to triangulate the findings. The values of case study methodology in this research lie on that it can provide a conceptual outline for describing, comparing, and analyzing the current computer graphics education in a small college as a bounded social unit.
CHAPTER 3

COMPUTERS IN ART AND ART EDUCATION

Introduction

For the artist, then, there can be no vision and no knowing without a concrete form of thought, or medium . . . The medium is not a mode of encoding the vision, but a means of its realization. The artist is not an encoder of a message, not an illustrator taking the known and spreading it before us so we can share in the insights of the vision . . . Within the creative process, the artist becomes aware of his or her vision through dialogue with the medium. Art is the process whereby the vision and medium interact and create one another, call each other into being. The medium is the means which puts the artist in touch with the possibility of vision and the means by which we and the artist touch each other” (Levine in Phelan. 1984. p. 33).

As artists visualize concepts, seeing inner space through the physical outer world, they utilize various media and materials available. From cave painting to synthetic

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acrylic paints, art has been influenced by and is conditional on the available
technologies of the time. Since their introduction in the field of art almost 40 years ago.
computers have made a profound impact that no other art media have ever done in such a
short period of time. With its power of visualization, the computer has quickly become
an essential part of many areas in the field of art, providing extensive sets of visual
possibilities. From fine art works at galleries in Soho, New York City to entertaining
Hollywood movies of living dinosaurs, various forms of computer graphics technologies
and techniques have been employed in various areas. More and more artists and
designers no longer need a specialized computer dictionary to understand words like two-
dimensional (2D) painting, image processing, three-dimensional (3D) modeling and
rendering, the Internet, multimedia, and virtual reality. These words are already a part of
their everyday lives and art making processes. Splater (1999) points out that computer
technology or digital processes are already an integral part of most commercial areas with
mass-media production. Splater expands the very meaning of computer graphics or
computer art by claiming that the use of computer no longer carries much significance as
computers are integrated enough into the almost all art and design fields. As a result.
Splater claims that many artists nowadays submit their works for exhibitions without
mentioning the use of computers and contents-oriented artistic statements rather than
technical explanations of their use of computers (1999, p.33).

Where computers are used as visual tools, however, there are some confusions
and concerns about the very meaning of computer graphics. It should be mentioned that
the term "computer graphics" was first used by a researcher at the Boeing Company in
Washington in 1960. William A. Fetter used the term for his computer-generated airplane cockpit drawings, done with a plotter. Since then, computer graphics has become a catch-all phrase. At the Association for Computing Machinery (ACM) Special Interest Group on Computer Graphics and Interactive Techniques (SIGGRAPH) 95 Fundamentals seminar, the term "computer graphics" evidently reflected boundless umbrella of its coverage as defined as "the algorithms and tools (both hardware and software) used for creation, display, and manipulation of visual information" (Schweitzer & Qwen 1995). This confusing term, "computer" plus "graphics", has now been used for any graphic works done with computers, regardless the intent behind the work. This confusion stems from the plastic and adaptable nature of computer technology for visualization. Some people have suggested and used other terms, hoping to specify the field of interests. Among the terms suggested are "computer arts", "electronic arts", "time arts", "digital arts", "media arts", and "computer visualization". These terms use "arts" as a purpose and employ various modifiers to signify the means of creation and delivery. While their use of the word "art" specifies the common purpose, these names do not quite succeed in differentiating the applied areas among themselves, thus add more confusion. The bottom line is that they all share the computer graphics technology as the core.

On the other hand, the term "visualization" itself has evolved to include new meanings related to computer graphics. Even though the computer had been used as a visualizing tool in various areas for many years, some researchers acknowledge that "Visualization in Scientific Computing", a study report by the National Science
Foundation in 1987, was the major initiation of use of the term (Earnshaw 1991, Machover 1992, Collins 1993). Edited by Bruce H. McCormik, Thomas A. DeFanti, and Maxine D. Brown, the report used the term “scientific visualization” to describe successful examples of visualization, using supercomputing facilities. Since that time, people have been calling the computing process for generating any graphics “visualization”, especially in science domains. An explosion of studies, publications, and discussions in workshops and conferences took place in the field of visualization. Like the term “computer graphics,” “visualization” has gradually become a confusing term that covers huge areas where computers are used for visual images. According to Brown and Cunningham, the most important part of visualization is the function of conveying information, not the image itself. They claim that visualization is not the same as computer graphics, because computer graphics simply means the use of computers for creating images. Collins (1993) also points out that "visualization is the end and computer graphics is the means to that end" (p. 5).

The exact or full definition of the term “computer graphics” and “visualization” can be interpreted and argued in many ways, depending on the various fields of its usage. However, it seems safe to say that the current trend of understanding the term “computer graphics” leans more toward the general use of computer technology for visual communication, binding multisensory elements including visual, auditory, tactile, etc., while “visualization” is more commonly used for describing the method and process of computing, especially in the field of science and engineering.
History of computer applications in art

History of using computers for art is mostly parallel to the development and availability of the computers to the field of art and design. Because the computer is technologically a "machine", using computers for art-making has required many interventions of science and engineering along with understanding and acceptance by the society. Three eras in the history of using computers for art can loosely defined, based mostly on the technological advances and availability (Spalter 1999, Lovejoy 1992). The three periods include the early, the expansion, and the explosion. Though such a division risks the danger of over-generalization of the almost 40 years of the history of the computers in art, it can sufficiently illustrate the overall pictures of how the computers have altered the landscape of the visual arts.

Throughout the early period, the pioneers had to make extreme efforts to use the computers for creating art including gaining access to the computers. They had to learn computer programming languages, algorithms, and mathematics. They had to share the limited resources and seek help from scientists, technicians, and mathematicians. Most artists and designers had to wait for their turns until the computers became popular, powerful, and readily available without requiring significant knowledge and financial burden. Only when the computers became more widely available with the introduction of minicomputers and personal computers during the 1980s could the artists afford to investigate the possibilities of utilizing them in various areas. In the period of expansion, the art and design community gained the steady access to the power of visualizing technology of the computers with a variety of interactive software that did not require
computer programming. During the last decade or so, our society has witnessed the explosion of computer graphics technologies for visual communication with literally unlimited potentials.

The beginning and early period (1960s – Mid 1970s)

The first graphics accomplishments with computers were through the hands of scientists, mathematicians, and engineers. Only a handful of people had access to the early mainframes and knew how to "communicate" with them. Collins (1993) suggests that the earliest use of computer graphics technology could be the Semi-Automatic Ground Environment (SAGE) air defense system, which displayed aircraft movement on cathode ray tubes (CRTs), based on data from radar. The work began in 1949 and the first SAGE was installed in 1958. However, quoting Douglas Davis, Goodman (1987) says, "Electronic Abstractions", the oscillons of Ben F. Laposky in 1950, are considered the first graphic images generated by the computer. Laposky, a mathematician and artist from Iowa, recorded abstracted patterns of electronic beams across the fluorescent face of a cathode ray tube using high-speed film, color filters, and special camera lenses. Goodman also mentions the bouncing ball application on a display screen of the Whirlwind, a mainframe machine built in 1949 at the Massachusetts Institute of Technology (MIT). The work, along with a graphic projection of a rocket based on mathematical information was televised in 1951 on the television show "See It Now." In fact, "Computer images" published by Time-Life Books (1986) claims that Whirlwind's...
bouncing ball program was the first graphic demonstration of data processing in real time. And SAGE was the first production-model computer system with any kind of interactive graphics built into its design, using Whirlwind as the prototype.

Visual images on the screen were not permanent. They disappeared when either the computer or the monitor was turned off. Scientists and artists had been looking for the solutions to keep their images permanent. The first hard copy technology was developed in the 1950s using a teletype printer. The first commercial plotter, the CalComp digital plotter, was available in 1959. Since then, a variety of plotters had been introduced. Some models had moving arms to draw on the paper. Some models kept the pen in one position, and moved the paper. Although they were almost exclusively used for industrial purposes, the plotters could provide various options for output presentation throughout the 1960s.

A major breakthrough in the computer graphics field was the development in 1962 of Sketchpad by Ivan Sutherland for his doctoral thesis at Massachusetts Institute of Technology (MIT). Sketchpad was an interactive device to help the user directly draw images on the cathode ray tubes (CRT) with a "light" pen. This new device had many drafting capabilities, and it initiated technical breakthroughs for spontaneous but limited visual interactions with computers, and thus it opened the door for a new era in the field of computer graphics.

These new developments in computer graphics, however, have mainly been initiated for military and industrial purposes. Pomeroy (1991) thinks that aesthetics is hardly the motivation for research and development in high technology. The access of
artists to this 'new' aesthetic opportunity had been severely limited because of its origins in military technology. High costs and security restrictions prevented artists from accessing the technology, and technical difficulties also handicapped them. It is no surprise that the idea of computer art began with mathematicians who programmed computers to produce a picture as did Noll, Knowlton, and Nake (Csuri, 1974).

An important year in the computer graphics history is 1965, because A. Michael Noll, Frieder Nake, and George Nees arranged the first exhibition of computer-generated art at the Technische Hochschule in Stuttgart, Germany that year. The works of scientists were also exhibited that year as digital graphics at the Howard Wise Gallery in New York from April 6 to 24. According to Noll (1994), “Computer-Generated Picture” was the first major exhibit of computer art in the United States. It should be mentioned that Noll, one of the pioneers in computer graphics, insisted that generating the program was the true work of art, rather than creating the resulting objects (Goodman, 1987). He was more interested in exploring the potential of computers in the field of art than in being an artist. In the article, “The beginning of computer art in the United States: A memoir”, Noll (1994) explains that he was willing to call his computer generated images “art” because he generated many images solely for artistic and aesthetic purposes while the co-exhibitor, Bela Julesz’s was careful not to call his random-dot stereograms “art” as they were generated for investigations of human visual perception.

There was no clear distinction between the works of artists and those of scientists especially in the early period of computer graphics when the applications and resources were limited. Sometimes scientists and engineers insisted that what they made was art.
(Grillo 1991, Brisson 1992, Dickson 1992). However, as more advanced graphics technologies had become widely available for both artists and scientists, certain characteristics of graphic works, distinctive to each domain, became more apparent. One example of the distinctions might be the subject matter. While scientists might focus on very specific and restricted subjects in their special areas, artists might show their interests in a variety of open topics in broader areas. Csuri (1974) has suggested that computer art may have started during the mid-1960s when several people with art and film backgrounds joined the search for artistic uses of computers.

Although the works and exhibitions met either serious criticism or cold indifference from the art community, many pioneers did not lose their faith and interest in computers as providers of new aesthetic possibilities. Charles Csuri, Robert Rauschenberg, and Billy Klüver were among the people who opened a new chapter in the field of computer graphics in 1960s. Organizations such as Experiments in Art and Technology (EAT) and the Center for Advanced Visual Studies (CAVS) at Massachusetts Institute of Technology (MIT) were founded in 1967. Major exhibitions and contests for computer art started to attract the public as early as 1968, such as the first international exhibition “Cybernetic Serendipity (Studio International)” by Jasia Richardt at the Institute for Contemporary Art in London, England, and the contest and exhibition “The Machine as Seen at the End of the Mechanical Age” at the Museum of Modern Art in New York sponsored by EAT. Even though computers still remained unreachable to most artists, the computer slowly moved into the art world. In 1976, Ruth Leavitt published “Artist and Computer” which clearly showed the emergence of the
international computer art community. Since then, with the help of advances in computer visualization technology, the community had expanded to all the fields of visual arts.

**Expanding period (Mid 1970s – 1980s)**

After the initial years of trials, the second period of computer graphics in art can be summarized as period of expansion. During this period of time, personal computers (PCs) were introduced and became affordable even for the independent artists. They also became powerful enough to provide graphics functions that only specialized computers were capable of just years ago. The availability and affordability of the computers alone could be one of the most significant factors in the history of the computers in art. Toward the end of this period, many schools and companies that were not research oriented could manage to pay for their own computers without sacrificing the entire budget. Soon after, individual users found themselves using computers at home. Personally, this was the time that I purchased my own computer. In 1988, I paid for approximately two thousand Dollars ($2,000) for an IBM AT (80286) computer with 1MB RAM, EGA graphics card and a color monitor. An Epson dot matrix printer was also the part of the purchase. That computer along with rather simple but interactive painting programs such as PC Paint and Dr. Halo provided a digital canvas and brushes with 16 colors. Even though it was not initially capable of the graphics functions such as 3D computer modeling and animation
of expensive high-end workstations, this kind of entry level computer was becoming more useful as a number of sophisticated commercial graphics software packages was introduced on the market.

During this period of time, many significant developments in computer graphics technology attracted more and more people. For the visual elements, Enhanced Graphic Adapter (EGA, 4bit), Video Graphic Adapter (VGA, 8 bit), and Super Video Graphics Adapter (SVGA, 24bit) were introduced into the market, bringing up to 17 million colors in high resolution instead of monochromatic colors on the low resolution monitor. The mouse (although initially invented by Douglas Engelbart in the early 1960s), video digitizers, scanners, sketch pads, and tablets were commercially available as input devices. For the output, pen plotters, films, videos, and color Xerox were some of the choices. Laser printers (in spite of its relatively expensive price of around $8,000) delivered the fine prints that would satisfy the commercial printing requirements. In fact, the laser printers with Postscript language as the means of output greatly helped the desktop publishing and other design programs prevalent at this time.

Earnshaw (1991) and many others (Sabin 1985, Peitgen & Richter 1986, McComick 1987, Thalmann 1990, Foley 1990) have described and summarized the technological development of tools and techniques for computer graphics. For the display algorithms, Earnshaw says, early works centralized on 2D elements such as points, lines, and curves. Then the range of algorithms expanded to characters, contours and surfaces to convert one, two, and three-dimensional data. These basic elements were developed further to represent more sophisticated data. In the earliest stage, for example.
graphics software drew lines in 3D and projected them onto a 2D plane, offering transformations such as scale, rotation, and translation. After cubic splines in 2D and bicubic splines in 3D, Bezier and B-spline curves were developed to provide local control of the shape of an area. In addition, the development of Non-Uniform Rational B-spline (NURBS) allowed even more flexibility and power for modeling. The continuing developments in modeling and rendering such as hidden surface removal, optical effects (colors, transparency, reflection refraction, etc.), anti-aliasing and shading had frequently reshaped the field.

Such developments in optics made it possible to render high-fidelity representations of optical reality. Photorealism became the catchphrase and promised to synthesize the real world (or as close to). The realistic representation of objects like photographs was a major breakthrough especially for the research and business sectors such as flight or combat simulations, advertising in video and special effects in the feature film. One of the developments that helped to recreate the nature for 3D graphics was fractals. French mathematician Benoit Mandelbrot in the early 1970s developed fractals by setting some rules to compute chaotic behaviors in complex systems. Based on the chaos theory, the underlying concept was that many irregular shapes of nature including clouds and landscape had some patterns of self-similarity that reveal themselves in descending scales of order. By controlling the ratios between order and disorder on noise interference and iterations, the seemingly chaotic behavior of noise displayed a fractal structure of trees, rivers, and mountains. Another important development in 3D animation for photorealism was a particle system. Reeves (1983)

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defined a particle system as “a collection of many minute particles that together represent a fuzzy object” (p. 92). Particle systems model an object as a cloud of primitive particles that define its volume instead of using polygons or freeform surfaces that define its boundary. A particle is just a point that has variables in addition to position and velocity such as color, size, age, type, mass, and spiral-axis. “Fuzzy” objects represent some natural phenomena that do not have inherent geometric structures such as snow, clouds, smoke, water, and fire. They are characterized with irregular, complex, and ill-defined surfaces. They are rigid and subject to natural forces such as wind, gravity, and time. Particle systems greatly helped to realize the complex structure and motion of many fuzzy objects with relatively brief abstract descriptions.

Dissatisfied with the trend of photorealism, some artists advanced their work in other directions. They generally did not believe that photorealism was the ultimate goal of creating art nor a way of expression. Some artists also resented the idea that the new developments actually (although unintentionally) suggested the notions of limited expression, thus restricted the artistic creativity. In response to the trend, some artists worked with the photorealism technology but presented works in non-realistic ways. For example, artist Brian Reffin Smith deliberately used low quality output devices for non-realistically manipulated photos. Some completely ignored it and concentrated more in abstractions and interactions (Landsdown, 1997). It is ironic that many artists and spectators think that the works of art done with limited and more primitive technology seem more aesthetically pleasing than the ones with the newer computer technology.
Longson (1999), while describing the early practices of computer arts, says that "Despite, or perhaps because of, the limitations, the work that people produced was extraordinary both in its originality and its integrity".

For many new artists and designers, the introduction of commercial graphics software especially during the late 1980s played a major role in adopting the computer technology in the field of practices. The graphics programs that were originally developed for military and research purposes became commercially available with user-friendly interfaces and step-by-step tutorials. No longer required was the knowledge and skills of computer programming in order to exploit the use of computers. Until that time, most computer artists had had to either learn how to program or rely on the scientists and programmers to create programs for them. In the research institutions and military facilities, only a small number of artists could have an access to cutting-edge proprietary software that did not require the artists to create the actual program but to learn how to use it. In addition, graphical user interfaces for computer operating systems (OS) also helped the new users to start to use the computers without memorizing any commands. They were Microsoft Windows for DOS and X-window for UNIX environment. Macintosh computers came with the graphic user interface as a standard operating environment. The commercial software packages in graphical user environment suggested the notion of the soon-to-be household name of "what you see is what you get (WYSIWYG)" that the actual output of the work is as close as the one on the computer screen. Longson (1999) explains why more schools begun to teach commercial software during the time. He points out that software packages provided "a well-defined body of
information, usually come with documentation and tutorials, therefore they were easily justified to administration. More importantly, many students started to demand to learn commercial software because more and more job descriptions in the art and design industry listed the knowledge of the specific software packages such as Aldus PageMaker as requirements.

There have been various approaches to using computers in the process of making art. Some artists used it as an art tool or medium, some as a beginning point for other media, some for design decisions, and some others even as subject matter itself. For example, New York-based artist Barbara Nessim has used simple drawing programs to draw either final pieces or base drawings for further development with other traditional art mediums such as water color and pastel. To her, the computer can be an art medium or direct extension of her work in other art mediums. Many computer graphics programs allow artists instant and unlimited changes of colors, forms, shapes, and design. With such a possibility of endless variations and the ability to store images, artists and designers can do numerous visual experiments without fear or pain of losing the original works. Computer graphics technology has also brought an unlimited set of brushes and paper with which artists can define the characteristics and constraints. Artists and designers can, if they want, mix watercolor with oil paint or develop a brush which automatically mimic the Impressionist style. Further, image manipulation or image processing techniques offered artists a new way of interacting with visual reality, blurring the line between reality and fiction.
While 2D programs are helping artists and designers to extend the visual possibilities, 3D modeling and animation programs are bringing life to their work. Goodman (1987) calls three-dimensional computer works the mathematical synthesis of reality. Artists and designers can construct and define three-dimensional environments. Such virtual environments can include artistically abstract objects or mathematically precise buildings. It depends entirely on the applicant’s intention, making either a sculpture in a foreign space or previewing a future museum in the current landscape.

Although the techniques have been most vividly displayed in the feature films and music videos of Hollywood, computer animation opens a new phase in many areas of art. Not only is it for creating Coca-Cola drinking polar bears or a set of dinosaurs, artists can now create worlds of things that ask the very questions of being or existence in stunning ways. These creations can move, talk, sing, and dance the way we do. Such techniques allow artists to create a universe which can have life of its own—something with authority. With this visualizing power, computer animation can help artists and viewers actively transform or “morph” themselves into the other beings sharing and experiencing a different point of view.

For design, Nadin (1991) claims that digital technology has initially given us faster design and production cycles, cutting unnecessary stages. It also makes possible lower costs and higher efficiency. In the long run, however, Nadin emphasizes the most critical benefit that computer graphics can bring is the ability to transform raw data in any form into meaningful information. Nadin refers to “data delivery design” as the ability to facilitate visualization of data regardless of its locality, format or content.
There have been on-going debates about whether learning computer programming should be a requirement for artists and art students. At the beginning, there was no choice. In this period, people had to learn programming languages like FORTRAN, Pascal or BASIC. Many pioneers in the field developed their unique ways of creating arts to show the individuality and genuineness of their works. As the computer technology advanced, however, the required knowledge and skills of using computers for creating art were widened and deepened. The later commercial software packages were much more sophisticated and specialized than the previous rather simple painting and drawing programs. No one person can possibly know the whole technology. Those cutting edge technologies and developments in the research facilities were mostly the results of collaboration or teamwork. For many people in the field of art and design, learning computer programming to create a work of art was too difficult and too time consuming to start with, not even reaching the level of being able to create meaningful works with free expression. On the other hand, some educators in the field of art and design suggest that students need to learn how to program in order to gain the fundamental knowledge of how the computers work, avoiding superficial knowledge of how to use a specific software. Csuri (1974) indicates that in the field of computer graphics control is the issue. He says that the artist can create a work of art only when (s)he “understands the medium well enough” to make expression easily (p. 504).
Explosion period (1990s - current)

At the Graphics and Visualization Education Workshop (GVE 99), held July 3-5, 1999 in Coimbra, Portugal, the forty four participants stated that computer graphics had grown and changed immensely from "wonderfully interesting and challenging subject looking for applications to a broad-based, mature, intellectually accepted subject with its own body of theory and practice whose applications lie all around us" (p.81). The applications and practices of the field are too vast and specialized to mention all. These ever-evolving technologies constantly demand re-establishment of our sensory balances. While sight is the most important element in computer graphics, sounds and tactile input and output are also being explored. With the current development in telecommunication, people can not only 'see' but also 'hear,' 'talk' and 'touch' in real-time interactive modes. Such multi-sensory input and output in computer graphics are possible through the innovative approaches and developments including interactive multimedia, the Internet/World Wide Web (WWW), and virtual reality. Combined, they suggest new concepts of time and space over a remote and virtual world, weaving together a diverse set of participants. People in different geographical locations can communicate and interact with one another simultaneously as if they were in the same space. They can also enhance opportunities for the educational process in a variety of fields, for teaching courses, holding seminars, presenting a lecture series, and creating exhibitions of computer graphics, video art and animation.

The explosive growth of the Internet and the World Wide Web (WWW) has reflected the importance of computer graphics in our society. Like many other recent
developments in the field of computer graphics, the success of the Internet is due to the availability and affordability of the computer technology to the public. Inexpensive personal computers that had found their ways to ordinary households became the foundation. However, the explosive growth and use of the Internet have largely been possible through the creation of the World Wide Web (WWW) for multimedia data and the user-friendly browsers. Wanblatt et al (2000) think that the World Wide Web would not exist as it does without the introduction and use of multimedia. The Internet in today’s world has its root in the military, just like many others parts of computer graphics technology. Many people see the Internet as the legacy of the ‘Cold War’ era with the underlying purpose of establishing the communication network that could survive the possible attacks from then Soviet Union. In the late 1960s, the US Department of Defense financed the design of a computer network, the Advanced Research Project Agency Network (ARPANET), that was to link a small number of universities, research laboratories and military bases. Later, it divided into two networks, MILNET (military) and ARPANET (non-military). The National Science Foundation (NSF) established NSFNET, a high-speed network as a backbone for connecting smaller networks into the larger and faster networks in 1985. However, until very recent years, the computer networks remained in the domain of science and technology oriented communities. The original means for communication was the text. The original tools for such textual communication included Telnet, Archie, File Transfer Protocol (FTP), and Gophers. In 1990 Tim Berners-Lee developed a multiple media network protocol that he called WWW at the European Particle Physics laboratory (CERN) in Geneva, Switzerland. It
was an attempt to share research data for physicists. In 1993, Marc Andreessen, a student intern, developed a beta version of user-friendly web browser Mosaic at the National Center for Supercomputer Application at the University of Illinois at Urbana-Champaign. Soon after the commercial version of Mosaic was introduced in 1994, other commercial companies started to compete for the market including Netscape and Microsoft. These browsers with user-friendly graphics interface have helped even the novice users of a computer and network to jump to the Internet bandwagon. Since then, the Internet has grown into the mainstream in our society, reaching hundreds of millions of people in every continent. According to the Internet Industry Almanac, there were 100 million Internet users and the number would be over 327 million in year 2000. The Internet has become a household name and taken the unanticipated roles that original inventors never thought of. It has made a revolutionary impact on the ways people live, think, and communicate. Using the Internet, the information superhighway, a user can travel to any place on the globe to reach information sources in seconds or minutes.

Artists and designers are eager to explore the new dimensions that computer technology can add to their traditional visual elements. Multimedia can integrate a variety of sound, images, text and animation. Interactive multimedia installations can create multidimensional experiences, appealing to different modes of human experience. Multimedia (digital multimedia or computer-based multimedia in contrast to the notion of mixed media in traditional arts) in its essence is the collaboration of art and science. as most of multimedia projects require both artistic and technical sides. Olsen (1997) says that multimedia "combines and packages a large number of known technologies and art
forms such as text, audio, music, photography and video into something new and wonderful” (p. 6). Nowadays multimedia computer technology includes functions of text-to-speech, streaming audio/video, telecommunications, speech recognition, and image capturing. Encarnacao et al. (1993) think that the multimedia technology has gained device-independence after completing device-dependent early stages of development such as Digital Video Interactive (DVI) or Compact Disk Interactive (CDI).

While multimedia can lead the users to multi-sensory experiences, interactivity suggests active involvements in the electronic media environment. Interactivity allows the users to participate and make a decision on various levels from clicking the simple ‘next’ button to strategic decision-making which will govern the outcome of the program. The authors of the multimedia can design a complex environment where the users can control their destinies. It can be one of the many possible (yet predefined) scenarios or entirely open ended one, depending on how the program is designed. The idea of sharing or shifting the authority from the creators (artists and designers) to the users has triggered calls for a new paradigm in the relationship between the artists and the audiences. While the required involvements of the audiences are not entirely new especially during the Postmodern period, traditional art mediums advocate a fixed relationship between the artists and the audiences as creators and passive observers. Interactive multimedia can blur the line between them, suggesting that the artists serve as facilitators who provide the structure with which the audience actually ‘create’ the actual art pieces.

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One example of such real time interaction in art is “Telematic Vision” by British artist Paul Sermon at the symposium of Inter-Society for the Electronic Arts (ISEA) in Helsinki in 1994. Sermon set up two cameras with chroma key background in two different locations, one in Helsinki Museum of Art and the other, the Marina, the café at the hotel where the conference was held. The video images from two cameras were transmitted to each other through the Integrated Services Digital Network (ISDN) lines then composited as one video image to project on large screens that the participants on both locations could see and interact with each other in real time. Another example of interactive multimedia art project over the Internet is “Chain Reaction”, a collaborative art making process among the participants from all over the world and attendees of ACM SIGGRAPH and ISEA in 1995. Each of the thirty-two (32) groups of starter images evolved into 64 final images after six (6) generations to create a set of more than 2048 images by worldwide participations. These kinds of tele-presence and tele-participation over the Internet have suggested more tangible (virtual yet real) Cyberspace where people can feel the presences of each other.

The use of the combined technology can create a powerful synergy, reinforcing each other’s power to provide a whole new range of applications. Most of all, the real power of the Internet comes from its real time interactive communication experiences provided by telecommunication technology. In “Multimedia meets the Internet: Present and future”, Wynblatt et al. (2000) claim that the technologies of both interactive multimedia and the WWW are not only complementary but also capable of creating entirely new communication paradigms. New developments in computer networking will
be able to handle all kinds of human activities with text, graphics, images, animation and live video, voices, sounds, and much more. Besides a CDROM or downloaded programs, multimedia communication tools help the users of the Internet can interact with other users in different locations in real time. For the artists and designers, the Internet/WWW means the work place for both creation and learning. The Internet/WWW presents the ultimate stages for many of them to realize their creative endeavors.

In addition, the Internet/WWW offers a wide range of help for the artists and designers. By the sheer number of contents providers, the Internet can act as a huge multimedia database for various purposes including art. There are already hundreds of thousand libraries, museums and art galleries on the WWW. According to Kline (1994), there are three different types of libraries: paper, automated, and electronic. The paper library is the traditional type, where all information is on paper, including the catalog. An automated library utilizes the computer for limited purposes such as cataloging, searching and circulation. The electronic library has all information and functions of library operation in digital form. It can supply a whole range of unique resources and information that enhance the learning process. The information may be in a variety of multimedia formats, including electronic books, magazines, documents with still images, animation, videos, and music and speech. Researchers and students do not need to literally travel to the different geographical locations to get the information they need. An electronic library can be globally accessible, open to users 24 hours a day, 365 days a year, without library fees or cards.
Interactive multimedia can enhance the learning process of the students, engaging all the senses, especially the visual thinking, thanks to the visualization technologies and techniques. It is generally agreed that the rate of retaining information by the interaction and participation is up to 75% compared to 40% by hearing and seeing and 20% by hearing only. Each student has a different learning style. Multimedia employs various data formats, which can accommodate students' various learning styles from auditory to visual to kinesthetic. The interactivity can benefit students by promoting the changes in the role of students from passive learners to active participants and providing environments where communication and collaboration can actively involve students and educators.

Other educational uses include collaborative computing and distance learning. The Internet/WWW has the potential to expand the traditional notion of education to a global classroom. If the goal of a virtual library is storing information, the goal of collaborative computing is sharing the information. The most important role of computer graphics is the ability to process, modify, transform, and expand ideas visually, in real time, collaboratively with others. Their importance lies in the fact that the human visual system is a powerful processor of information. With high-speed networking and interactive multimedia technology, people in different geographical locations, researchers, scientists and artists can work together, interacting and sharing the information in real time as if they were in the same place. Multimedia provides both the interface between participants and the information to share. New developments in virtual reality promote the concept of tele-presence and data manipulation in cyberspace. High
speed networking such as the information superhighway brings them together. Such collaboration suggests an entirely new way of researching in many areas including artistic collaborations, group works, and real time critiques from the participants in several locations.

Likewise, distance learning is opening a new chapter of education, connecting the teacher and students in different locations. Weiss (1994) reviewed the current practices of distance learning at the University of Wisconsin, the New York Institute of Technology (NYIT), and Stanford University. While they all shared the basic principles of distance learning, each school developed a unique approach utilizing various available resources. The University of Wisconsin, for example, used a basic computer network to teach engineering courses for students nationwide. This required two telephone lines and a computer for each student. One line was for teleconferences, and the other was for a virtual whiteboard through computer software called Vis-a-Vis. This was a minimum setup for distance learning. NYIT was using both analog and digital technology to connect three classrooms in different locations. The classrooms were connected with analog video broadcast and the computer over fiber optic lines supplied by Nynex Corporation. Project Cardinal at Stanford University, on the other hand, experimented on a futuristic setup, with the information superhighway in mind. Everything was on the computer desktop: full-motion live video of the professor in one window, and the transmitted data from the professor in another window. Asynchronous Transfer Mode (ATM), a high-speed digital networking standard for fiber optic lines, was utilized for this project. The students and educators could get the benefits of true real-time
interaction. Each system had advantages and disadvantages. Sometimes technology can provide very fast and effective tools, but the costs often are too high. Sometimes the price tag represents the bare minimum, but the uses are then also very limited.

In addition, a virtual reality interface can help artists explore the multi-dimensional graphical representation of their works, which is not limited to the screen of the computer. Users can interact with the objects in the virtual environments through a fully three-dimensional interface for both the display and control available through the interactive computer graphics technology. For the display, stereoscopic head-tracked systems, using helmets, glasses, or small mobile screens, present an illusion of a three-dimensional computer generated world. For the control, a variety of interfaces has been developed and used including spaceballs, data gloves and data suits. As a result, the user can have the impression of being in a computer-based three-dimensional world. Objects in the virtual world may readily be transformed as the user "contacts" them. Balaguer and Mangili (1991) called virtual reality a new interface metaphor whose goal was to simulate operator presence in remote or computer synthesized worlds (p. 91). They pointed out that the major characteristic of virtual reality is inclusion: being surrounded by an environment. Bryson (1993) pointed out that the real power of virtual reality is from the exploration capability in this environment, especially when there is no tangible counterpart for abstract concepts in the real world. Thus, artists can take advantage of virtual reality for visualizing the creative imagination in virtual environment where abstract and 'un-real' recreation of the world can interact with the real people. Without computer graphics technology, the simulation of a presence inside a computer generated
world is not possible. While the current technology of virtual reality has not yet
delivered the promise of truly immersive environment as the original concepts suggested.
some innovative uses and on-going developments certainly show significant potential
such as the use of Virtual Reality Modeling Language (VRML) on the Internet, realizing
interactive 3D objects on the Web.

The challenges and future

At the present time, there are some concerns in the field of computer graphics
including the use of the Internet. While new technologies fill the Internet with the rich
multimedia data in the various formats, they tend to require more resources. On the
network, it means requiring more bandwidths, increasing latency and download time. On
the users’ side, the recommended minimum hardware configuration also requires better-
equipped computers. The need of utilizing the advances of technology for the Internet
have been so urgent that almost every minute and second counts. For example, the ever-
increasing requirements for better ways to communicate and to visualize data have led to
the development of the virtual reality on the Internet. Virtual Reality Modeling Language
(VRML) allows the users to fly through the three dimensional data. Streaming
technology has been developed to allow the users to play audio and video clips while data
is downloading. These developments mean that artists and designers also need to know
up-to-date technologies in order to keep up their art and design works. The design of any
Internet site is generally not a one-time deal. Constant upgrade, update, and redesign are
a must in order to provide a rich multimedia experience to its users.
One of the most serious concerns that the art community currently faces about the computer graphics and its use on the Internet is the protection for intellectual property. Digital technology provides the possibility of unlimited reproduction of the data including images, audio, and video without losing the original quality. While this capability of unlimited reproduction gives the creators and authors of 'works-of-art' the creative power of unlimited variations of their works without losing the originals thus providing unlimited experiments, it also threatens the livelihood they hope to earn by their creations. Bramhill and Sims (1997) state that the materials in digital form have less physical protection and control while they can be reproduced as easily as a 'drag-and-drop' operation (p. 63). With the developments of the network including the Internet, many authors' creative endeavors can be available to audiences all over the world. This availability could be a significant benefit for the artists and designers who want the works to reach wider audiences. Through the Internet the 'works-of-art' can be accessed in any places at any time. However, the availability to such anonymous audience takes the risk of no control of the misuse or unlawful use in spite of many attempts to prevent such actions. The works may be developed for commercial purposes or have natural commercial values or are simply aesthetically pleasing. In any case, unauthorized copies, displays, distributions, performances, or distortions of the works severely damage the original intentions. New technologies are being developed for copyright protection, including steganography, which is the core technology for digital watermarking. This
technology is sometimes called digital fingerprinting, hiding embedded information of the copyright holders. However, no current technology can completely prevent the unauthorized or illegal reproduction and use of the intellectual property.

Nobody knows what tomorrow will bring, especially with the accelerating developments of the computer related technology, which has shown many promises of recreating the reality. Then, what will computer graphics for art and design look like? Some people suggest that personal computer will fade away as network computers take their places. Some envision wearable computers that can be integrated into the human body. Longson (1999) foresees tailor-made environments where artists and designers can create their own sets of tools with rented software. He sees the importance of networking in which browser will be the only software for the future computers. However, Longson (1999) also states that it is oxymoronic to predict what future of art and design will be like since it will not be a future as soon as it is described. Splater (1999) points out that the concerns in the art and design area have not been the determining factors but those of "technology-driven business such as aerospace and the military" for developments of hardware and software. Consequently, Splater recommends artists to develop critical views about the medium and work closely with the research and development (p. 441). One thing is clear that arts and art mediums are the products of the culture of the time. No matter what kinds of cultural (including technological) changes artists and designers face, they will and have to challenge and extend the meaning of art by searching for a new aesthetic development.
Computers in art education

For art education, computer graphics technology can be utilized in many ways. Certainly the computers can be used as a tool or art medium to create works of art and enhance their charms. The computer is indeed versatile in art-making process, providing virtually unlimited visual possibilities. More importantly, however, with the development in interactive multimedia and network technology such as the Internet/WWW, computers can be far more than a 'simple' tool or medium. Computers can be a delivery system for the instruction of art as well as an art form itself. Madeja (1993) confirms the growing role of the computer in art education as "synthesizing hub" of the "electronic and visualization wheel" (p. 9). He argues that the essential role of the computer has extended from the prerequisite for almost every field the visual arts, including design fields and fine arts, to a proliferation of new developments in the field of art education, such as multimedia and interactive arts. For education across the fields, the real benefit from using the new technology is that they can further enhance the teaching and learning process. In art education, educators focus on the use of technology to meet the different learning styles, incorporating of visual, auditory, and tactile modalities. Interactive multimedia technology can provide multifaceted leaning and teaching tools that will accommodate various learning styles. Dunn (1996) stresses the importance of the active participation of the children in the learning process. He argues that interactive integrated media can "support children-centered approach by shifting a significant amount of control over the learning process from the teacher to the learner" (p. 7).
Art educators can use computers as a research tool to explore and download rich multi-format resources from worldwide museums and galleries. Often these resources are available only on the Internet for various reasons. Devine and Welland (2000) at the Hunterian Museum and Art Gallery at the University of Glasgow explain that the World Wide Web (WWW) provides an opportunity to show not only the exhibits in the gallery to global audience but also materials that are on temporary display or in store because of their fragile condition (p. 32). The World Wide Web can also be used to showcase works of art that cannot be displayed at traditional galleries because of high cost, tight security, and immobility. Students and teachers can deepen their researches by investigating the various periods, styles, artists, historic events and movements of art. The aesthetics value of various art forms can be studied. In addition, such rich and dynamic resources are mostly free, easing the tight school budget for the on-site classroom resources and/or field trips. Students can also learn about specific topics from working independently or cooperatively with either their classmates or the participants on the other side of the continent through the Internet.

This cooperation can be extended to several areas of art education including art interpretation or criticism. Students tend to be more open critiquing works by unknown artists than the class works by fellow students. Art teachers can encourage the students to participate the worldwide discussions about works of art that they or their peers make. Through the Internet/WWW, student groups in different geographical locations can exchange their ideas of art-making process and aesthetics. Heise and Grandgenett (1996)
believe that sharing and incorporating resources and contextual information from various cultures through the Internet provides "a real opportunity to blend multicultural, multiage, gender inclusive educational reform into the art curriculum" (p. 13).

Art educators can take advantage of different types of resources for their classes, which are also available through the Internet/WWW. In addition to the reference materials and multi-format aids, hundreds of art education web sites provide various resources for teaching and learning arts. One of the most notable sites is ArtsEdNet (www.artsednet.getty.edu), which was launched by the Getty Center for Education in Art in September 1995. ArtsEdNet has provided educators with invaluable information and resources, from galleries and exhibitions to lesson plans and curriculum ideas. Art educators can share the vast amount of knowledge about Discipline Based Art Education (DBAE) with a variety of curriculum materials. It also serves the community of art education with newsletters, papers, on-line journals, books, and forums for on-going discussions. The web site is also linked with hundreds of other related web sites such as home page of the National Art Education Association (NAEA) (www.naea-reston.org), K-12 cultural and education resource of the Asia Society, AskAsia (www.askasia.org), and the New York Foundation for the Arts’ (NYFA) ArtsWire (artswire.org). Dunn (1996) indicates that art curricula are created in general by "individual art teachers for use in their own classes" since art teachers are usually "isolated from one another in schools" (p. 9). Besides serving as virtual libraries and resource centers, these international, national and regional web sites provide a place where art educators in the world can meet and share the accumulated knowledge and prepare the future of art education.
Personal computers continue to become cheaper, faster, and better. Good standardized software is now readily available. The components such as sound, animation and text can be orchestrated at an appropriate time for a seamless presentation through interactive authoring programs such as Macromedia Director, Microsoft PowerPoint, and Adobe Persuasion. Moreover, developed multimedia materials can be transferred to Web format easily by using either the same programs or drag-and-drop style software. It would be fair to say that, with currently available resources in the area of multimedia, educators can develop meaningful curricula and course materials. With curricular changes to take advantage of the computer graphics technology, both instructors and students can further enhance the teaching and learning process. Research in educational evaluation must keep up with these changes to ensure that these techniques do indeed enhance the learning process.

Over the years many articles in art education journals have emphasized the importance of integrating computer technology with teacher education programs (Hubbard 1991, Madeja 1993, Dunn 1996, Heise 1996, Koos & Smith-Shank 1996). The authors encourage preparing the art education students to be confident to take leadership in their future schools for the development and use of technology. However, many colleges and universities do not require art education majors to take computer graphics technology extensively enough. Hubbard (1996) asks the question where the current art education stands in terms of integrating the computer technology. He argues that the curriculum planning of art education in colleges and universities usually fails to incorporate the new computer technology. Discipline Based Art Education (DBAE) has
been emphasized in art education for many years, teaching art in a disciplined-based body of knowledge that surrounds art and gives it meaning. While art criticism, history, production and aesthetics are getting special attention, why interactive computer education has been left alone, Hubbard asks. In his point of view, pre-service teachers are not adequately prepared for the classroom of the future or even the classroom of today. He claims that art educators should consider including integrated technology in their discipline-based art education by teaching the application, aesthetic value and educational merit of this exciting new area. Students in art education often choose or are asked to take minimum basic computer graphics classes as course requirements. With the dazzling technological advances in the field, these basic computer graphics courses are never enough for future art educators. For example, searching through the Internet for teaching resources is one thing, but creating a web site for distributing class materials or showcasing the works of students is quite another. Many schools are already flooded with educators that suffer from computer phobia. Vast amount of money is being wasted when expensive equipment sits unused in the majority of schools today due to the lack of professional training. Administrators of these schools are looking for and expecting the new teachers fresh out of the college to lead their students and teachers to the future with up-to-date knowledge and skills. Dunn (1996) points out that pre-service art educators who possess knowledge and skills of such interactive multimedia technology will be a vital part of their future school systems. They can assume the leadership at their schools in implementing new technologies not only for the art classrooms but also the whole school system, as their schools continue to restructure themselves for the future by
adopting innovations in technology for teaching and learning. As a result, art education can be in the core of the educational system with the interactive multimedia technology as it can facilitate active learning in many areas of education (p. 11). Higher education should take a serious look at implementing computer-related art courses as part of core courses in art education. Students should be strongly advised to seek out computer-based elective courses and utilize independent study options if they are to master this highly demanding and essential field of study. Art education must prepare the prospective teachers to be educators who have their own mastery of the discipline, and can actively apply it to their classroom teaching.

Computer graphics education

In the United States, computer graphics has become a valuable component across the field of art and design. Consequently the computer graphics curriculum in art department has grown from a curious new development in some specialty schools to mainstream curriculum of most colleges and universities. According to a 1989 survey by the Special Interest Group on Computer Graphics of the Association for Computing Machinery (ACM SIGGRAPH), there were approximately 175 to 200 schools in higher education including two and four year colleges and universities in the United States offering degrees, certificates, programs and/or courses in computer graphics in the visual arts. In recent years, especially during the last five or six years, the number has grown so rapidly that almost all art departments in colleges and universities in the US can be counted in. Eber (2000) says that computers have recently emerged as a commonplace
on the scene in a record number of traditional college and university art departments. A recent article, in ArtsWire Current, the newsletter of the New York Foundation for the Arts (NYFA), describes the current thriving of electronic arts/new media departments in the higher education across the country (April 3, 2001). The article points out that most universities provide at least one or two courses in that area if they do not have the department that is specialized in related fields. According to the article, colleges and universities are eager to “attract students, building new facilities, integrating with other aspects of the curriculum, and shaping widely varied approaches”.

Based on the programs they offer, schools can be categorized into three groups. The first one is the schools that are in the minimum developmental stage in computer graphics education. These schools offer basic introductory computer graphics classes that serve as a foundation for other art programs such as graphics design, typography, and photography. These schools often do not have specialized faculty members and/or art-only computer labs. The faculty may have specialty in other areas of fine and commercial art. The art departments need to share the general-purpose computer labs with others on the campus. The second category is the schools that provide several computer related art classes in conjunction with related degree programs such as graphic design, fashion design, digital photography or film and video. In this case, many schools establish designated computer labs and independent supporting structures including faculty and staff. Although the supporting structure is neither a degree-giving program nor a department, it works closely with other academic programs within the department. A certificate program or minor in computer graphics is possible with the degrees in
related areas. The third kind of schools have developed specialized programs in the field of computer graphics. They offer degree programs that have a focus on specific computer graphics technology such as 3D computer animation, interactive multimedia, digital video, web, and game design. Both undergraduate and graduate programs are available under the various titles including computer graphics, computer arts, time based arts, media arts, digital arts, electronic arts, etc. In addition, many of these schools have developed interdisciplinary approaches. And it is common to see that more than one academic departments are working together for the programs.

Among the schools that have a specialized study in computer graphics, several different educational structures and approaches are apparent. These non-standard approaches are not new to computer graphics education because of its interdisciplinary nature. Because of its metamorphic ability, the potentials of the computer in art are almost limitless: it can easily branch out into areas of music, dance, architecture, telecommunication, and performing arts. It is the resources and goals of each institution that decide the kind of programs it provides and the way it carries them out. For example, the School of Visual Arts and Pratt Institute in New York offer Master of Fine Art programs through the Computer Art Department, which specializes in using computers for art. On the other hand, the Advanced Computing Center for the Arts and Design (ACCAD) at The Ohio State University focuses on an interdisciplinary research environment for computer graphics, combining resources of a variety of departments such as art, art education, music, industrial design, and computer information science. Other institutions integrate the computer technology into the existing studio art programs.
California Institute of Arts offers various computer graphics courses in its programs including art and video/film. Although the degree is in the studio arts, students can focus on the computer graphics as a particular choice for their career. Even there are new institutions that mainly concentrate on digital media. DigiPen Institute of Technology in Redmond, Washington, in conjunction with Nintendo of America, has offered associate degrees in 3D computer animation and video gaming programming since 1998. Overall, there has been no standardized form in computer graphics education. While the advances in technology in the field of computer graphics are the main force to propel the education, academic institutions in general depend on their academic expertise and available resources to develop the programs.

Because it utilizes technologies that are constantly changing, arts programs should be flexible to adopt new developments in computer graphics. The panel of "Approaches to teaching introductory computer graphics" at SIGGRAPH 94 (1994) reemphasized the findings of the Undergraduate Faculty Enhancement Workshop in Computer Graphics sponsored by the National Science Foundation (NSF) and the ACM SIGGRAPH Education Committee in the same year that there were widely different viewpoints on the content and methodology in terms of teaching the introductory computer graphics course (p. 479). This is a quite understandable phenomenon as computers can be adaptable to almost any areas of art and design. Using the same computer lab, art educators can select and emphasize the specific functions of the computer graphics technology to meet the goal of their classes. They can also utilize different pedagogical approaches. While explaining the practice of teaching and learning computer graphics in art and design at
the Center for Electronic Arts in United Kingdom. Lansdown (1994) pointed out that "over-the-shoulder instruction, projects and private study" were preferred strategies of teaching and learning over more formal lectures because computer graphics education in nature was similar to traditional skill-based art and design education (p. 479). Lansdown argues that teaching and learning strategies on the van Hiele model of learning (Burger & Shaughnessy 1986) can be validated for computer graphics education as it is "apparent that the levels of learning are sequential and ordered yet continuously connected and that each level has its own terminology and language of discourse". He claims that it will be necessary to create an environment in which students can incrementally learn and understand the underlying concepts of computer graphics, especially computer graphics programming, in an orderly manner (p. 479).

There are concerns about the limited resources for the computer graphics education in response to the advances in computer technology. The availability of high power computers with affordable prices has played the major role in the computer's popularity in the field of art and design. Nowadays even the basic low-end computers are capable of performing the graphics functions which used to be the specialties of the supercomputers. Imaging software, many of which had their roots in the military research, have now been widely available with an incredible array of functions and usages. Most of these hardware and software are so affordable that even students can buy them without a great deal of financial burden. Interestingly enough, however, these ever-evolving technological advances come to the education as a two-sided blade. While the costs of hardware and software are down significantly, their life span shortened as well.
In the case of hardware, any computer lab is expected to have a major upgrade every two or three years simply to keep up with the current technology. Such fast advances in computer technology are clearly illustrated in a television commercial, which promises free upgrade options upon the purchase of a computer. The commercial shows a man driving his car from the store with a newly bought computer on the passenger seat. He is pleased and proud to have the most up-to-date computer in his possession. He was! That is until he sees the billboard on the way, where workers are putting the advertising of a newer computer model by the same company. This tantalizing commercial is a bit exaggerated but wittingly exemplifies the speedy advances of the computer technology that are as fast as a blinking of an eye. In addition, most graphics software companies put a newer version of the existing software on the market every half-year. While the cost of individual hardware and software is much less than ever before the financial burden for the academic institutions to keep their computer labs operational has not been lightened.

In addition, these new technologies have brought many challenges to the academic institutions. It is the role of the academic institutions to prepare their students for the real world. Students need to develop their skills and accumulate knowledge to compete on the market. Then, the question is how much they need to know about the ever-evolving technologies. When will the educators be able to feel that their students have learned enough to start to create instead of still having to learn about new developments of specific technologies? Also, the educators need to study and be retrained continuously, which seems getting harder and harder because the advanced technology is getting more and more sophisticated and specialized, and expands to cover
new areas everyday. New technologies usually come with a stiffer learning curve as
they provide more whistles and bells for the users. Historically, many academic
institutions did not respond quickly enough to be in the leading positions, especially in
the areas of such rapid changing technologies. Those institutions that cannot take actions
quickly will remain as passive followers and so will their students.

Summary

The field of computer graphics has come a long way in such a short period of time
since its introduction almost 40 years ago. Within that time, the computers have been
transformed from amazingly curious thing to an integral part of many art practices. The
history of the computers in the field of art may be loosely divided into three periods
based on the enabling technology and accessibility to the field: the early, the expansion,
and the explosion. The early period can be defined as struggles and triumphs of the
artists who pioneered the uncharted territory. In spite of limited access and difficult
required learning in technology, the early artists pulled out some incredible achievement.
During the expanding period between mid 70’s and late 80’s, the artists and designers
took advantage of more readily available computer technology as the introduction of
affordable personal computers. The technological developments in the field including
graphical interface and various commercial graphics software, enabled the artists to
explore the set of visual possibilities that had previously been limited to the only a small
group of people. In the explosion period since early 90’s the field of computer graphics
has matured to be a legitimate study subject with its own body of theories and practices.
Along with the explosive growth in the use of computer in our society, the filed of computer graphics have changed the way many artists and designers work in the visual communication.

In addition to the use in art-making process, the computers can enhance the teaching and learning of art by providing a multi-sensory delivery system for the art instruction. The use of interactive multimedia technology and network such as the Internet/WWW can help to meet the different learning styles, appealing visual, auditory, and tactile sensors. By active participation, the students can improve the learning with the help of the teacher.

As a result of the current popularity of computer graphics in our society, a record number of schools in higher education have developed computer graphics curriculum in art department. From few introductory classes to a specialized department, computer graphics has found a new ground in almost all art departments in colleges and universities in the United States. While the field of computer graphics is thriving, there are many questions for teaching and learning computer graphics. From the technological concerns to selection of the curriculum and pedagogy, the academic institutions in higher education must face many challenges ahead.
CHAPTER 4

CASE STUDY PART I, YEAR 1984 TO THE SPRING OF 1995

Introduction

The computer graphics program at the USF started in 1984 by a commercial art faculty member. During the late 80's and early 90's the (former) Art Department at (former) Saint Francis College felt the necessity of developing and providing quality computer graphics courses for the students. As an effort to meet the challenge, the Department hired a new faculty member who had expertise in computer graphics in 1995. Also, a new computer lab for art purposes was set up in the same year. As the computer technology had become the essential part of many areas in art and design, especially in the field of commercial arts, the concentration program was developed to address the problem of inadequately prepared students for the present and future job market.

In 1996 the Art Department started a computer graphics concentration in several arts programs for both Associate and Bachelor degrees. The concentration was available as one of the options for degrees that included the Associate degree in Commercial Art, the Bachelor degree in Fine Art, and Bachelor in Fine/Commercial Art. Each individual course of the concentration in computer graphics was also available to any art students.
who were interested in. Soon after, the Art Department changed itself to the Department of Art and Visual Communication during the 96-97 academic year in order to better fit itself for the future development and to provide necessary education for the students who would face many challenges in the real world of changing technology. Thereafter, the Department had experienced many changes and developments in its computer graphics program.

While the development of the new concentration in its degree programs met the immediate needs of the Department and the students, more programs followed immediately in order to meet the future challenges actively and effectively. In the fall of 1997 the department started to set up a new major in Computer Arts and the new major became available in the fall semester of 1998. This new program offered two concentrations, which were multimedia and 3D computer animation.

Even though the recent developments were more striking, the teaching and learning of computer graphics in the Department had relatively a long history. In 1984, the faculty member who was in charge of commercial art program started a computer graphics course using AT&T's digital painting program called TIPS on an 80286 (AT) personal computer (PC). This probably was the first computer graphics course among the colleges in Northeast Indiana and one of the earliest ones even in the country teaching the use of computers in art-making process. The class reflected the early development in the field of computer graphics. As mentioned in chapter three, the 1989 survey of SIGGRAPH counted 175 to 200 schools in higher education that offered degrees, certificates, programs and/or courses in computer graphics in the visual arts. The time
was 1989. While the fast-growing popularity of the computer graphics in the recent years could make the class look less than impressive, it was not a small thing in a small college even for a course of computer graphics to get started back in 1984.

However, until 1995, the computer graphics program at the University of Saint Francis had to struggle to survive, especially during the last years in that period. While the class might satisfy some curiosity of the computers in art, it was not further developed enough. The program was not developed quickly to meet the rapid changes in the field. The program did not get enough attention and/or supports from the USF, or the Department. Despite the growing enthusiasm of the students and demands from the some local commercial graphics agencies for graduates who were skilled in computer graphics during the early 90’s, the program did not get the much further support it needed.

However, through the series of events especially those in 1994, the Art Department gradually realized the importance of implementing computer technology in its visual art programs. The wide and rapid establishments of computer graphics programs in the academia throughout the nation also affected the Department. Then, the Department convinced the administration of the University to take a forward step to revive its almost-abandoned computer graphics programs in 1995.

From Chapter Four to Chapter Six, the developments of the computer graphics program at the Art Department in University of Saint Francis are described in detail. Chapter Four depicts the period from the beginning of the program in 1984 to the spring of 1995 before the new development of the computer graphics program. Chapter Five illustrates the developments between 1995 and 1997 of the certificate program and the
computer graphics concentration within several degree programs. In Chapter Six the initiation and maturation of BA degree in Computer Art since 1997 and the current practices and status in 2000 are described.

**About the university: The University of Saint Francis**

The University of Saint Francis (USF) in Fort Wayne, Indiana is a small private (Catholic) coeducational institution of higher education in the liberal arts tradition. The USF was founded in 1890 by the Sisters of Saint Francis of Perpetual Adoration. The University changed to its current name from Saint Francis College in 1998. It is offering more than 30 major academic programs along with several minors for approximate student body of 1,700. About 1,450 undergraduate and 250 graduate students are enrolled in 14 academic departments. Even though students are from many states in the US and foreign countries, the majority of students are from surrounding states including Indiana, Michigan, Illinois and Ohio. The USF does not require any religious faith for the students to enroll. As the biggest department is nursing and allied health, more than half of the students are women. The majority of students, up to 75%, are non-Hispanic white.

**About the department: The Department of Art and Visual Communication**

The Department of Art and Visual Communication at the USF is well known in the region for its strong programs in both fine and commercial arts. The Department changed its current name from the Art Department in 1996 as a result of merging the Art
Department and the Communication program. Many graduates from Fine/Commercial art program are currently working at advertising and graphic design agencies throughout the region. The art education program also has produced many art teachers who are currently working in both public and private schools in the Greater Fort Wayne area. In fact, about 85% of graduates are reported to work in the fields related to their majors.

The Department recently moves to new art and design facility. This three-building complex has 34,000 square feet space for various art and design activities. In the main three-story facility are many art studios, classes, two galleries, and graduate students studios. The technology building has a television studio, a video editing suit, and two computer labs. The Department has 225 students as of fall 2000. There are 208 undergraduates and 17 graduate students. There are six fulltime faculty members, several adjunct and part time faculty members, and staffs. As the University is a teaching-oriented institution, most classes are taught by the full-time faculties. No classes are taught by graduates or teaching assistants. The Department currently offers the degree programs in:

**Associate Degree**

Commercial Art: 65 hour major
Concentration in illustration, photography or computer graphics

**Bachelor Degrees**

B.A. in Fine Art: 35 hour major or 47 hour major
Concentrations in one of the following: Graphics and Drawing, Painting and Drawing, Sculpture, Crafts, Photography, Computer Art

B.A. in Fine and Commercial Art: Double Major - 65 hour major
Concentration in Illustration, Photography, Computer Art

B.S. in Art Education, Visual arts: 40 hour major or 56 hour major for all grades
B.A. in Communication: 42 hours
Concentrations in the following areas: Electronic Media, Production, Communications Management

B.A. in Computer Art: 65 hour major
Concentrations in the following areas: Multimedia Design, 3/D Computer Animation

Master Degrees
M.A. in Art: 33 hours of study in any of six major areas

Description of the early developments: 1984 - 1995

The Beginning

The initial development of computer graphics program at the USF goes back to 1984 when the commercial art faculty received a grant that allowed the purchase of a computer as a part of the development in audio/video program. In 1984 the Department offered the art programs much similar as the current one mentioned above except the computer arts and communication. Students had choices at an associate degree in Commercial Arts and bachelors in Fine Art, Fine/Commercial Art, and Art Education. There were 65 art majors in 1984 and majority of them were commercial art majors. Students were generally more interested in the commercial art program since it generally provided better job opportunities than fine arts. Across the town, Indiana University and Purdue University at Fort Wayne (IPFW) competed to recruit students for their fine art oriented programs.

There were three fulltime faculties in the Art Department in 1984. Two of them were fine art oriented and one, commercial art. The Department chairperson had education and fine art background. He was teaching courses in fine art, art history, and
art education. The fine art faculty taught other fine art oriented courses. However, in a small college, it has been a necessity for the art faculties to teach more than one area. For example, while the fine art faculty mainly taught fine art courses, he also taught art history and a couple of commercial art courses, including graphic design and 2D advertising design. And the commercial art faculty also taught a variety of courses, including illustration, television graphics and three dimensional art courses such as sculpture and ceramics in addition to the regular commercial art courses. The commercial art faculty came to the Department in 1976 and triggered off most of the initiations and developments of the commercial art courses including computer graphics. Before he joined as a new fulltime faculty, the Art Department was more fine art oriented.

The first computer graphics class at Art Department in USF was offered in 1984 by the commercial art faculty. The faculty was very interested in the use of computers in art and design and had an eye on the developments of computer graphics. He explained that computer graphics was “happening as a painting on the computer” during the early 80s. He added that, “but soon I saw the possibilities or functions of typography, text typing and layout” (1998). As a director of commercial arts program, he explored possible uses of computers in the degree program. In 1983 he applied and received the fellowship from the Lilly Foundation for the research of the use of computers in art and design program. He used his sabbatical between August 1983 and April 1984 and the Lilly grant of $36,000 to visit schools and institutions including Harvard University and Century 21 Studio in Florida in order to survey the uses of computers for art. The result
was a report about what kind of psychological effects the uses of computer had on the artists. Unfortunately, he did not publish his report. He said, “I researched but I did not publish because it was like my own personal research even though I got many invitations for publishing the report nationally and internationally” (1998). Nonetheless, he explained that the report concluded that the creative process of computer could provide limitless visual possibilities. He argued that artists would have different sets of mind when they worked with computers instead of traditional art mediums. He pointed out that when using computers, artists would work in a different way from the traditional art mediums because they no longer had to worry about losing the initial images, concepts, and ideas since they could endlessly save different versions of works in progress. And he concluded the report by saying that the computer would be the way to go for the future. From that experience and research, he wanted to develop the new computer graphics program in the Department. He also explained that after he witnessed the introduction of desktop publishing and (computer) graphic design programs, he thought that the commercial art program would not survive without the computer.

In 1984 he wrote a grant proposal to Cable Access, a local cable television company, for the development of a computer graphics program. The company, on the other hand, did not have a direct interest in computer graphics. Rather, Cable Access wanted to develop an audio/video production curriculum that could utilize the University’s television studio to produce television programs regularly. The company wanted the produced television programs to be aired on the public access channels in the Fort Wayne area. The grant, however, allowed the purchase of one computer that could
be used for video graphics and character (text) generation. With the grant total of $45,000, the television studio purchased one Sony U-matic recorder deck, three CCD cameras, an A/B Video editing system, and one computer with two monitors. This computer became the main tool for the first computer graphics class at the University. It was an IBM AT (80286) computer with Targa graphics board. The computer was equipped with a computer monitor, a video monitor, and a tablet. The software was TIPS by AT&T. The computer was set up in the department's weaving room. He also bought one computer for his own at home to learn the program. The faculty member said, "I didn't know anything about the computer." "I just used the program" (1998).

There were 10 students in that first class. "They couldn't take their eyes off, they couldn't stay away from it", he said (1998). The students took turns to use the computer. It was a three-credit hour class mostly for Fine/Commercial art majors as an elective. The title of the class was "Computer Graphics", which reflected the trend of the time. The class was offered once a year. In the class the computer was introduced as a painting tool. The class was labeled as a studio art course. In the class syllabus, the goal of the course was "to learn to use computer graphics software as an independent art medium and use the medium to produce original art work" (1994). A list of assignments was given asking the students to create several images from landscape to still life. In addition, the assignments included the creation of ten titles for the University television programs as a part of the Cable Access grant agreement. There were two examinations, a midterm and the final, in order to test students' knowledge about hardware and software. They were counted for 20% of the grade. There was no output device attached to the
computer. Students were required to save their images either in the hard disk or floppy disks. The only way to get a hard copy of the images was taking photos directly from the computer screen using a 35 mm camera. Because there was only one computer available for the whole class, the students were required to use sign-up sheets to reserve the time slots that they could use.

When the faculty tried to introduce computer graphics course, however, the reaction from the school was not an overwhelming welcome. From the top administrator to the members of the faculty in the Art Department, the commercial art faculty had to face many challenges. First when he explained what he had learned from the research with the Lilly fellowship, the president of the University at the time did not show much understanding. According to the faculty, the president made it clear that the University did not appreciate any research that the University did not support. The faculty also claimed that the president expressed her apprehension of the computers as a trend that would not last long at the several meetings.

Within the Department, the reaction was not any better. The faculty who was in charge of fine art programs expressed his dismay about the use of computers in art. At the scheduled art-making demonstration of the computer to the campus community, the fine art faculty told the audience that the images done with the computer were not art. And he argued that the computer did everything. The faculty in commercial art programs explained that the computer did not do anything until the users put the hands on it. But, his explanation could not change the ideological belief of the fine art faculty about the definition of art. According to the commercial art faculty, the fine art faculty disagreed
with the direction of the Department and argued it should be more fine art oriented. The commercial art faculty felt the Department was all against the introduction of the computer into the program. However, the chairperson at the time explained a bit differently. The chairperson supported the decision as he also could see the development of computers 1980’s especially in the graphic design area. And he did not think the fine art faculty was against the introduction of the computer. The chairperson said, “He (the fine art faculty) simply did not care” (2000). In any case, the reaction of the fine art faculty was not surprising. His indifference or even rejection reflected the general responses from the art community, especially fine art, at that time. In its still early period in the 1980’s to get its way into the field of art, the field of computer graphics faced many obstacles and resistances. And the educational institutions were no exception. The technology was unproven and expensive. The results in most cases were in poor quality. The final output quality of images generally was not there yet to meet the standard of the industry. Most of all, the fear and the misunderstanding of using a ‘machine’ to replace the artistic creativity for art-making process was not fully resolved. The commercial art faculty said that the graphic design and advertising agencies in town laughed at the Department’s attempt to adopt the computer graphics technology in 1984. Other faculties also confirmed that the industry in the region was skeptical about the use of computers in their business and did not take the computer seriously.
Developments

During the early years more computers were added to the program and the existing computers were upgraded despite the lack of enthusiasm and supports from the outside of the Department. For the first three years, the grant from Cable Access provided for the addition and upgrades of the computers. Two computers were added in 1985 and another two in 1986. The faculty wanted to have enough computers to provide each student with a computer. But the administrators of the University kept the ratio of the one computer per three students. In 1988 the Department added three more computers to make it a total of eight with some of the department equipment budget and the donation from one of the department patrons, who annually donated money between $25,000 and $30,000. After that there was no more addition of computers until 1995. The only technical supports for the computers had been minor upgrades. However, there were some important additions of peripherals to the lab, including printers, a digitizing camera, and a scanner. These peripherals not only improved the input and output capacity but also provided more choices for the curricular development.

There had been no change in the curriculum until the early 90s when two more computer classes added to the computer graphics curriculum. The first one was a one-credit hour introductory computer class for the computer novice. The topics covered the computers terminology, typing with the keyboard, saving files on the disk, and working on Disk Operating System (DOS). This class was taught by the system administrator at newly found Academic Computer Center in 1992. With the possibilities of printing the works done on the computer, the Department added "Desktop Publishing" as a new
curriculum in 1993. It was the laser printer that made the class more feasible. The concern before was that there was no way of printing the images and the design with the same quality as the commercial printing. Before the laser printer there was a dot matrix printer whose resolution and printing quality was much less desirable. With the addition of the laser printer, "Desktop Publishing" class became a requirement for commercial art degree (Fine/Commercial art). The printing quality became somewhat compatible with the commercial printer, but the fonts on the computer screen were not compatible with the ones for printing at the time. High quality text printing had to wait till later time.

Also, the works done at the Computer Graphics class still needed to be either photographed directly from the screen or saved on the floppy disks and brought to the commercial printing service because the print outs from the laser printer were only available in grayscale.

The "Desktop Publishing" class dealt with typography, typesetting, page layout, and preparation for commercial printing. Aldus PageMaker was used for the page layout and Adobe Photostyler was used for scanning and manipulating images. Students were asked to design various forms of publication including resumes, newspaper advertisements, newsletters, and a two-color advertising. Students were also required to take examinations that tested students’ knowledge of hardware, software, and the terms and functions of the computer. Unlike the "Computer Graphics" class where the artistic creativity was emphasized, the "Desktop Publishing" class put more weight on learning the software. The use of the computers was still a new thing to many art students not only for the art and design but also any general purposes in early 90's. As a result.
"Desktop Publishing" class had to deal with the problem of introducing the computers for the first time computer users. One of the important lessons of the class was 'learning how to use' rather than 'learning how to create' or 'learning how to design'. That approach was apparent in the syllabus for the class as it stated the objectives of the class:

1. Learn basic terminology used in desktop publishing software
2. Learn most commonly used functions in PageMaker and scanning functions in Photostyler
3. Learn to design a document with text only
4. Learn to design a document with text and graphics created in PageMaker
5. Learn to scan images in Photostyler and import text files from word processor
6. Learn to edit text, graphics, and imported images
7. Learn to design a document with text and imported graphics and images
8. Show evidence of basic word processing skills and terms.
9. Understand basic concepts of computer connectivity with high resolution color digital and chemical output devices for preparation of comps. And color proofing of computer generated images
10. Learn terminology used in typography and learn typographic measurements
11. Learn to produce multi-page documents with consistent layout (design a Master page)
12. Learn to produce mechanical art for commercial printing (keyline and camera-ready via digital medium)
13. Learn manual scaling of images
14. Learn how computer generated artwork is interfaces with the images setters for commercial printing (Course syllabus, 1994)

The approach was even more noticeable when the students were required to do all the assignments without any help at all. The students were even warned that both the students and the helpers would be penalized if any help were given for the assignments. No collaboration or team works were allowed. In other words the class was designed to
focus more on what each student should learn about using the computer than how each student could learn or develop to design with the aid of the computer. For the early computer classes, it was necessary to teach the students how to work with hardware and software because the lack of previous computer experiences of the students’.

On the other hand, no major changes happened in the curriculum for several years for the “Computer Graphics” class. It was still a popular class for the commercial art students as an elective. Students at the moment had the choice of printing their images but still used computers for digital paintings only. Then, the class became a requirement along with “Desktop Publishing” class. With the purchase of a digitizing camera and the scanners the class no longer was limited to digital painting. The additional software of Aldus Photostyler and Painter were used for photo-retouching, digital collage, and special effects.

In terms of taking care of the equipment, the faculty member had to take care of everything because there was no supporting technician among the staff. It was not until a later time that the school started the Academic Computer Center on the campus with one system administrator. Meanwhile, the faculty member refused to be a technician. He said, “I am not a technician. I am the user” (1998). When there was something broken or not working, the school had to send it out or called somebody in to fix it.

**Deterioration**

Despite the rapid developments of computer graphics technology and wider acceptances in the industry in the early 90’s, the computer graphics program at the USF
deteriorated without the required support. Until the late 80's, computers were still
treated as nothing more than a curious thing without real usages inside and outside of the
USF. From the beginning of the program, top administrators of the USF at that time did
not consider the computers seriously. At the meetings the president often expressed
doubts about the usage of computers in academics. Within the Department, the reaction
was not overwhelming enthusiasm, either. Other members of the faculty did not see the
real benefits of implementing the computer technology in the existing art programs.
Students took the class mostly out of curiosity. The beginning of the program was
possible mainly by the efforts of one faculty member. The same faculty member had to
develop the program with little support from the USF. Outside of the campus, the
graphics-related industry in town, except a few curious agencies, rejected the idea of
using computers for their business. They did not support the computer graphics
curriculum, as they wanted graduates who could draw and paint in the traditional way.
These reactions, however, were not groundless at the time as the technology was not
there yet to satisfy the industry's standards, at least not within acceptable budgets.

The developments in computer technology during the early 90's were so
tremendous that it surpassed people's expectations including the computer experts. The
wide uses and availabilities of computers found some new ways into people's daily life.
During the early 90's more and more design companies moved from a X-acto knife and
Rubber Cement to the keyboard and mouse so that computers became a must-know
prerequisite for the students to get a job. The same advertising and design agencies in
town, which had rejected and laughed the use of computers in the art-making now
repeatedly suggested and demanded that the Department teach the students more computer-based art and design courses. Having noticed the changes in the industry, the students asked the school for better education for their future. Some of them purchased computers on their own, now more affordable, and taught themselves new graphics software. Throughout the country, there were mushroom effects in academia, upgrading their art programs with new computer technology.

On the other hand, what happened in the real world did not cause much reaction in the University community, especially from the administration. It was business as usual, at best—no need to hurry to fix the old system until it became outdated to unusable and dysfunctional. One of the main reasons for such indifference was the cost. No matter how low the computer price went down, implementing computer technology still required the University to make a major budgetary commitment. There were concerns about where the large amount of requested fund would come from. A very small amount of the annual department budget for equipment could not be enough even for a major upgrade for the computers. Developing computer graphics curriculum certainly meant a big investment that the Department could hardly afford without the help of external funding or major commitment of the University. In fact, the early beginning of the computer graphics program was only possible by external funding. In addition to the major investment for the equipment, the school had to find other resources such as human resources, including faculties and supporting staffs, and facilities such as space and power supply. Space had always been one of the most expensive commodities that the
schools could hardly afford. In the case of the University of Saint Francis it was the
external funding by the grants and donations that started and sustained the computer
graphics program.

Between the years 1990 and 1995, no additional computers were purchased and
no major upgrades were conducted for the computer lab. Other than two new courses.
"Introduction to Computer Operation" in 1992 and "Desktop Publishing" in 1993, the
computer graphics program did not get much attention but had to wait for some
breakthroughs. Meanwhile, the environment outside of the University was changing, and
changing very quickly. The technology was advancing in the dazzling speed. New uses
of computer graphics were introduced almost everyday. The commercial art faculty kept
trying to convince the Department and University. He proposed a new concentration in
computer graphics and a new art computer lab every year. For example, before the
administration's decision of hiring a new faculty member in 1995, the commercial art
faculty prepared and submitted a proposal for the development of a computer graphics
concentration, suggesting five required courses (Table 1).

While struggling to keep the program going the commercial art faculty was
overwhelmed by the technological developments he had to keep up with and the
additional work to his already heavy workload. Soon it became clear that one person's
single-handed effort was never enough to sustain the program that required constant
researches and developments. Besides the computer graphics program that he wanted to
develop, he was already busy enough to take care of everyday matters. The faculty had
to teach four classes every semester along with student advising and committee works.
He also had many commissioned works of sculpture. He repeatedly requested the Department and the University to give him some time off to research and learn the new computer graphics software. In the Department meetings, however, his repeated requests met cold responses from other faculties. The other faculties insisted that all the faculty members in the Department were doing the same thing, leaning the new things while working fulltime. They asked why his position should be treated differently from other faculties. Such responses from other faculty members might be the results of the lack of understanding that in the rapid changing world of computer graphics even remaining current with the technology could take excessive time and efforts. The responses seemed based on rather politics than real consideration especially in later time like 1993 and 1994. By that time the faculties in the Department knew it was important to have computer graphics program developed for the future of the Department. Also, they understood it would take a significant amount of efforts and time to learn a new computer program. But, they refused to acknowledge the reality and gave no break that the commercial art faculty needed. His requests for reduction in teaching load or sabbatical were never granted. Instead, the Art Department hired an adjunct faculty to teach a desktop publishing class.

The commercial art faculty also requested a new computer lab for the computer graphics program. In the same proposal of a new concentration in computer graphics, he requested total of $116,900 over four to five year period. The first year (1995) request was $39,900 for 5 multimedia capable computers and various graphics and multimedia software packages. His repeated request for a new computer lab or major upgrade every
year never went through, either. For a time there was no sign of relief on the horizon. It was very understandable that the commercial art faculty gradually lost his enthusiasm and gave up any hope. More and more complaints came from displeased students in the computer graphics classes. About fifteen to eighteen students shared eight outdated computers, often without books or manuals. The low quality outputs from the computers were generally unsatisfactory for any purposes. In most cases, the students did not get excited about these required classes. Moreover, they did not feel that the classes were beneficial to their future. There were even some incidents of dissatisfied students demanding the refund of their tuition from the USF. Even so, the students had to wait until 1995 when the University finally took some positive steps.

Summary

The computer graphics program at the University of Saint Francis was possible mainly by the one faculty’s efforts in 1984. From giving the initial concepts to finding the funding sources for the development, the faculty was instrumental for the foundation of the program. The program was developed more during the early period, getting the attention from the students despite the lack of the support. However, the time might be little too early for the school and the industry in town. The lack of understanding and support in and out of the USF kept preventing the further development and success of the program. The program lost its goal and became deteriorated during the early 90’s.
CHAPTER 5

CASE STUDY PART II, YEAR 1995 TO YEAR 1997

The New Beginning

Changes in and out of the USF had a strong impact on the development in computer graphics program. In 1995 the USF built a new art computer lab, even though it was not exclusively for art making. The University administration also allowed the Art Department to hire a new faculty member who had a specialty in computer graphics. While many people outside of the school could simply view these developments as a trend of the time, there actually was a series of proceedings that made them possible. Some of the proceedings were not hard to notice. Probably the most direct and obvious cause behind all these changes was the rapid development and expanded use of computer graphics technology both in academics and in the society in general. The art and design industry demanded well-trained graduates who could help the business from the first day they were hired. Many colleges and universities across the nation responded with a quick adjustment in their art and design programs adopting new technology. The Department
of Art and Visual Communication at the University Saint Francis soon realized the necessity of incorporating the computer graphics technology in order to project its viable future especially for its commercial art program.

On the other hand, some proceedings were so subtle and complex that they did not seem to have a direct relationship with the developments. While they were virtually unnoticeable to outsiders of the institution, some internal events in fact had a bigger impact on the developments, creating an entirely different climate in the decision-making process. They were mostly well known secrets, however, hidden and tolerated under the culture of the everyday work at the Department and the USF. In the following part of the paper, some important proceedings that both directly and indirectly had impacts on the developments are described.

Time for Change

Until the late 1980’s the regional advertising and graphic design agencies did not concern much about computer graphics technology, since they did not see the benefits of using it. When the Art Department began a “Computer Graphics” class in 1984, no one seemed to care. It was much later, especially the early 1990’s, that the graphics industry in the greater Fort Wayne area began to utilize the computer and wanted students who were skilled and knowledgeable in computer graphics. A large number of art directors and the owners of an estimated 64 advertising agencies in the region were alumni of the University of Saint Francis. Some of them were serving on the Art Department’s advisory board and they frequently asked or told the Department to develop more
computer graphics courses. In addition, a departmental survey of regional high school students who were interested in art as a major indicated their growing interests in computer graphics, especially in computer animation. Some of those students not only were aware of the developments in computer graphics but also had some experience using computers for art making.

**Climate Changes in Administration in the College and the Department**

The culture and decision-making in a social entity can be shifted by the changes in the decision-making body. In 1993, the University of Saint Francis got a new president. Probably this event alone had a very significant impact on the climate of adopting computer technology on the campus. The former president did not consider the impact of computers significant to the academic institution. While some members of the faculty believed the former president's rejection of computer technology was a reflection of financial responsibility, others saw it differently. Some faculties pointed out that the former president regarded the broadening use of the computer in society as a trend that would not last long. Consequently, the path of the computer technology to the campus was very narrow. No significant development was done for the use of computers on the campus before 1993. The new president, on the other hand, created a new environment where the use of the computer was encouraged. She was not only sympathetic to the new technology in general but also supportive for any innovative use of it for the school. As a matter of fact, in 1996 the president added a new position in administration, Associate
Vice President of Academic Affairs (AVPAA) who would take charge of developing the academic uses of new technology. The president promoted the use of computers in every possible way.

Opinion changes also occurred in the Art Department. In 1993 there were four full-time faculty members in the Art Department, three senior members and one junior. There had been some disagreements among the faculty members about the developments in their computer graphics program. Prior to 1993, while the faculty member in charge of the commercial art program wanted more developments in computer graphics, the faculty member in charge of the fine art program did not cooperate. He could not envision that the Department would get many benefits from the further development of a computer graphics program. In 1993, however, the fine art faculty member had an opportunity to rethink about the use of computers in the visual art program. That year, he took a sabbatical after he applied for and received a Lilly Foundation Fellowship for his research of decorative art. He traveled to many places, including universities of the West Coast. He visited the art departments of well-known universities in order to get some ideas for his own Department’s direction and future developments. He was surprised to find out how widely computers were used in those art programs.

Those visits must have profoundly influenced his thoughts about the use of computers for art. In fact, he received a Development Grant from the College to research new directions in the visual arts in 1994. A big part of his research was about computer graphics as it was projected to be one of the most promising fields in the future in many publications. He researched the field of computer graphics both in industry and
academics. He checked publications on arts, culture, jobs, market reports, and entertainment. He also collected the information about the computer graphics programs in leading colleges and universities. In his report, he explained what he found out about the national trends in art activities and appreciation, new careers and business opportunities for the arts and communication, and these trends reflected the situation in the region of Northeast Indiana. He found that photography, media development, film and video, art therapy, and animation were among the clusters that were growing faster than the average on the job market. Also, he noted the fast-growing numbers in enrollment for those college art programs that had adopted computer graphics technology. He concluded that it was time for the department to adopt a new approach to the future. This faculty member specifically recommended the computers technology and communication program for the USF.

The Art Department and the USF listened to the recommendations of the fine art faculty member and responded very quickly, and very positively. The Art Department prepared a proposal of the future developments in computer graphics. The first action suggestion was hiring a new faculty member in computer graphics. It was a mutual understanding between the Art Department and the administration of the USF that the Art Department desperately needed new faculty. There were not enough members of the faculty of the Department to take care of the required courses for 119 full time art students in 1994. It was a matter of what areas of the Art Department had priority. The Department chose computer graphics over art history, graphic design, art education, and illustration. The second part was a new art computer lab. A new computer graphics
faculty member teaching with old, dysfunctional computers did not make sense. The College agreed with the Department that it needed a new lab to rebuild the computer graphics program, even though the function of the computer lab was left open for other departments as well.

The Culture and Decision-Making Process of the Art Department

In any social entity, the dynamics of decision-making is greatly influenced by the culture that is shared by its members. It is interesting to see how the Department and University responded differently to the recommendations of the fine art faculty member from those of the commercial art faculty. For the most part, the similar recommendations from the commercial art faculty member did not seem to be taken so seriously. In contrast, the recommendations of the fine art faculty member were not only received with positive responses but were also incorporated into policy and put into action almost immediately. The purposes of both proposals, building a new, more comprehensive computer graphics program, were the same. Many parts of both recommendations also shared similar approaches, including hiring new faculty, building a new computer lab, and developing a computer graphics concentration.

There were, however, some noticeable differences between the recommendations. For example, the commercial art faculty member had asked for a teaching reduction for his own reeducation about new software packages. In other words, he recommended having a new faculty member to teach other regular art courses. On the other hand, the fine art faculty member recommended hiring a new faculty member who already had
expertise in computer graphics. The commercial art faculty's proposal might be less appealing to the Department and University, as it would cost valuable teaching time and money more than at of fine art faculty. Besides, there was no outline of the required time as well for the commercial art faculty member to reeducate himself. There was no certainty of effectiveness of the commercial art faculty with newer software packages. The Department and the University had already experienced some complaints about the computer graphics courses from the students even though the administrators should share partial responsibility for problems in those early courses, as they did not fully support the efforts of the commercial art faculty member with adequate hardware or software.

In the case of the fine art faculty's proposal of hiring a qualified computer graphics faculty member, on the other hand, the Department could achieve several goals at the same time. First, this new faculty hire would bring much needed current skills and knowledge of computer graphics to the Department in no time. There would be no waiting period necessary for anyone's reeducation. Second, the commercial art faculty member would no longer need to teach any computer graphics classes but could cover his own regular art courses, allowing the Department to maximize the possible teaching loads out of all of its faculty in their own areas of expertise. Another factor may have been that the commercial art faculty member was getting closer to his planned retirement. In retrospect, he retired in 1998. Even if everything had gone smoothly, he would have taught some new classes for only about 3 remaining years. Then, the Department would
have been forced to search for new faculty anyway. The proposal of the fine art faculty member was not only academically more beneficial but also more economical than that of the commercial art faculty member.

In spite of the understandable circumstances of adopting the proposal of the fine art faculty over that of the commercial art faculty, however, a question is raised. Why did the Department not do anything about the recommendations by the commercial art faculty member during 1993 and 1994, before the research of the fine art faculty member? Until late 1994, when the fine art faculty member submitted his report about new directions for the Art Department, the Department and the USF did not do much about the existing computer graphics program. They did not give much consideration to the repeated requests of the commercial art faculty member. The contrasting response to the fine art faculty’s report could have been the right timing of the report, as it was submitted when public interest about computer graphics was surging. The Department and the USF recognized the demands for better computer graphics education from industry and the students. Notably, however, the commercial art faculty member also made less grand suggestions at the same period of time and did not get any support at all. The commercial arts faculty member requested (but was refused) the amount of $39,900 for upgrading the computer lab, far less than the actual amount of $100,000 which was actually used for the new computer lab in 1995. While the support for the new computer lab demonstrated the commitment of the USF for the future of the Art Department, funding the large amount requested was not an easy decision for the administration. It could have not been possible if there was no close tie between the administrators and the
fine art faculty. As one faculty member put it, "one day there was no money, then turn around and there it was" (2000). It became apparent that the preferences of the decision-making body had bigger impact on the decision for the development than the specific plan or the amount of money.

In the Department of Art and Visual Communication, two senior faculty members shared the same important decision-making power. Sometimes the decisions were made by two senior faculty members even before the agenda were openly discussed at Department meetings. In those cases, the Department meetings had little importance. The meetings were primarily a place for announcements rather than discussion. The majority of those decisions caused few problems among the members of the faculty, as they were generally reasonable and acceptable. Nonetheless, the culture of decision-making in the Department was rigid. For example, the rather sudden and friendly climate change towards developing a new computer graphics program was not the result of the commercial art faculty's persistent efforts. It was possible mainly by the political influence of the fine art faculty member who had realized the importance of adopting computer technology for the future of the Department. The fine art faculty member in particular was influential in decision-making not only in the Department but also the University. It was mostly good for the Art Department as he worked really hard to make the Department better and grow even though his ideas were not always shared by the other faculty members. The commercial art faculty member, on the other hand, was hardly a part of the decision-making body. In fact, the commercial art faculty member was not invited to the initial discussions about hiring new faculty in computer graphics.
and development of a new computer lab. He did not know about the plan for new faculty or a new computer lab until they became official. The commercial art faculty member expressed his disappointment and frustration at being excluded from the important decision-making processes in the Department concerning the proposal for a new computer graphics concentration to the Vice President of the College in 1995. In a letter he wrote, “I have been given to understand that there is a distinctive possibility of hiring a new faculty member who would be an expert in computer graphics and graphics design . . . I could not make any commitment without knowing what decisions would be made by the Administration. Actually, I am still not clear; only your response can clarify the issues listed above regarding the budget, equipment and power needs, space facilities, and hiring of a new faculty member and his/her qualifications.” He also added, “These decisions are always made by my superiors, regardless of the advice by the Director of the program (the commercial art faculty) involved.” One of the faculty members at the Department described the commercial art faculty member as always an “underdog” in the Department.

**Recruitment of a New Faculty Member in Computer Graphics**

The Department searched for a qualifying faculty who could lead the new development in the Department’s computer graphics program. In the self-study report for the renewal accreditation of North Central Association of Colleges and Schools (NCACS) in spring 1995, the Art Department wrote:

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There is a real need for the addition of more full time art faculty. With the number of art majors that the department now has it is very difficult to register and adequately advise all of the students. The present full time art faculty feel very "stretched out" in trying to accomplish all of the things they normally do in a semester, i.e.: teaching, recruiting, advising, serving on campus committees, creating and installing art exhibits, modifying physical facilities, running high school workshops, developing alumni relations, etc. This sort of over burdening could result in teacher burn out which, of course, could create the risk of losing students. The art faculty really feel the need for some relief (p. 5-6).

There were 123 art majors in the fall of 1995. With only four full time faculty members, every bit of the human resources in the department was indeed stretched to its maximum. The usual workloads of the faculty members did not allow any time other than just teaching the required classes semester after semester. The faculty members including the department chairperson were assigned to teach four classes per semester. The average number of 31 advisees per each faculty member was also a big responsibility. Committee work, recruitment, and maintenance of the art studios were regular parts of the job. Other 'required' unofficial extra workloads of the faculty members included the preparation for and receptions of art exhibitions, soliciting donations, and the presence of fundraising activities.

The self-study report also pointed out the priority of hiring a new faculty member:
There is another reason for the need of additional art faculty; that is a need for more technical expertise. With the unprecedented growth of the use of computer graphics in the commercial art field, the art faculty now feel we need a person in that area. This person would teach computer graphics, maintain the art computer lab, and be able to teach other commercial art courses as well (p. 6).

The Department had for a long time been serious about recruiting a new faculty member specializing in several subjects including art history, illustration, graphic design, and art education. Computer graphics was not a part of the list. As the College already acknowledged the needs of the Art Department for a new faculty member, it was just a matter of the Department's decision. However, the situation had been changed as the Department (the fine art faculty and the Department chairperson be more exact) recognized the urgency of implementing computer graphics technology for the visual arts program. Suddenly computer graphics became the top choice out of nowhere. The two senior faculty members discussed the choice with the administrators first. Only after the decision to hire a new faculty member in computer graphics became a done deal at the top level was this news shared with the other members of the Department. Department members were then invited to discuss the necessary qualifications of the prospective faculty member.
Outlining the qualifications and finding a new faculty member required a clear goal and direction for the program. In general, any department will define the specifics of the curriculum and working assignments for new faculty. In the case of computer graphics, however, the Department did not have much knowledge. One faculty member mentioned the situation saying, "We were clueless." "You know, we were all 40-50 year old faculty members who did not know anything about computer graphics. then" (2000).

There was no master plan for the new computer graphics concentration. The commercial art faculty member withdrew his previous development proposal, understanding the new faculty would employ a different strategy. The Department was in a situation of 'just wait and see'. The College did a national search for faculty and put an advertisement in the Chronicle of Higher Education, the College Art Association (CAA), and some local newspapers. The job title was "Graphic Arts Computer Specialist." The outlined details included a strong background in graphic design, teaching desktop publishing and computer graphics courses, and developing two new graphics arts oriented computer courses. The advertisement also asked the applicants for knowledge of several popular graphics software programs and ability to run and maintain a computer graphics lab.

There were six applicants and the Department interviewed three of them. The Department was particularly interested in one candidate who had 3D animation experience. The fine art faculty member mentioned that the Department was very excited to find that qualification in the resume because 3D animation was the area that the Department was hoping to have in the future.
The Computer Facility

Creating and maintaining a new computer lab was exciting but difficult task for the Art Department especially with the limited budget. In 1995 the Art Department expressed concerns about either upgrading the computer lab or establishing a new computer lab for art only. The self-study report asked for the computer equipment and space in conjunction with the need of a new faculty member:

The Art Department faculty feel there is a great need for more computer graphics equipment (i.e.: computers, printers, software, etc.) and additional physical space to house that equipment. The great need for more technological improvements in the Art Department cannot be overly emphasized. It is absolutely crucial for the department to keep up with all of the changes that are now going through the graphic design industry. If we don’t make the changes necessary, we most probably will lose the majority of our art students (p.6).

In the summer of 1995, the school paid $100,000 for a new Art computer lab that could be used for both art department and general purposes. There were 13 Pentium 75 Gateway P5 computers with 2 Microtek flatbed scanners and 1 HP laser printer. Each computer was equipped with a 17-inch Vivitron monitor, 16MB RAM, 1.2GB hard disk and mouse. They were networked and had Internet access. Also, there were 2 Centris 610 Macintosh computers from previous years. For better functionality of the lab, new
computer desks and chairs were ordered. The location of the lab was right next to the
general computer lab of the Academic Computer Center on the second floor of
Bonaventure Hall, the building that the Art Department shared with other academic
departments. The general purpose computer lab was also upgraded with 15 Pentium 66
and Pentium 75 Gateway computers in the same year. The two labs were connected with
a door and each lab had its own exit door as well. Both labs had similar settings except
that the art lab had more graphics oriented software.

While the Art Department aggressively pursued the art computer lab, the
administration was firm about also using the computer lab as a general purpose lab even
though the new faculty assumed the responsibility of maintaining the lab. The
Department wanted to have an "Art" lab that could be used and maintained exclusively
by the Art Department. However, the administration insisted that the new lab should be
an open lab with art lab capacity. The administrators suggested that the Art Department
should have the priority of using it for classes and student practice. During the time other
than official art classes, the lab should be open to the campus community for general
uses. In several heated meetings between the administration and the department no
agreement was reached. The dispute about the use of the lab became so intense that the
usually well-reserved department chairperson once walked out of the room in the middle
of the meeting. In the end, the lab became a blurry area. The lab was assumed as an art
lab and the Department and the art students were supposed to have priority. Nonetheless,
it was still an open lab that anyone could use, other than during art class periods. This
ambiguous policy for the use of the compute lab proved to be fine later as the art

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department heavily used the lab anyway. Mostly, art students occupied the lab outside of class times anyway for practice and assignments since the general lab next door was not well equipped to provide necessary hardware and software required for the art classes. The students of other majors did not bother to use the art lab unless no alternatives were available. Consequently, the lab was adapted as an art lab and generally used for art purposes.

However, the ambiguity did cause many problems for maintenance. First of all, there was the question of who should be responsible of maintaining and updating the computer lab. Certainly, the Academic Computer Center (ACC) on the campus did not want to maintain the ‘art’ lab. The administration was in the same position with the ACC. The administration outlined the responsibility of maintenance as a duty of the new faculty member in computer graphics. In fact, the administration pointed out that the advertising and contract of the new faculty in computer graphics specifically required running and maintaining the lab. There was, however, a big difference in interpreting the exact nature of ‘running and maintaining’ between the administrators and the faculty. ‘Supervision’ was the initial impression of the faculty for that specific duty. The faculty thought that he would be in charge for researching the industry, deciding the direction, and specifying the requirements for the lab while the administration wanted the faculty to run the lab in self-sufficient manner. There was no support of lab technicians or student assistants who could monitor the computer lab. In a small academic institution, this additional duty for the faculty may not be uncommon. However, the actual maintenance more than the supervision requires a lot of time and energy that many schools provide.
either course reduction or dedicated technical supporting staff. In the field of fast evolving computer technology it becomes a huge obligation for the faculty to regularly reeducate himself/herself to stay current. From upgrading hardware and installing software to networking computers and troubleshooting, the new faculty member in computer graphics felt a shortage of hands and time.

Second of all, there was no operating budget for the art computer lab. Unlike many of the traditional laboratories or studios where equipment tends to last a long time, the advances in computer technology require constant upgrade and update for the computer lab to stay functional. Unfortunately, the University administration assumed that the Art Department should be financially accountable for operating and updating the lab without any increase in budget. Then, the University charged the whole cost of upgrading the computer lab as the Art Department’s expenses, which resulted in an overall increase in Department’s expenses. The Art Department did not have the full control of the computer lab as it remained a general purpose lab. But the Department abided a full responsibility of maintenance, including the search for operating budget. For example, the new faculty member did not get as much as a tool set for the computers when he was assigned to maintain the lab. The lack of a secure and steady budget constantly put pressure on the Department to search for external funding sources. The lack of funds especially restrained the development of new computer graphics courses such as multimedia design.

This example of a ‘one time big investment then forget about it’ mentality about starting and operating a computer lab has been a universal problem for many academic
institutions. It is like building a new house without any plans for providing utilities such as water, electricity, and gas. And there was no money for groceries, either. A predictable problem, which was not foreseen by the administration or the business office, was that the computers did not remain "cutting edge" for long. The advances of computer technology have brought new challenges to all colleges and universities. Setting a new computer lab requires a major financial commitment for the institutions. However, the maintenance of the lab requires even bigger commitment as the needs for upgrading computers and updating the labs are far more frequent and expensive. Within two or three years, computer labs may need a whole new set of computers to keep up with current technology. With ever tightening budgets in many academic institutions, the burden of continuous investments has been formidable.

Revamping the Existing Program

During the 1995-1996 academic year some changes were made for the existing computer graphics courses. There were three computer classes for the art program as of the spring semester 1995. They were "Introduction to Computer Operations (1 credit hour)", "Computer Graphics (3 credit hours)", and "Desktop Publishing (3 credit hours)". The commercial art faculty member had worked on the plan for development of a new computer graphics concentration. However, he withdrew the proposal when the College decided to hire a new faculty member in computer graphics. The Department chose to wait until it could find out what the new faculty member would suggest about the direction of the program.
No new classes were added immediately in the fall of 1995. However, there were some changes in the content and structure of the existing courses. For example, the "Computer Graphics" class changed its focus toward the more complete introduction of computers in the visual arts than simple digital painting. The choice of software changed from TIPS to Fractal Painter and CorelDraw. This change meant the class would deal with two major formats of digital images: raster or pixel-based images (Painter) and vector-based images (CorelDraw). Previously the class worked with raster images only. The class utilized the vector-based software for the first half of the semester and the raster for the second half. Some studio assignments specifically emphasized the use of both programs together, mixing raster images and vector images. One thing that was not changed from the previous class was the emphasis on the studio class where art and art-making process was deemed primary only to be followed by practical knowledge and skills of hardware and software.

The content and the structure were changed accordingly in order to guide the students to a broader understanding of the computer as an art medium. In the class, the students were required not only to practice computer arts but also to research the field of computer graphics. First, the class introduced the current functions and uses of computers for art and design. A variety of images and samples of current computer graphics in various formats from digital drawings to 3D animations were presented. The educational slide sets and videotapes from the SIGGRAPH were very helpful to open the eyes of students. Second, reading/writing assignments were given to let the students read and write about the most recent developments of computers in the field. Articles from
computer and graphics journals were assigned to the students as required readings. The
students were asked to write a brief synopsis about the articles and their reactions to the
contents of the reading materials. Then, the whole class discussed the article together.
Often the students talked about how many aspects of their lives were actually related,
from the computer graphics in TV commercials to video games to medical illustrations.
Toward the end of the semester, students were required to write a term paper about topics
related to computer graphics. For this formal six to eight page assignment, students were
encouraged to find topics that they could relate to real life. For example, students
majoring in art education wrote about the use of computers in art classes K through 12.
A commercial art student wrote about the developments in digitalized printing processes
in the commercial printing industry. Some described the use of the computer for featured
films and special effects.

Another change in the class was the collaborative environment. Unlike the
previous classes, the students were encouraged to help each other and learn as a group.
For example, a fun experimentation and collaboration exercise was performed at the very
beginning of the class. Everyone in the class started a seed image on their computer, and
then moved to their neighbors' computers to work on what the others had done on the
screen until everyone had worked on every one of the seed images. Class participation
became an integral part of the curriculum. In the class discussions of the reading/writing
assignments everyone was required to participate. Also, for every studio assignment,
there was class critique. Students were encouraged to talk about the each other's works
in a positive way, trying to find what worked on the images.

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The desktop publishing class adopted the same approaches as in the computer graphics class. Class participation and collaboration was emphasized even though this class did not have the writing assignments. Studio activities were centered on six project-based assignments. The students were required to design and produce publishing materials for each assignment and present them in the class critique for the course credits. Experimentation was encouraged. The students were allowed artistic freedom to choose the contexts of the projects within given descriptions. For example, for the assignment of creating a poster, the outline provided detailed information about the event such as hosting institution, time, date, color (full or spot or B/W), size, and budget. Then, the students were required to research and create the visual content. The students were expected to incorporate techniques presented in class into the assignment with artistic creativity. For the presentation and critique, ready-to-hang (printed and mounted) format was required.

**The Metamorphosis of the Department: From Art Department to the Department of Art and Visual Communication**

The Art Department at the USF was looking for the its viable future through the computer graphics technology in addition to its strong traditional studio art programs. In the pursuit of integrating the computer technology with the studio art programs, the Department transformed its structure into a new form. In the same self-study report to
the North Central Association of Colleges and Schools (NCACS) in 1995, the
Department projected the name change of the Department and the merger of the Art
Department and the Communication program as a part of its future plans.

First the department’s name probably should be changed to Visual
Communications. Most of the art departments at the collegiate level are
now doing that. It is felt the name Visual Communications will be more
indicative of the types of activities and instruction that the department will
be engaged in the future. The word art is toll limiting, particularly when
the one considers the technological changes that will take place on art
production in the next five to ten years.

Thinking in that direction the department also feels that it could beneficial
to add the television studio in Bonaventure Hall to the Art Department. It
is felt that many of the changes in the art curriculum of the future could
entail television equipment and resources. For example, future multi-
media based computer courses would require T.V. equipment. It doesn’t
make good economic sense to duplicate equipment in the department
when much of it already exists in the current T.V. studio. Combining the
television studio with the Art Department would create a whole new set of
possible course and/or curriculum offerings (p. 6-7).
On June 24, 1996 the Art Department at Saint Francis College officially became the Department of Art and Visual Communication. Before joining the Art Department, the Communication program, with only one faculty member, was part of the English Department even though the focus of the program was audio/video production. Both the Art Department with its computer graphics expertise, and the Communication program, with its specialty in audio/video production, hoped for synergistic effects from the merger. For example, the computer art program could take advantage of the much needed audio/video production programs and facilities such as the television studio for its animation and multimedia classes. At the same time, the Communication program could afford a balanced curriculum of new digital applications for audio/video production, including digital sound manipulation and non-linear digital video editing.

The self-study report neither outlined any immediate actions nor put down any dates. However, from the initial ideas and talks to completion, the whole process of the merger took only about one year. This fast merger demonstrated the efficient decision-making and implementation possible in a small college if the decision making body is synchronized. No bureaucratic steps, agonizing waiting period, rewriting or adjustment of the proposal took place. It became a done deal once the administrators of the Department and the College discussed and agreed on the proposal. Other than that, the interactions between the two administrators was only a formality. No concerned voices or objections were raised from other parts of the campus community. There were, however, unheard concerns of the lone faculty member of the Communication program. She was not a big factor in the decision. In casual conversation during the process of the
merger, that faculty member expressed her anxiety of an uncertain future for her. She wondered about her new roles and functions at the Art Department, and possibly the security of her job. One of the biggest concerns of that faculty member was the approval criteria of the senior faculty in the Art Department for her performance as a faculty member. In the end, however, everything worked out fine as the Communication faculty member fit into the Department well.

Before and after the merger, a myriad of developments occurred. This rather sudden and quick development proved to be a head in the right direction for the Department and, later, for the College. The merger became one of the most significant stepping-stones for the Department in its development for the future. Developments on an even bigger scale followed soon. In particular, leading to those developments was a series of timely decisions within the Department. The merger and rebirth as a new Department was a direct result of departmental efforts by both the computer arts and the visual communication programs. Some of the important developments are described in the next section.

Development of a Computer Graphics Concentration

After the initial revamping of the existing courses, the Department was searching for more developments in computer graphics program in both short term and long term. Beginning in the fall semester of 1995, the Department became aggressive in promoting the computer graphics program. One of the main reasons for such a change in attitude stemmed from the understanding within the Department that the viable future of the
Department would heavily depend on the computer graphics program. There were no more objections coming from any part of the Department. The fine art faculty member became the major advocate of the computer graphics program and was more than eager to adopt computer graphics technology for the fine art curriculum. The self-study of the Department of Art and Visual Communication in 1996 recognized that increasing student recruitment in a progressively more competitive environment was the first concern in the future of the Department. In addition to the already intense competition among the regional academic institutions for the students in traditional art majors, the regional schools had to face new challenges from the leading schools that attracted students nationally with their well-known computer art programs. As society witnessed what computer graphics technology had brought to people's daily life, the new stream of high school students were getting more and more familiar with the use of the computer in art and design, especially in the entertainment industry. These changes in student recruitment pushed the Department to add a more marketable program to the existing traditional art programs. The Department of Art and Visual Communication initiated the study of a new development in computer graphics. Previously, the commercial art faculty member had proposed a tentative plan for the integration of computer technology into the existing art curriculum. The proposal was for developing a concentration with five computer courses. This proposal did not get much attention from the other members of the faculty or the administration. Now with the new faculty member in computer graphics the Department decided to give a new look at the development of a computer graphics concentration.
Among the degree programs in the Art Department in 1995, three of them had some sort of concentrations. For the associate degree in Commercial Art and bachelor in Fine/Commercial Art, students could choose a concentration in either illustration or photography. For the Fine Art major, students had optional concentrations in graphics and drawing, painting and drawing, sculpture, crafts, and photography. The associate degree in Commercial Art was a 65 credit hour major program. In addition to 12 hours of general education courses, the associate degree required 20 hours of core art courses, 6 hours of electives and 9 hours of concentration courses. For the illustration concentration there were Illustration I, II, and Fashion Illustration. The photography concentration consisted of Advanced Photography, Photography Lighting, and Experimental Photography and Color. The same sets of concentrations were offered for the Fine/Commercial Art majors working on a bachelor degree.

Two plans for the computer graphics program were developed in the spring of 1996. One was a short-term plan for creating a computer graphics concentration within the current capacity of the Department. The other was a more elaborate long-term plan for future developments towards an independent degree program specializing in computer arts. The short-term plan projected the creation of a computer graphics concentration, the reorganization of the existing courses, and the establishment of two new computer graphics courses. In the three-course concentration, desktop publishing became a core course along with the introductory computer class. Then, digital image processing and multimedia classes were added to fulfill the three-course requirement. The course numbers were changed accordingly and prerequisites were set up. Art 410: Computer
graphics changed to Art 208. Art 202: Desktop Publishing changed to Art 206. Two new courses became Art 308: Digital Image Processing and Art 411: Interactive Multimedia Presentation. This concentration of computer graphics was implemented in the associate and bachelor programs in the spring of 1997. Also, Desktop Publishing became a core course for all art majors. In the proposal, the objectives of the concentration were outlined as:

Upon the completion of the program, the student will:

- Have a basic understanding of commonly used software programs in the graphic design industry.
- Be able to compete for an entry-level position in various computer graphics industries.
- Have a portfolio of computer graphics artwork. (p. 1)

An outline was made for the long-term development in computer graphics as well. This rather wishful plan for a computer graphics concentration at that time outlined the core courses, course descriptions, required facility and equipments, and possible (wishful) dates of realization. For the procurement and installation of the facility and equipment a step-by-step plan was also considered. In addition to three existing courses, six new courses were suggested for the long-term development plan (Table 2).
Development of New Classes

The actual curriculum and course design varies in every institution. For the education in the field of computer graphics, the actual curriculum and course design have been mainly up to each academic institution in many reasons. Sometimes it is the facility that may shape the outline for the program. For example, the curriculum of virtual reality (VR) will be possible only in the institutions where enough computer powers and technological expertise are readily available. Other times it is up to the human resources such as the numbers and expertise of the available faculty members. Not one faculty can teach everything in the field of computer graphics in any given time. Most of all, the applications of the computer graphics technology have been deepened and widened it becomes impossible for the academic institutions to cover every possible topic in the field. Nowadays, the interdisciplinary nature of the applied areas put almost impossible to even count all applied areas. For the education in this vast area of the study, no standard set of curriculum can address all concerns of any given academic institutions. Each institution has to decide the direction and outline of the program within its ability.

At the USF two new courses were created to complete the initial 5 courses concentration. Those courses were digital image processing and interactive multimedia. The faculty in computer graphics alone decided the selection and design of the courses. The faculty believed that image processing became the essence of computer graphics for the visual arts that the class should be the foundation for many other courses to follow. Besides, it was a safe choice as the use of the specific software, Adobe Photoshop, had become an industry standard. For the interactive multimedia, the faculty felt the course
reflected the trend of the time in 1996. The term 'multimedia' became the buzzword and the popularity of the Internet/WWW was exploding. While the faculty wanted more courses, including digital video editing and 3D computer animation, the existing facility prevented developments in such areas. Therefore, the available resources mostly shaped the curriculum design at the USF at the time.

**Digital Image Processing: Art 308**

Image processing had been the essence of computer visualization technology, suggesting a reproduction of reality. Several other names were used to describe the nature of the image altering functions, including image enhancing and image manipulation. In the fall of 1996 a new class was added to the computer graphics curriculum. "Art 308: Digital Image Processing" was developed to address the needs of the students in almost all areas of art practices. For the commercial art students, skills in image processing were a 'must have' when looking for a job. For the fine art students, it brought new aesthetic opportunities. For the photography students, it was the beginning of digital photography, a new but already firmly established trend in the field. The class was a requirement for commercial arts students. Later, it became a part of the computer graphics concentration available for fine arts students as well.

The class introduced the computer as more than an electronic darkroom. It focused on the use of computers for creating content for artistic purposes. Like any other classes in computer graphics, this course also emphasized the principles and practices of art making over a mere technological and technical know-how. Like "Art 410: Computer..."
Graphics,” this course was designed as a studio art class. The students learned mainly through hands-on experiences with project-based assignments. For each studio assignment the students were required to combine artistic creativity and understanding of the class materials including hardware and software. While the demonstration and the lecture by the instructor provided the foundation, only through practice and experiment could the students’ learning process begin. Again the reading/writing assignments were designed to secure a better understanding of and individuated approaches to the medium and practices.

However, the existing equipment in the art computer lab could not meet the needs of the class. While the computers in the lab were adequate for running the software, Adobe Photoshop, the problem was the devices for input and output. For input, two flatbed scanners were used to scan photos or printed materials. Black-and-white laser printers could print on paper up to tabloid size (11 inches by 17 inches). These input/output settings fell far short of producing high quality digital images and often could not produce even a simple printout. The Department was again forced to search for funds for the computer lab. This time, however, the Department did not just look for the immediate needs. The Department at this point was researching not only the development of the computer graphics program but also the ambitious but feasible short-term future of the Department. For the computer graphics part, the Department initiated the concentration in computer graphics leading to an associate or bachelor degree. As part of the plan to get there, the Department decided to upgrade the computer equipment in two phases. Phase One was designed to provide the necessary peripherals for the
digital image processing class. The original budget request for Phase One listed the needed input/output devices. The devices included a slide scanner, a film recorder, and several removable media drivers for storage. The affordable removable drivers were critical for the image processing class as the file size of a good quality digital image could easily exceed the 1.44 M capacity of a floppy disk. Without the drivers, students would be forced to cut the file size down by lowering the quality of the images or saving the images on the hard disk only. These limitations were simply unacceptable for professional work. Following is the original request for equipment budget.

**Phase I: Computer equipment for Digital Image Processing**

**Input/output Devices**

- 1 Film (slide and 4x4) recorder
  (Personal LFR Plus by Lasergraphics) $6,500
- 1 Slide Scanner
  (Nicon Coolscan) $2,700

**Storage device**

- 7 Zip drive: 100 MB External:
  $250 x 7 = $1,750

**Total** $10,950

For funding, in 1996 the Department again used donations from the patron who regularly supplemented the Department's small annual equipment budget of $12,000. In the middle of the purchasing process, brand names and the prices of the film recorder and the slide scanner were changed since the market for computer graphics equipments continuously advanced. A Polaroid HR 6000 film recorder was a good choice for giving excellent alternatives to the direct printout from the computers. A high quality recoding
of the image up 4800 scan lines on the photographic film became available for the students at affordable expenses. The only thing the students needed was a roll of film. If using the professional service at the local photography labs, the students had to pay more than a couple hundred dollars for processing a roll of film of 24 exposures. Also a Polaroid slide scanner, in a much cheaper price than Nicon, provided easier transfers from negative films and slides to digital images. The students did not need to use printed photos to scan. This recorder saved time and money for the students especially for those who were in the photography concentration.

**Interactive Multimedia Presentation: Art 411**

The most common way of using a computer in art is generating images on the screen. However, generating visual images is only the beginning of using a computer in the field of art. With the function of multimedia a computer has become a hub for synthesizing multi-sensory experiences for artistic purposes. This new aesthetic opportunity can be enhanced even further with interactivity, which has not been possible with traditional art media. Most traditional visual art media has appealed to the limited sense of sight. With advances in computer technology, however, artists and designers can create works which not only appeal visually but also interact with people in multi-sensory modes of seeing, hearing, and touching. Such an interactive multimedia art form asks the viewers to participate in the creative process and allows each individual his or her own unique multidimensional experience.
To further develop the computer graphics concentration, the Art Department decided to add a new class, "Art 411: Interactive Multimedia Presentation" to the existing four courses of computer graphics in 1996. The purpose of this course was to introduce students to the role of the computer as an interactive artistic platform for integrating a variety of human senses. The existing computer graphics courses of computer graphics and digital image processing mostly dealt with generating and enhancing visual images. Desktop publishing utilized the images for printed materials, and thus did not add any new aspect in terms of using computers, either. It was a natural step for the computer graphics concentration to start a multimedia class, adding some new dimensions to the visual elements.

Art 411 was a three credit-hour studio art class that introduced the use of the computer to combine a variety of audio and visual elements including text, graphics, music, speech, and animation with various electronic devices. Art 411 required all the other computer graphics courses as its prerequisites to ensure that the students already knew to create various visual elements. Sound Forge, a sound manipulation program, was used for students to record and alter sound, or create new audio files for the design. In addition, the interactive function was emphasized to encourage the students to create an artistic environment that allowed the audience to participate and modify the sequences provided by the given programs in the electronic media environment. One missing part in the course was video. The courses of audio/video production in the Communication program were not yet integrated into the art program. Also, the digital video equipment was not available until a later time because of the lack of funds. Like other computer
graphics courses, this course consisted of demonstrations, lectures, studio activities and critiques, discussions, readings, and writing assignments about using the computer as an interactive platform for creating multimedia forms of art and design. Also, the related issues of the ever-changing forms of art and technology and their relationship in our society were addressed and discussed.

For the design of the class, there was yet another problem of inadequate equipment. The computers in the existing lab did not have a multimedia capability. There were no sound cards, speakers, or recording devices attached to the computers. No immediate funding was available to purchase multimedia software, either. While the proposal for adding a five-course concentration in computer graphics was approved at a University-wide Faculty Forum meeting on April 12, 1996, the multimedia class could not be given until the spring of 1997 because of the inadequate equipment. The total 1996-1997 equipment budget for the Department was $12,601. This was nowhere near the amount of $181,083.10 requested by the Department. The major part of the request, $150,917.15, was for the graphic design academic program, and for upgrading the computer lab. Other requests were $10,615.95 for the drawing, painting, and design academic program, $3,450 for the photography program, $11,100 for ceramics, and $5,000 for sculpture. The actual amount of the equipment budget, however, was decided by the business office of the College. The business office based the budget on the number of students in the major in the Department in the previous year, rather than basing it on requests from the Department for a budding new program.
In order to get the computers equipped properly for a multimedia class, the Department set a guideline for Phase Two. The aim of Phase Two was to get just enough equipment to enable the Department to start the multimedia class. The element of video production for the multimedia was almost ignored because of the high price and possible future integration of the Communication program with a television studio and production facility. Then, the Department searched for available resources. The Department once again had to rely on donations from a patron who agreed to donate the amount needed for Phase Two in October 1996. This external funding allowed the Department to offer the multimedia course the following semester, in spring 1997. The original request of $19,579 in Phase Two was itemized as the following:

**Phase II: Multimedia**

**Software**

13 Licenses of Multi-media software

3 Macromedia Director Package II $1,100 x 3 = $3,300
1 Macromedia Director Win (10 package) $2,649
4 SoundForge $150 x 4 = $600

**Hardware**

2 Touch screen monitors: $1,000 x 2 = $2,000
2 Microphone $100 x 2 = $200
6 Sound card and speakers $295 x 6 = $1,770
1 CD Rom writer
   (PCDR-4X: Procom Technology) $5,050
1 Digital camera (Kodak) $1,010
1 HP Wide Format Printer $3,000

**Total** $19,579

**Additional request (extra)**

3 new computers for instruction, presentation and demonstration:
   Pentium 90 or 100: 32MB RAM, 2GB HD, 4X-CD Rom, Sound Card and Speakers, Network card, 17 inch monitor

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Computer for video and audio editing:
- 64 MB Ram
- Video Capturing Board & I/O Card
- Sound card, Network Card
- Microphone, Speaker
- Video camera
- Video tape deck
- Video projector for the art computer lab

The purchasing process of computer equipment, as briefly discussed for the Phase I, should be noted. The rapid development in the computer industry often causes unexpected results in terms of the purchase of computer-related technology. In most academic institutions there are usually some intervals of time between the initial plans and actual purchases. Depending on the situation, the intervals could be any time between half an hour to several months or even to several years. Through the normal purchasing process the approval can be granted in two or three days or up to a week. This rather short-term decision does not cause any immediate changes in the purchasing list. However, if the purchase requires more time for planning and approval, the possibility of changing several items on the list is much more likely for computer equipment than any other technological equipment. Usually the change is positive. You may get more than you expected. The rapid development in computer technology usually means a quick descent in price for the equipment. When the purchasing plan is longer than three months, the planner may need to look at the market again for new products and prices. For example, the actual purchase of the equipment for the multimedia class was much different from the original budget. There was a big price difference on the CD recorder from $5,050 (PCDR-4X: Procom Technology) to $599.99 (Smart & Friendly CDR 2006 Pro 2x/6x), which saved a budgeted amount of $4,450.01. For the seven
sound cards, the final cost was $1,043 instead of the original figure of $1,770, saving $727. There were some changes on the hardware necessary. Instead of a digital camera and 2 touch screens, several Zip drives were ordered. The result was a total saving of $10,866.80, which was later used to purchase a Hewlett Packard 2500CP large format printer.

**Computer Graphics Certificate Program for the Weekend College: The Lesson from the Improvised Attempt**

Budgeting was not the only place where rigid rules, which while applicable for the USF in the past, did not serve it well in a changing environment. Even when the University intended to be innovative, it was unable to be sufficiently flexible to make new ideas work. This section explores an example of this shortcoming. The University of Saint Francis started the Weekend College for non-traditional students who were older than twenty-five years in the fall of 1994. This program was designed to accommodate the working adult who could not come to school during the regular weekdays for various reasons. Students can enroll as either part-time or full-time students and finish the complete set of required classes, which were offered on weekends. Classes were given from Friday evening to Sunday evening. Students could attend nine weekend classes per semester.

In 1996 the administration suggested that the Art Department develop a computer graphics certificate program for Weekend College as compatible to the regular program. Because of the time limitation, being offered only during the weekends, the Department
was not enthusiastic about the program. However, the Department followed the
suggestion and started to give the courses. The courses for the certificate program were
the same as the computer graphics concentration in the regular programs. The same five
courses were offered for the students who wanted to take advantage of this rare offer of
computer graphics education during the weekend in the region. In fact, most students in
the classes had working experiences as fulltime employees in the industry where they
could use the computers for art making. There were some students who had their own
business of graphics services. Some of the students were working for companies where
their jobs were designing materials for internal communication such as newsletters or
brochures. They already had some experiences with computers and wanted to know how
to use the computer better. They often expressed their frustration from their previous
experiences of using the computer since most of them were self-taught. In general, they
were motivated students with many questions to ask.

There were some concerns about the structure of classes. The first and most
obvious concern was the lack of time. The 9 weekend meetings for three hours each
could never be enough for an art studio course. Both faculty and students were busy just
to cover the hardware and software functions, not to mention the aesthetic and intellectual
developments. There was not much time for the studio activities after the demonstrations
and lectures. It was mostly a one-way education in which everything was rushed. The
second concern was the lack of communication among the students. A brief time in some
weekends was all they had. There was no discussion or debate for the work in progress.
No extracurricular activities tied the students together as a group. They did not see each other’s works until the due date of the assignments. Because most of them had full time jobs, no open lab hours fit their busy lives.

Classes were given in sequence: Desktop Publishing in spring 1997, Computer Graphics in fall 1997, and Digital Image Processing in spring 1998. However, Interactive Multimedia Presentation, the last class of the sequence for the certificate program was never offered for a couple of reasons. First of all, there were not enough students. Even though those students who attended the program were motivated students, most of them did not find any cause to take a multimedia class, other than to fulfill their curiosity. It could have been workable if the class was for Web designs as some students suggested in private. Second of all, there was no faculty available to teach the class. Even if there were enough students for the class, no faculty could teach the class. The faculty in computer graphics already had a full workload, teaching four regular classes in a semester. No adjunct faculty was available, either. This lack of available teaching personnel along with fewer applicants prompted the USF to stop offering the certificate program without certifying anyone. This was a short-lived program, which started from the beginning without a sound master plan or being well thought through. It was a quick business decision of the administration without the consultation of the actual department that provided the service for the students.
Summary

During the period of 1995 to 1997, the computer graphics program at the USF was rebuilt from the ground up to a new concentration program. The climate changes in the industry, the USF, and Department initiated such changes. As developments in the field of computer graphics expanded its use to the visual arts, the industry demanded more computer graphics education. The administrators in the Art Department realized the importance of integrating computer graphics technology into the existing visual arts programs for the future of the Department, and the administrators of the USF supported the decision. A new faculty member was hired in computer graphics, and the new art computer lab was constantly upgraded to meet the newly developed courses. During the same period time the Art Department changed to the Department of Art and Visual Communication to prepare itself for the future. The concentration of computer graphics was the first step of the Department for the long-term goal of creating a more complete program in computer graphics.
CHAPTER 6

CASE STUDY PART III, YEAR 1997 – YEAR 2000

Development of the Computer Arts Major

The new development in computer graphics program led the realization of computer arts major that concentrated in multimedia and 3D computer animation in 1998. The second phase, the long-term plan, for developing computer graphics education focused on the expansion of the computer graphics concentration into a full independent program. As the former Art Department turned into the Department of Art and Visual Communication with the merger of Communication program, the foundation for developing a new visual communication program was established in 1996. The administration of the University supported the direction of the Department and charged the Department to undertake a study to examine curriculum changes that would be beneficial to the future of the Department. The Department conducted the research and came up with the proposal for a new academic program in Multimedia Communication. Originally the Department had proposed more developed concentrations in existing programs. However, as more details added to the studies of concentrations, the
Department was convinced to pursue a new program because of the complexity of the curriculum. In a memo to the administration in 1996 the Department reported the new direction:

The Art Department discussed how to implement the new computer animation courses into the curriculum and decided that, contrary to what we had originally thought, the best way to do so was with a major in computer arts rather than a concentration. When we closely examined the necessary prerequisites for a complex course of study such as animation, it became evident that an entirely new major was the only way to go. In the print out of the program you will see that it is very close to the same one that the department had proposed before. we made only very minor changes in it.

This new academic program had originally three concentration areas. Electronic and Digital Media Communication was a concentration for the Communication program. Multimedia Production and 3D Computer Animation were for the Computer Arts program. Then, Communication Management was added to the Communication program. These concentrations reflected various aspects of multimedia communication, which has become an essential part of the business, education, and entertainment industries. A large part of the multimedia developments rely on the computer graphics technology, integrating various senses of human communication. At the end of 1996 the
Art Department wrote the formal proposal of new academic programs. After a year of detailing the contents of the proposal and searching for the funding, a new initiation was granted to institute the Bachelors of Arts in Computer Arts. The request for a new major in Computer Arts was approved at the Faculty Forum on October 10, 1997 followed by the Board of Trustees on October 21, 1997. After another year of preparation and phased developments, the new program was offered to students in the fall of 1998.

The Proposal

The Department of Art and Visual Communication at the USF prepared the proposal of the new major, which outlined the rationales, goals, required resources, and means of achievement. The need for a new program in computer graphics had grown since the developments in computer graphics offered many possibilities in human communications. While analyzing data of career opportunities preparing students for the 21st century, many findings pointed to computer technology as the future in many areas including art. For example, US and World Report (January 1996) stated that computer animation, web specialists, and multimedia design and production were “hot jobs” or among the fastest growing careers. The US Department of Labor listed computer related occupations among the fastest growing areas in 1995. The July 1996 issue of Working Women stated that animators and software designers were among the top 25 jobs that were ideal for women because of equal pay based on skill level. Even though the demand and supply for skilled workers in computer graphics related areas have been balancing in recent years, the future job markets are still strong and steady. New
developments in the field of computer graphics kept opening the doors for new career options as well. In addition to the existing graphics design and advertising market, new positions were available in areas of feature film, broadcasting, Web design, interactive multimedia design, computer and video game design, and so on. The industry wanted more people with skills and knowledge in the field. More importantly, it was the mutual understanding and belief that the use of a new computer technology was a direction that would not stop in the near future. In its proposal the Department described the program as a professional career oriented program. This did not mean a 'vocation-oriented' education. Rather, it outlined the ever-changing nature of the program and the available job market, which required constant research and analysis. The outlined program objectives were:

Upon completion of the program, students will develop skills and knowledge of:

- Video and audio production and postproduction.
- Creating computer imagery including animation.
- Designing interactive multimedia presentations and web design, using various elements.
- Effective message delivery focusing audience analysis, objectives, design strategy, and functionality.
• Awareness of mass media theories and current practices in multimedia law including copyright, trademarks and legal concerns.

For academic institutions, the developments in these rapidly growing areas were not something that could be ignored for long. The future of the students thus the future of the institutions, depended on an education that could be marketable. The Department and the University pursued these two obvious goals, as any academic institution might, of providing students with quality education for their future and the growth of the institution. The Department wanted to take advantage of the favorable situation of having a new faculty member and the administration's support for the new facility already in its hands. The Department noticed the growth in the field of computer graphics and was particularly encouraged by many success stories in higher education. The Department also realized more than ever that a great deal of its viable future depended on the successful developments in technology. When it made the proposal, the Department was highly optimistic about the functions of the computer graphics program as a vehicle for the growth of the Department.

Another important part of the proposal was the indication that there were no similar programs offered in the close geographical area. The new program was the first of its kind in the local and regional community. At the time, Indiana University Purdue University in Fort Wayne (IPFW) offered a computer graphics program. That program, however, was geared towards the fine arts and was not a full-blown program. The
nearest competing institution was Bowling Green State University, which already had an established program. Amongst the private colleges and universities in Northeast Indiana the University of Saint Francis probably was in the forefront for this type of program.

In addition to recruiting new students, the new program was also expected to ease the huge retention problem of the Department. Retention had been a big problem for the Department for a number of years. During the period 1992 to 1996, the average attrition rate of freshmen at the end of the academic year was 35%. For instance, there were 15 freshmen at the Art Department in 1993. Five of them did not come back in 1994. When the class graduated in 1997, there were only 6 of these students for a retention rate of 40% (Department Review, 1997). Despite many attempts, the Department had not been able to solve its retention rate problem. By offering a very marketable degree program with up-to-date computer graphics courses the Department hoped the students to stay to graduate.

In terms of required resources, the Department was aware of what would be necessary for future success. The Department was well aware that computer graphics was a field of study where new technology was introduced every day, and the unceasing adoptions and new trends became routine. The list of requested resources, for example, reflected the Department's commitment to address those concerns. On the other hand, the administration was not always able to provide the all requested support. The
deficiency in available resources could be one of the most shared problems in any academic institution. It could be the most widespread factor but is an unfortunate one, nonetheless.

The Implementation Process

During 1997 the Department set up a timeline (Table 3) for implementing its proposal. First the curriculum was developed and revised several times. One of the most important parts of designing the curriculum was providing a balanced visual art education in computer graphics for the students. Along with major courses for computer graphics education in specialized areas, a group of foundation art courses are added for balance between the artistic and technological sides. Another important concern about designing the curriculum was the required credit hours for majors. Even though the Department felt many more classes were necessary to prepare the students for the future, it also recognized that the students needed to graduate within a reasonable time, usually thought of as four years. The bottom line was that the Department must provide a program that would enable the students timely completion of their studies with minimum requirements and maximum learning. The course structure (Table 4), descriptions with prerequisites, sequence offered (Table 5), and program requirement sheet (Table 6) were updated accordingly. Other concerns in the process of implementing the new major were addressed, including the need for human resources, facility, funding, education materials, and equipment.
The Curriculum and Course Structure

The curriculum and course for the new computer arts major at the USF was designed to provide computer graphics education in multimedia and 3D computer animation based on the available resources. Because the applied areas of computer graphics are vast, there has been no standard of curriculum among the colleges and universities in the nation. As much as the practices and technologies are diverse, it is up to each academic institution to decide the direction and specifics of courses. There are many factors within the institution that will influence the curriculum design, including the number and specialized areas of available faculty, the facility, time, technology, and goal of the program. In addition, once established the curriculum is a subject of constant change as the technology advances with such unprecedented speed, along with other changes. In any case, it would be impossible to cover all applied areas of computer graphics. The individualized practices are noticeable with the various titles that institutions in higher education are using. While they share some elements, no two courses are equal. The curriculum for the new Computer Arts major at the University of Saint Francis was designed to provide the students computer graphics education in two concentrations: multimedia design and 3D animation. The direction was decided by the trend of the time and the specialty of the available faculty. Multimedia was the applied area of computer graphics that was probably most widely used in society, including Web design. 3D animation was an area that the public became more and more aware of with special effects in feature films. These two popular choices were also the subjects in which the computer graphics faculty member specialized.
After the specialized areas of the major were decided the list of courses (Table 4) was outlined. The field of computer graphics for art and design required not only practical skills and theoretical understanding of computers as an art medium but also a strong general arts component such as creativity, aesthetics, and visual problem-solving skills. The design of the curriculum for computer graphics often tends to focus on specific technologies and practices of hardware and software. While getting the technological proficiency is important, understanding the underlying technical concepts along with artistic expressions and creativity should be equally emphasized. Three areas of study in art were developed in order to provide a balanced curriculum. The first area was the Art Foundation. This 30 credit hour area was developed to provide foundation courses in art, including studio art courses in traditional art mediums and art history. The second area consisted of the major courses in communication. This seven-course area focused on learning practical skills and knowledge of audio/video productions and developing theoretical understanding of digital media. A traditional animation course was also added. The third was the area of major courses in computer graphics. This area had a list of computer graphics courses from digital painting and drawing to Web design and advanced 3D animation. After finishing all major courses in computer graphics, students could choose the concentration area of either multimedia or 3D computer animation. If students preferred, they were allowed to take all courses in both concentrations.

One of the big concerns of the curriculum design was the lack of the contact time for studio art courses. All studio art courses, including the computer graphics classes at
the University of Saint Francis met only once a week for three hours in 1997. For studio art courses, three hours a week is too little even for just lecture and demonstrations. For the national standard, the National Association of Schools of Art and Design (NASAD) suggests the minimum contact time for the studio art courses as six hours a week and recommends nine hours a week. NASAD is an organization whose membership in 1997 included 185 schools out of approximately 2,000 art departments nationally. It is the only accrediting agency covering the whole field of art and design recognized by the United States Department of Education. For the computer graphics courses, meeting three hours a week and 14 weeks a semester was barely enough to cover the minimum course materials, not to mention the engagement for creative endeavors. This lack of time in the classroom was a serious problem for both instructor and students. The instructor rushed to deliver the all lessons in time. The students had a little or no time for in-class practice. In the midterm class evaluation surveys of computer graphics courses, the students had always expressed the most distress about the lack of class time for practice. Students wanted more class time for practice and working on assignments with the presence of the instructor. In that way, the students could get help when they ran into problems.

However, there was no immediate solution for the course contact time. All faculty members in the Department taught four courses a semester. That was the twelve hours of teaching a week for each faculty. If the Department tried to double the contact time for all studio art classes, it would have needed to also increase the number of faculty members in the Department significantly. That was not something that the University
could afford, at least for the time being even though the Department recognized the
problem and tried to address it. In fact, the Department itself pointed out the necessity of
doubling the contact time for the studio art courses. In an effort to get the NASAD
accreditation, the Department invited a consultant of NASAD in 1997. In her report, the
consultant strongly recommended the increase in contact time if the Department and the
University were serious about getting accreditation. NASAD accreditation had been one
of the Department’s top priorities. Getting the accreditation means a lot to any school in
the art and design field. The accreditation generally means a sound total educational
system for art and design. Through the rigorous accreditation process and categories, the
ability, capacity, and practice of the school can be scrutinized. Accreditation indicates
the proven educational system of the school. Consequently, the schools make use of the
accreditation as an important recruiting tool. The Department tried to find its strengths
and weaknesses by consulting and pursing accreditation even though it understood that
accreditation might not happen immediately. The lack of contact time for the studio art
courses was not an issue that the Department could solve without support from the
administration. It required that the Department and the University secure more resources
and coordination on things such as the faculties, classrooms, and class schedules.
Sometimes, there were problems that did not have immediate solutions. Meanwhile, both
the faculty and students felt class time pressures.
Art Foundation Courses

As already noted, to balance learning and practicing art instead of focusing only on some technological aspects of computer art programs, various foundation art courses were included in the curriculum. Many times at other schools the computer graphics curricula and individual courses are caught up with the requirements for intense technological proficiency. As a result, the curriculum could become vocation-oriented, overly emphasizing the learning of specific hardware and software. More and more incoming students, especially traditional students (18-24 years) already had a great deal of computer experience. These students did not have problems using computers. Also, they usually wanted to learn the graphics software right away. Most of them, however, had not developed their basic art skills and understanding of aesthetics and creative processes very well yet. The majority of the new students had not taken any art history classes, either. In order to avoid the pitfall of one-sided learning toward the particular computer technology and techniques and bring balance to the curriculum, a broad spectrum of foundation art courses, including traditional studio art and art history were selected. The 30 credit-hour courses were: 2D Composition, 3D Composition, Drawing, Advanced Drawing, Sculpture, Photography, Graphic Design, History of American Art, History of Art 1, and History of Art 2. With this set of courses students could develop effective problem solving skills, critical thinking, and creative art-making approaches and expressions in historical and traditional art contexts. In addition, this body of knowledge could apply to digital media later.
**Major Courses**

The major courses in computer art focused on the principles and practical knowledge of using computers for creating works of art. The merger of the Art Department with the Communication program not only made the audio/video production courses available but also created some new courses in the professionally specialized areas including “Communication 340: Introduction to Traditional Animation.” This new course was designed to introduce the students to the world of traditional animation. It provided historical information about developments, practices, masters, and masterpieces. The students also learned the process of making animation with practices. Many existing courses especially in Communication changed to adopt the new direction of multimedia communication. For example, the former “Communication Theories in the Modern World” changed to “Electronic and Digital Media Theory” in which the relationships between communication, electronic and digital media and human perception were discussed. This class also dealt with theoretical understanding of the role of computers in our society and the field of art and design. The computer art classes concentrated on comprehensive understanding of the role of computers in the art-making process and included hands-on experience for practical production skills and techniques. As mentioned earlier in Chapter Five, all computer graphics courses were considered studio art courses where the individualized creation and expression in visual language were emphasized. In addition, many major courses required reading/writing assignments in order to understand the background, history, and the current developments and practices in the field of computer graphics.
There was another concern about curriculum. While the curriculum provided a wide variety of courses, the depth of courses in specialized areas such as interactive multimedia presentation and Web design were rather shallow. After taking the introductory courses, students did not have the choice of advanced courses. These subjects required the student to take more than one semester course to get the knowledge and skills developed enough to compete in the entry-level job market. Such advanced studies could include the Java programming course for Web design and Macromedia Director's Lingo programming for interactive multimedia courses. Even the two courses for 3D animation were not enough to cover the advanced learning in specialized areas in the field such as character animation, special effects (F/X) animation with particles and dynamics, Renderman programming, etc. Even though students could develop skills and knowledge further in either independent study or senior project courses, additional structured offerings were recommended. On the other hand, there were problems that prevented such developments. First of all, 64 credit hours of major courses put constraints on the number of courses that the students could take and still graduate within the given time frame. The students have may preferred to stay a little longer and learn more. However, the University and the Department had to work with the required course hours in curriculum that made timely graduation practical. Second of all, there were not enough faculty members to provide all extended curriculum. There was not enough time for the faculty to offer all specialized courses. Otherwise, the students would have to wait two years to take a sequenced class because of the shortage of the faculty. Furthermore, a lone faculty member could not possibly cover such wide and specialized
areas of study by himself. It was simply not possible for one person to know all new technologies in the field. Most commercial works currently in the field are the results of collaborations. For an interactive multimedia project, for example, a group of people in specialized areas needs to work together. The members in the working team may have various backgrounds and specialties for the projects such as design, art, photography, writing, system engineering, audio/video production, psychology, sociology, and computer programming. The concern of the faculty member in computer graphics was shared with other faculty in the Department. They agreed that the Department should look for new faculty who would supplement the program in the specialized areas of the field such as multimedia. However, everyone in the Department also understood that it might not happen in the near future.

**The Initiation Plan for a New Major**

The Department of Art and Visual Communication prepared the initiation plan for the development of new major, which outlined the required resources and the means of recuperation in economic term. As the curriculum was being finalized, the required resources including new faculty, equipment, and facilities were identified. Because the Department asked for a large amount of funding for creating a new major, the business office of the University required that the Department submit the initiation plan for the new program. According to business guidelines for the initiation plan, the Department of Art and Visual Communication should provide student enrollment increases to match the allowed funds. In general, for every $10,000 budgeted by the University, the Department
was expected to enroll one new student in the major for at least three years. Therefore, with the requested amount of $100,000, the Department pledged the enrollment increase of 10 new students for the major every year. This requirement, however, did not have any immediate punitive consequences even if the Department would not reach the projected number of new students, at least for a while. It allowed the Department rather a long period of time to evaluate the performance of the program. Like any other social organization, the University had developed some measuring methods and guidelines for its performance in business terms. The survival of the institution depended on sound business decisions. The initiation plan was a kind of measuring stick for the University in order to evaluate the soundness of the new program in business terms. Not all academic programs are designed for business purposes. And not all programs can be evaluated for its worth in economics. However, it is one of the most important factors nonetheless for the survival of the institution. If the performance of the new program does not achieve the minimum goal, then either the initiating department or the college must seriously reconsider the future of the program.

The Needs for Human Resources

The needs for human resources were very critical for the new development in computer graphics. Yet, human resources were the element that academic institutions often stretch to the maximum. In the proposal, the Department outlined the needs for human resources. It stated the need for two part time faculty members to teach lower level computer courses such as desktop publishing and computer graphics. This was
necessary because the lone fulltime faculty member could not teach all projected courses in sequence. The faculty member was regularly teaching four courses in a semester.

Some of the courses were already in a sequence, offered every other semester. Otherwise, the teaching load of the full time faculty member would have been a constant overload. The first solution was eliminating Art 100: Introduction to Computer Operation. Instead of the Department of Art and Visual Communication offering the class, the general education sector of the University took over this introduction class. In 1999, CIS 190: Introduction to Computers replaced the Art 100 requirement. However, the Department still recognized the need for new faculty who would teach the graphic design course and other lower level computer graphics courses.

Hiring a supporting staff, on the other hand, did not go too well. One system administrator was requested to manage and operate the two computer labs of the Department: the Art computer lab and the Animation computer lab. The Art computer lab was now equipped with 13 Windows NT machines, 8 Macintosh G3s, and many peripherals, including various scanners, printers, a film recorder, and audio/video equipment. The animation lab was filled with 9 Silicon Graphics (SGI) O2 machines, Avid Xpress Non-linear Editing machine, and Immersion 3D digitizer. The qualified computer technician sought had to have expertise in all three platforms (Windows, Mac OS, UNIX) in the Department’s two computer labs for operation and networking. The multiple platforms including the UNIX operating system for the workstations in the animation computer lab required highly skilled system administrators. Only well trained system administrators could handle the demanding high-level job of the UNIX system.
For example, there was a time in 1999 when the licensing server for animation software was out of order. No one in the University including the faculty knew how to fix it. The faculty contacted a local engineering company where several system administrators took care of a large number of UNIX workstations. One of those system administrators came over to the lab and tried to fix the server. He could not do it. After several failed attempts over many days to revive the server with technical support over the phone, a system engineer of SGI finally came from Indianapolis to fix the computer. During this down time, which spanned weeks, no one could use the animation software.

However, the university found it difficult to hire an experienced system administrator for two advanced computer labs. There was a shortage in the supply on the market of computer system engineers in 1998 as "Dot Com" fever swept the nation. Finding a computer technician even at the entry level was difficult for the University with the current market prices. A skilled system administrator or even one fresh out of school would have cost the University much more than the average salary of a full time faculty member. Instead, the University provided a more economical substitute. The University simply rewrote the job description of an incoming staff member for the Department of Art and Visual Communication. A new full time staff person whose original job description was as director of the Department's art gallery and also as a part time faculty member got the additional job of assisting the computer graphics faculty member to manage two computer labs. The administration wanted the faculty member to teach the
staff person to manage the lab. While the staff person’s efforts were sincere, the required high level computer maintenance skill was unavailable. At the end, the responsibility of maintaining two computer labs went to the computer graphics faculty.

This rather unfortunate incident might be the result of a technologically uninformed decision made by the administrators who might not really understand the seriousness of the situation. The administration did not recognize that even the faculty was unable to perform the required high-level maintenance for the animation computer lab. But, this lack of support for the supporting staff could be the result of financial motivated decision. The administrators of the University understood the necessity of hiring a system administrator. The balance of the weight, however, went to the balance in economy, as the needs for the new academic program were greater than the University expected.

This practice of self-sufficiency could reveal the patterns of underlying culture and practices of the University of Saint Francis regarding human resources. When the USF needed new employees, it tended to look inside first instead of searching for quality personnel outside. For example, when creating the Academic Computer Center in 1992, the University hired a student graduating from the University that same year. He had been a student in business and had no formal training in computer technology. The University hired him as the first director of the ACC because the administrators thought that he knew how to work with computers more than any other students they knew in the University. During his residence at the University, the University sponsored him to attend computer training workshops to become a Microsoft certified technician. With his
increased qualifications, he promptly moved to another institution for a better job offer in 1999. The University promoted its assistant technician to be the new director and added another business student as a new assistant for this director. This practice of hiring from within in human resources prevailed at the University. While this practice may have saved some money for the University in the short term, a noticeable side effect was the lower quality in service. Perhaps the riskier thing was the same practice in the academic field. The same new full time staff member at the Department of Art and Visual Communication was taking computer graphics classes for his Master of Art in Fine Arts degree at the Department. Then, the administrators of the University wanted to know if the staff member would become a faculty member after he finished his degree. The administrators wanted him to take over some basic computer graphics courses from the existing faculty in the future so that the existing faculty member could teach all upper level courses. Academic inbreeding is something that colleges and universities usually try to avoid. While the schools are looking for feel-good numbers in economy, they also need to look at the quality of service to their students. If achieving a short term financial goal is more important than maintaining long term quality, the future of the institution can suffer eventually.

The Facility, Educational Materials, and Equipment

The development in computer graphics requires many resources, including the facility, educational materials, and equipments. Space is a commodity that is rarely available in academic institutions. Finding and creating a facility for a computer lab
which could hold all equipment, networks, electrical power, and users is much more
difficult than finding an ordinary classroom. The University could not find any space for
an additional computer lab for animation. In the end, the Department found the space in
a room occupied by a big old processing camera that had been used for graphics design.
The room and the processing camera were no longer used, as the digitalized process by
the computers replaced the mechanical process. While the room was not as big as the
Department hoped, it solved one of the most difficult problems. The processing camera
was removed and the room was renovated in 1997 with network outlets, electrical outlets,
adjustable lighting, and furniture to hold animation classes with 9 Silicon Graphics
workstations and a projector.

Another consideration was the educational materials for the program. As many
developments in the computer graphics area were recent developments, neither the library
nor the Instructional Resource Center (IRC) on the campus was properly prepared to
support the program. In addition, because of the rapidly advancing technology, the
contents of many educational materials including books, manuals, CD-ROMs, slides, and
videos would be quickly outdated literally as soon as they were available. The library did
not subscribe any computer graphics magazines or journals, either. Only a few outdated
books were available. Suggestions were made and the library got the one-time initiation
fund of $6,500 for the new program, which was used to buy a list of books in computer
graphics related areas. Also, the new faculty had several sets of slides and videos of
computer graphics from recent SIGGRAPH conferences, which were added with the new
sets of slides and videos later. The use of the Internet was a wonderful thing for the art
classes. The Internet became a huge library, art gallery, museum, and database. A variety of education materials, including multimedia data, were readily available for the classes if a little time of preparation could be spared. However, the regular library budget for the Department was not enough to cover the materials.

Because a large amount of money was required for the equipment, the budget request for upgrading the first art computer lab and setting a new animation computer lab was phased into several chunks that the Department and the University could afford. The Phase I was initially done as the multimedia class was offered. But, the computers in the art computer lab needed a major upgrade again with multimedia functions. The University administration no longer intended to jeopardize the development of its new Computer Arts program by ignoring the cost for upgrading the existing computer lab, forcing the Department to again look for an outside patron. Instead, this time the University observed the cost and agreed to upgrade the first art computer lab without sacrificing the budget for the proposed animation lab. The administration used the general technology budget to upgrade the first art computer lab. The University continuously upgraded the art computer lab throughout the whole process of the Computer Art program development. In addition to the phased developments, the computer lab was upgraded several times with new PCs, peripherals, and a non-linear digital video editing machine for the multimedia class. More recently 8 Power Macintosh G3 machines (400 Mhz Power PC G3 with 1MB L2 cache) were added with a new set of peripherals and furniture in 1999. These developments clearly demonstrated the determination and the newfound enthusiasm of the Department and the University.

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Phase II was for creating a new computer lab for 3D animation. The Animation computer lab was designed to have a state-of-art facility parallel to those of highly regarded CGI production studios. Because of the hefty requirements in hardware configuration for high-end 3D computer animation programs, high power Silicon Graphics (SGI) workstations and Intergraph machines were considered. For the high-end 3D animation software, Alias/Wavefront Entertainment package was selected. This package came with several industry leading software packages including StudioPaint 3D, Power Animator, Composer, and Maya for available educational discounts. The retail price of the animation software package was more than one million dollars. For educational purposes, however, the school was required to pay only the annual maintenance fee of $5,000 for 6 to 10 licenses.

Phases III and IV outlined the plan to equip the Animation computer lab with peripherals. Avid Xpress non-linear video editing machines, and an A/B cut video editing deck. The 3D digitizer would provide students with more power of 3D modeling for their animation projects. In addition to creating animation in the Phase II animation equipment and computers, Phases III and IV were designed to provide professional quality non-linear video editing machines, which would be used for both animation classes and audio/video production classes in the communication program. It provided an exciting working environment for dedicated students to be successful in the real world.

**Phased Process**

**Phase I**
Multimedia Computer Lab Upgrade (for existing programs)
Phase II
1 Avid system with supporting equipment (for existing programs)
7 SGI Computers for computer animation program (for the new programs)

Creating Computer Animation Lab
Proposed hardware and software
Hardware: 7 SGI (Silicon Graphics) 02 Desktop Workstations
(Regular Educational Price) $8,996.25 X 7 = $62,973.75
or
* Possible Grant from SGI Lab Initiation (7 computers for the price of 6)
7 Computers for price of 6 $9,000 X 6 = $54,000*

$800 for technical support X 7 = $5,600

Software: Alias/Wavefront package
$5,000 maintenance fee per year for 6-10 licenses
or
(* Softimage: Initial Purchase: $950 X 7 = $6,750.00
Annual maintenance: $195 X 7 = $1,375.00)

Projector for the classroom $8,000

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Phase II Total $81,573.75
(* $72,600)

Phase III
Peripherals for Computer Animation Lab
3D Digitizer (Faro Space Arm) $5,495

Audio / Video Editing
1 Avid-MCXpress Digital Nonlinear Video Editing System
Base system: $30,000
Software Bundle: $15,000
1 JVC BR-S800U S-VHS Editing Recorder/Player Deck $3,200
1 JVC TM-1400SU 14” Color Video Monitor $1,050
JBL Speaker $130
Network Card and Cable $110
Removable Hard Disk Deck and Hard Disk $5,000
CD Player $450
Cassette Deck $450
Microphone $100

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Phase III Total $60,985

Phase IV
1. Avid system with supporting equipment (for existing programs)
   Beta SP Recorder/Player Deck (for existing programs) $46,500

Program Promotion and Student Recruitment

While the development of a new Computer Arts program and its implementation in a small college is the main subject of this study, the development and its success can hardly be understood solely by the descriptions of contents and a series of chronological events. Such a successful outcome was also dependent on various efforts that were not directly related to the developments in the content of the program. The impressive growth of the program in three years in student enrollment from 8 to 65 was no accident or pure luck. Behind such success was a full-blown effort and devotion of everyone in the Department. Those efforts should be understood as significant parts of the big picture of the development. Finding out how one art department made a total effort to make a new program be successful can portray the difficult and daunting tasks of realizing an academic program in small colleges and universities. In the next section, some of the efforts, events, and tools that the Department used to increase the awareness of the new program are described.

Animation Lecture Series, Exhibition, and Festival

One of the Department's efforts was directly related with advertising the new program to high school students and the public. As part of the awareness campaign for
the new program, the Department held a couple of lecture series about computer animation given by guest speakers from famous production companies. The first ones were held on April 23 and 24, 1998 to celebrate and draw attention to the official opening of the Computer Arts major in the fall. The guest speaker was an animator from Industrial Light and Magic. There were two lectures. One was an evening lecture, open to the public on April 23. The other was designed specifically for high school students on the morning of April 24. Over 120 high school students attended the second lecture, watching the video clips and listening to the lecture about the latest developments in computer animation and special effects in feature films. At the end, the Department distributed brochures and printed materials for the Department and the new program. Along with the lecture, the Department also launched a touring exhibition of computer works of art done by the faculty and students of the Department. In an attempt to raise the awareness and recognition of the computer graphics program among area high school teachers and students, the works were exhibited at eight regional high schools in the Greater Fort Wayne area from March to May 1998.

Another lecture of computer animation was held in early 1999. The Department applied for and received a grant from Arts United to host an Animation Festival and Exhibition from January 23, 1999 to February 27, 1999 in the Department’s art gallery. Several activities were planned to raise public interest in computer capabilities for the entertainment industry. During the period, demo video reels of the participating production companies were featured in a small theater setting. Thirteen well-known production companies in the feature film and special effects industry were invited. Eight
of them participated in the Festival, sending their demo reels and supporting published materials for exhibition. Those companies were c.o.r.e. digital pictures, Windlight Studio, Kleiser-Walczak Construction Company, Digital Visual Effects, Blur Studio, Rhythm & Hues, VIIFX/Blue Sky, and Digital Domain. Part of the program was a lecture series by a guest speaker from Dreamworks SKG on February 11 and 12, 1999. A technical director (TD) in the Effects Department of Dreamworks addressed the topics of animation and Dreamworks SKG’s innovations in the technology of computer animation. There were two speaking engagements including a public speaking engagement and presentation for the University students and regional high school students.

Inviting the guest speakers from the well-known production companies was not easy. Most companies were not willing to send their employees for public appearances especially to places they did not know well enough, including academic institutions. For example, an invitation to Disney for a guest speaker for the lecture was rejected. The Feature Animation division of Disney imposed a set of unofficial guidelines for engaging public appearance of its employees. One part of the guideline limited the visit of their employees, including animators and technical directors, to colleges and universities for official purposes only such as recruitments and Disney sponsored activities. When an individual employee was requested as a guest speaker, Disney limited the place for the schools that either had well established academic programs that the company was familiar with or the school that the requested person graduated from. This cautious guideline was necessary to protect the name and image of that company from both intentional and unintentional unwarranted use or misuse. It was no secret that many
schools wanted to use the names of well known companies to attract prospective
students, suggesting strong connections between the academic program and future
employment. The lecture events at the University of Saint Francis were possible through
the personal connections of the computer graphics faculty member with the guest
speakers. Guest speakers for both occasions in 1998 and 1999 were personal friends of
the faculty member. Nonetheless, permissions from both of their companies were still
required for the official visits. Both companies, in the end, reluctantly allowed their
employees' visits.

In addition to the lectures, high school students were invited to participate in a
hands-on animation workshop on Saturday, February 12 from 9:00 a.m. until 3:00 p.m.
A total of twenty-four students from local high schools were invited to attend this
workshop. In the workshop the faculty of the Department led the students to use the tools
of traditional and computer animation. The students were divided into two groups and
worked during the morning and afternoon sessions. Each group took turns to have the
hands-on experience of creating cell animation and 3D computer animation.

High School Art Workshop

The Department of Art and Visual Communication worked in conjunction with a
third party marketing firm in creation and development of a marketing plan. The
Department had a contact list of 612 high school art teachers, communication and
audio/visual directors and guidance counselors. High school students were encouraged to
participate in either a fall or spring art and communication workshop, or to participate in
either a fall or spring portfolio day. Each semester a workshop was given for juniors and seniors in regional high schools, who wanted to be art majors in college. This all day workshop was held on a Friday from 8:30 a.m. to 4:00 p.m. There were usually seven workshops for airbrush techniques, drawing, ceramics, photography, illustration, computer graphics, and television production. All workshops were given by the full time faculty except one or two, usually illustration or drawing, by adjunct faculty. The number of students for each workshop was decided by the needs of the particular workshop. For example, the drawing workshop usually had a limit of fifteen students while computer graphics had twelve due to the number of available computers. About sixty students, mostly from a sixty miles radius around Fort Wayne, participated every semester. Around 30 high schools out of 225 schools where the invitation were sent participated. Because of the limited number that the workshop could accommodate, each school was limited to send two junior or senior students.

For computer graphics, the workshop started with the introduction of the computer graphics field. After a short discussion about the students’ perception about computer graphics, the slides and animation video were shown. This curriculum of the workshop was similar to that of the digital image processing class, shortened to cover the fundamental background information with hands-on experience. During the morning session, the students worked on Photoshop as a painting tool. The afternoon session focused on manipulating photo images to create photo collages. The students first manipulated several images, and then arranged them to create a collage. In the end, the students could walk around to see the works of other students. They also had the option
to color print their works as a souvenir. In 1999 and 2000, the workshops changed the subject from image processing to 3D computer animation in order to draw more attention from the high school students. The contents and procedures of the workshop were very similar to those of the workshop given at the animation festival and lecture series.

The fact that full time faculty members were the instructors giving the workshop was very attractive to the high school participants in many ways. First of all, the participants were able to have a real experience with the university faculty whom they might see in the future, which gave students a good opportunity of tasting what future classes would be like. Secondly the students could get advice for their future from the faculty. Participating students were encouraged to bring their portfolios. At the close of the workshops, there was an hour period in which student portfolios are critiqued. For the seniors who had strong portfolios, the critique could lead to art scholarships. In order to receive the art scholarship the student was obliged to be admitted to the school and submit satisfactory letters of recommendation from their high school art teachers. This incentive worked well for the Department since a high number of students who had their portfolios reviewed later chose to attend the University. Often juniors who previously took the workshop participated again for the following year, which usually indicated the seriousness of the students in art and to be a future student. The benefit of the workshop for the Department was tremendous as well. The workshops have been extremely successful in not only attracting outstanding area high school students but also becoming more familiar with their art teachers. There was no secret that art teachers in high
schools had a great influence for the decision of the students to choose the colleges. Strong ties with regional high school art teachers, many of whom were alumni of the University of Saint Francis, played a significant role for the department success.

**Other Endeavors**

In addition to the high school workshops, the department also held a formal art portfolio day each semester. Even though critiques were given year round for the high school students who asked to be critiqued, one Friday each semester was designated for seniors in high school who were interested in coming to the University. About 24 students participated each semester. Like the high school workshops, this critique could provide the opportunity for students to learn of scholarship possibilities, including amounts. Many of the participants came with their parents, who had a variety of questions on topics ranging from financial aid to dormitory life to the future job market. To help to address such concerns of the students and parents effectively, the Department asked the presence of a representative from the admissions office. The admissions office usually set up a booth and helped the students with applications and brochures of the University.

Another departmental effort of recruitment was an art exhibition for regional high schools. Every March the Department sponsored an art exhibition, which usually attracted more than 200 entries from twenty to thirty high schools. In order to maintain the quality of the works and competitiveness the Department limited each school to ten entries. The exhibition became a showcase for the regional high school art programs and
their talents. This effort also attracted the students who were interested in computer graphics and animation. More and more high schools started to include computer graphics classes in their art curriculum. There were many entries of computer generated images and even a couple of computer animation in 1998, and the numbers were growing. For the new Computer Art major, this high school art exhibition became a showcase of its own as the exhibition attracted a large crowd of participants, their parents, relatives, and friends. The works of Computer Arts majors were displayed on the hallway of the building and printed promotional materials were handed out.

Other recruitment efforts included departmental mailings, tours, lectures, and participation of portfolio reviews held in other institutions. The Department also expressed the necessity of the expansion of the target area and the inclusion of 200 more high schools in the marketing group. The Department and the University hoped the new Computer Art program would be easy to market since there was no direct regional competition.

**Realization of the Computer Arts Major**

In fall 1998, the Department of Art and Visual Communication at the University of Saint Francis officially started to offer the new major in Computer Arts. When the proposal was initially made, one of the biggest concerns was the enrollment. The Department conservatively estimated that the program should attract 5 to 10 students annually if the program was properly marketed and the Department’s geographical recruitment boundaries expanded. In 1998 as the program was offered, however.
immediately there were eight students who wanted to take advantage of the new
development. The total number of art majors was 152. In 1999, the number jumped to
28 out of 162 in the Department. The majority of the new program’s students were at the
freshmen and sophomore levels. Then the Department experienced a huge boost, a 38%
increase in student enrollment in 2000 to count 224 students in the Department. A big
part of the success was the Computer Arts program, which more than doubled the number
of students in the new major from the previous year, to 65. The Department somewhat
expected and partially hoped for the steady growth in numbers but never anticipated such
a large increase. If enrollment can be counted as a measure of success for the program,
the new Computer Art program had already more than met its goal.

This was the result of a great deal of effort and money by the whole Department
and University. Years of research, preparation, and implementation were finally realized
as a new Bachelors degree in Computer Arts. From the beginning, it required a team
effort. There were faculty members in the Department who believed, designed, and
supported the developments. While some faculty members were working more on
developing the design of the program, others tried to find resources. Everyone in the
Department participated in development and no one expressed second thoughts about the
decision. The key to the realization of the program, however, may have been in the
timing and the determination of the decision-making body in the Department. The
necessity and the opportunity of the computer graphics program were well recognized by
the Department, including the governing body. The Department understood the need for
the developments in computer graphics education. But, the decision was still up to the
administrators within the Department. If there had been no commitment from the
governing body, the program certainly would not have been realized. The administrators
in the University had rather less influence on the developments, respecting the decision
made by the Department. It may be true that there were faculty members who had more
control over developing the program than others. Nonetheless, all members in the
Department were supportive of the development. And if the administration of the
University ever doubted the decision of the Department, the developments might have
turned out differently. It was a triumphant outcome for the small university that had only
123 art majors when the program’s development began, and almost doubled the
enrollment in three years. It was the belief of each and every member of the Department
that this program must be implemented for the viable future of the Department in order to
continue to grow.

Summary

Since 1996 the Department carried out the long-term plan of a more complete
program in computer graphics. In the middle of the planning stage, with the support of
the University, the Department changed its goal to an even bigger one, of developing a
new major in Computer Arts. The program was developed through careful planning and
efforts by the whole Department. Despite many obstacles, including misunderstandings
of the field of computer graphics, the lack of resources such as facilities and supporting
staff, the program was realized in 1998. This Bachelors of Arts in Computer Arts program had two concentrations in 3D animation and multimedia. The Department also actively promoted the program and recruited students.
CHAPTER 7

FINDINGS AND CONCLUSION

The Issues of the Computer Graphics Courses

Recently, in visual art programs across the nation, more institutions in higher education than ever have searched for ways of integrating computer graphics technology into their existing art programs. The field of computer graphics has found less resistance on its way into the academic institutions in higher education, as our society is becoming more familiar with the use of computers in everyday life. A record number of schools provide various kinds of computer graphics programs for their students. Depending on the goals and available resources of the institutions, some have developed academic departments specifically designed for utilizing the computer graphics technology while some have only minimum introductory courses.

Since 1984 the University of Saint Francis (formerly Saint Francis College) has developed some form of a computer graphics program in its visual art program. While the program has a relatively long history of employing computer graphics technology for the visual art program, the development has had its own ups and downs. The initial program did not get the continuous support from the University and deteriorated into the
early 1990's. However, the program was revived as the timing and the situation became more favorable. After a period of deterioration, the program got much needed support from the Department and the University for a new start. In 1998 the development materialized as a new major in Computer Arts. From developing and teaching the computer graphics classes between 1995 and 2000 at the University of Saint Francis, some issues of teaching and learning computer graphics emerged. Some issues are directly related with teaching and learning computer graphics, including curriculum and course design, the available resources, and assessment of the program. Other issues are subtler yet have stronger influences on the formation of computer graphics education programs, such as the culture and decision-making process in the institution. In this part of the paper, findings of those emerged issues are discussed.

The Technological Aspects: The Balance Between Learning and Creating

One of the most difficult aspects in teaching and learning computer graphics is achieving the balance between technological proficiency and artistic creativity. Perhaps the most common concern of instructors in teaching and learning computer graphics is the use of technology for the art-making process. Using technology for the art-making process is not new. In fact, artists have used the available technology of the time for creating art throughout the history of humans. Any artists who want to create must learn the technology, the medium and materials of art. It is true that students need a period of time to learn how to work with an art medium in any given traditional studio art classes. They must learn enough about how to handle the medium before engaging in the process
of creating visual messages. The issue of the balance between art and technology is an on-going challenge that is universally shared among the educators in the field. The curriculum and course design need to address the concerns of technological proficiency for the students. At the same time, the goal of learning the digital technology is creating contents and messages in the visual language. In the case of the computer graphics classes, however, learning technology often has more significance than the creative process. As the technology advances and the applied areas are getting larger every day, it may not be possible to master the technology. In the middle of learning this ever-changing technology, some important lessons can be missed.

It is evident that the technological aspects of using the computer as an art medium bring many challenges for teaching and learning computer graphics. Computer graphics is probably the field of study that requires much more understanding of the technological aspects of the medium than any other art medium. For teaching and learning computer graphics, both instructors and students must deal with intense learning of the medium before starting to create. In the field of computer graphics, rapid changes are considered normal. The technology is advancing so fast that even staying current takes enormous effort and time. Unlike many traditional studio art classes where the same basic skills are practiced over a long period of time, even centuries, computer graphics courses face constant updates and changes. Then, the question is when the learning of how to use the medium (the computer) ends and the creation begins. In this field of study where everything changes, the learning and creation must coexist. In other words, there will be

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no end to learning. Letting the students understand this task of continuous learning is one of the real challenges that the studio art teachers must face in the field of computer graphics.

The frustration of the students about the learning and using the computers at the same time for creating a work of art was universally shared through the all computer graphics courses. At the beginning of classes such as "Computer Graphics" and "Desktop Publishing" the frustration of the students was highly focused on computer literacy, especially before 1997 when a more comprehensive introductory computer class became mandatory. From turning on the computer and starting the graphics program to saving the file on disk and printing the works, many students expressed their frustrations. The students were generally afraid to make any 'dumb' mistakes and lose their work. As the computer has become a part of everyday life in our society, the computer literacy problem of the students for basic operations diminished. Now, incoming students are more knowledgeable about computing and generally do not worry about jumping into a new technology. For the computer graphics classes, new students want to learn right away about the graphics software and peripherals such as scanners and printers. They do not want to waste their time on basic knowledge of working with computers. They already know how to work with hardware and some are familiar with the graphics software as well. Many of them try to take an optional computer literacy test in order to test out of the introductory computer class (CIS 190: Introduction to Computers).

Another problem of the beginning classes, and even some upper level classes, was the diverse levels of technological proficiency and computer literacy among the students.
For the same class materials, including the use of the software, some students thought them too technical while for others they were too basic. It was a dilemma for the instructor to decide at which level the class lessons should be taught. In the computer graphics course, giving class lessons at the level of the average students does not work very well. When the students fail to follow instructions, they get confused and frustrated very quickly. The problem is that they tend to refuse to do anything until their individual problems are properly addressed. They often just sit still in front of their computer, doing nothing. On the other hand, the students with better knowledge or previous experience also have problems of their own. Sometimes, when they believe they already have sufficient skill, they pay no attention to the lecture or demonstrations of the instructor, so they miss important lessons, not realizing that their knowledge still needs to be deepened. Depending on the level of courses, the required technological proficiency and computer literacy varies. For both lower and upper level courses, students usually had problems with graphics software. No longer was the subject a simple painting program with a limited number of functions. More and more graphics software programs provided the users with an array of functions and options. Students were mostly overwhelmed by the required learning of specific sets of functions, then available options for the functions and finally other choices of the software that the class lessons did not even touch.

In most cases, the solution is up to the instructor and the lesson plan. First of all, the instructor must encourage the students to freely ask questions in and out of the classroom. In order to do that, the instructor needs to create an environment in which the students feel comfortable to ask any questions. Students are often afraid to ask 'dumb'
questions in the classroom, fearful that the other students might laugh at them. Second of all, the instructor needs to make the lesson segmented. Instead of giving the lesson in one continuous lecture or demonstration, the instructor can divide it into several small parts and give them one by one. During the interval, the instructor can walk around the computer lab and observe whether the students follow the lesson. By walking around the instructor can not only make himself/herself available for the students who are experiencing difficulties in following the lesson but also address the advanced students' needs, thus balance both ends of the students' learning. Third of all, the overall approach for learning and understanding computer technology should be broad and long-term oriented. Students need to know much more than basic operations of the computer and some functions of the software. While the practical knowledge of the hardware and graphics software may serve the students well at the time, the students also have to face tomorrow's technology. The lesson plans should include the history, technological background, trends, and new developments in the field. The learning should lead to an understanding of the computers and digital technology in historical and theoretical contexts. In addition, the lesson plans systematically encourage the students to develop a habit of self-guided learning of the technology as the technology keeps advancing. The lessons should not be limited to one time learning. For example, in the "Computer Graphics" course, the students were required to write a formal research paper about the computer graphics field as part of the reading/writing assignments. The students could choose the research topic in the area that they could relate to, whether it was about
special effects in feature films or the use of the Internet in high school art classes. Students should be able to learn not by receiving the knowledge in a passive way, but through active research and study.

The more serious issue of utilizing the technology for the art-making process comes from the technology itself. Because the new technologies keep on coming and existing technologies are continually transformed, the applications and applied areas are deepening and widening. Therefore, the needs for learning new technology never stop. This volatility puts the pressure on everyone in the field. The industry is looking for better technology. The educational institutions try to accommodate the newest developments in technology to better prepare the students for the job market. Also, the students try to learn which hardware and software they have to know in order to make themselves more marketable. In the frenzy of chasing new technology, what is often forgotten in many people’s minds is that it is the art-making process that the technology is for. Unfortunately, learning hardware and software may be the goal for many art students in computer graphics classes. The learning of the students tends to stop at the knowledge of available technology instead of applying the knowledge to the creative process. In the traditional studio art courses, the objectives go beyond the mere learning of the medium. The courses focus on the knowledge for creating works of art. The applied areas of knowledge include creative visual thinking, personal expression, analytical problem-solving ability for visualization, story-telling ability, and developments of aesthetics.
For the computer graphics classes, however, these underlying principles and objectives are often lost in practice. Many lessons are structured around the specific hardware and software. Within the limited time frame of the class, the instructor has to cover the medium as much as possible. And that is what many students expected for the class. In the surveys for midterm class evaluation, some students in the computer graphics courses in the Department expressed that the course was not as technically based as they had expected. What they were looking for was a kind workshop that some commercial companies offer. In those one- or two-day workshops, very specific techniques and functions of the graphics software (usually Adobe Photoshop) were demonstrated such as using special effects filters or added web design functions. Some students wondered why the class content and structure was more artistically oriented. In the "Desktop Publishing" class, a (probably non-art major) student expressed that he/she had expected to learn the mechanics of DTP and suggested that the class should have provided the students some needed 'artworks' such as photos and clip art for practice and assignments instead of creating their own. This was a common misunderstanding of the students that learning specific software such as a high-end 3D animation program would grant them automatic art-making ability and success in the job market. This misunderstanding was addressed several times by the teacher, that potential employers are looking for people who can think, create, and provide visual solutions for them, not ones who only know how to work with specific software but cannot create. In the middle of the semester, however, students in a 3D animation class often work on their demo reels only to demonstrate how much they know about the animation software, not the story.
(content) and the story-telling ability. In addition, the technology that the students are currently learning, especially the many functions of a specific software package, are subject to change at any time. While a vocation oriented education may provide specific information about a given graphics program, it does not provide the more important knowledge concerning creating messages.

Without the knowledge and understanding of art-making, the knowledge of the hardware and software alone soon will be useless. This is an issue that should be addressed in the design of the curriculum and individual courses. In order to balance the learning between the computer technology and other concerns in studio art courses, the curriculum for the Computer Arts major was designed to have foundation art courses. The goal of these traditional art oriented foundation courses was to introduce students to the general understanding and appreciation of arts before the students got into any use of the computer technology. A group of traditional studio art courses along with art history classes in any foundation art curriculum should guide the students to look at the concerns of art and design fields such as colors, subject matters, compositions, themes, symbols, and expressions. The students need to know how to visualize ideas, values, and emotions. Through the history of art, the students also learn and understand how the field of art and design was filled with continuous struggles and triumphs of the countless artists and designers. In the process, the students can learn about the attitudes, trends of the time, motivations, developments, and environments. Without the critical knowledge of art in these areas, it will be very difficult, if not impossible, for the students to create a work of art that is worth anything with the new digital technology alone.
The Design of the Course

The individual classes in computer graphics should be designed to lead the students into balanced learning between art and technology. While the design of the curriculum for the whole program can address the general directions for the balance in courses, it is in each individual course that the actual learning of students takes place. In the traditional studio art classes, the focus of teaching and learning is on mastering a body of knowledge through various activities that can draw the attention of the student to art-making, art criticism, art history, and aesthetics. For the courses in computer graphics, the same approaches can be utilized. Even though the art-making process, particularly the learning of the art medium, usually becomes the center of many computer graphics classes, other elements of learning and practicing art can be achieved through careful course design.

The curriculum and practices of computer graphics share many common aspects with other studio art courses. In general, the computer graphics course can be a studio art course, dealing with artistic creativity and aesthetics. On the other hand, many computer graphics courses are commercial art oriented as the applications of the computer graphics are widely used in the commercial art industry. From the beginning, all computer graphics classes at the University of Saint Francis were open to any art majors. Both fine and commercial art students could choose a concentrated study in computer graphics. While this availability of the computer graphics classes to both fine and commercial art students was necessary as they could choose computer graphics as their area of study, teaching them in one class imposed some challenges. In the studio art settings, the
computers are usually used as an art medium or tool to create works of art in various forms and formats for mostly aesthetic purposes. For commercial art, the purposes of the artistic creativity focus on the content and design in order to deliver the message of the clients efficiently and effectively. The answer can reside in the goal and structure of the course. For example, both sides share the same goal of searching visual solutions for given problems. It is the same creative thinking and problem-solving process. The students from both sides can share the same course materials for different purposes. The differences between them are blurry and tolerable in most computer graphics classrooms. Moreover, it may be a more desirable environment for the art students in order to learn and understand various perspectives and approaches of creating art among their peers. The instructor should be the facilitator who needs to advocate such dynamic learning in the many aspects of art.

For the art-making practices, the focus of learning should go to the message and expression. During the course demonstration and practices, the teaching and learning of hardware and software can be stressed. After all, technological proficiency is a prerequisite for utilizing the computers for creating art. However, the emphasis should be on content and expression along with the technology. At the beginning of the class, the teacher can explain objectives of the lesson and demonstrate specific sets of techniques. Then, the teacher can ask the students to go through the similar process in their own ways. The in-class practices should be flexible enough that the student should be able to freely explore the course materials. A set of possible subject matter and themes can be given as an option or the students can discuss and choose their own in the
class. During the exploration of the students, the teacher can walk around the computer lab in order to assist the students. In the process, the students are allowed to move around the room or engage in discussion with the instructor and other students about content. In this case, the teacher is not a lecturer who gives the lesson in step-by-step fashion but a facilitator who launches the research of the students in visual language. In addition, the studio assignments can help to achieve the goal of balanced learning. For the assignment, students are expected to incorporate content and techniques presented in class into the assignment with artistic creativity. Students may have artistic freedom to choose the contexts of the projects within a given description. The assignments should encourage artistic experiments and personal expressions as well. It is often up to the instructor who can show support and encouragement by evaluating the students' assignments based on the achievements in overall quality and personal expression, rather than just creating a pretty picture.

The studio assignments can serve the learning of the student even better through presentation and critique. Engaging students in thoughtful criticism is one of the best ways of teaching art. Art critiquing can foster understanding and appreciation of works of art by describing, interpreting, judging, and theorizing. For the studio assignments, students should submit them in ready-to-hang (printed and mounted on board) format for proper presentation and course credit. In the classroom, however, critiquing each other's works often put the students in reserved attitudes, being afraid to talk about each other's works. Most students do not want to hurt fellow students' feelings nor get hurt by harsh words. They tend to keep quiet until they are asked to speak out by the instructors. It is a
common misunderstanding for the students that critiquing is the same as criticizing. Many times the students expect and are ready to get criticized by the instructors. They tend to see the classroom critiques as fault finding and scrutinizing activity as prerequisites for grading. This is a quite understandable phenomenon as much critiquing practices in the studio classes focus on those aspects, hoping to improve the students’ performances. Under a psychologically safe environment, however, group critiques often play major roles to increase understanding and appreciation of art, providing a broad spectrum of interpretations. Art critique can be an enjoyable activity, allowing the students to freely engage in analysis and appreciation of works of art. In the process, interpretation plays a critical part of criticism. The engaging students can soon realize how their classmates think differently about the same works of art that they concentrate on. For the computer graphics classes, the class critique can be one of the most helpful tools of balancing art and technology. By engaging in the critiques, students’ attention can be moved from the technological aspects to more of the concerns in art. To make the critique successful, the instructor must facilitate the students to engage and contribute in the discussion by promoting an environment in which constructive and positive attitudes and comments are encouraged.

Other helpful tools for balancing the class lessons are reading and writing assignments as described in previous chapters. The instructor can select reading materials about various topics in the field of computer graphics and assign those to the students to read and write a synopsis about the topics. Such reading materials can be found in a variety of places including online journals and publications. Those articles in
online computer graphics journals are not only free but also do not require the instructor to go through the copyright permission process for reproductions. The instructor can simply tell the students the address of the web site and the title of the article. The student can either read the article directly from the screen or print it out to read, or download and save it on a disk for later use. Also, the reading and writing assignment can include the research paper about the field of computer graphics. By doing the research of their choice in the field of computer graphics, the students can develop self-directed active learning habits. As the journals and publications are readily available in various topics, the learning of the students can also be enhanced by acquiring information about computer graphics in the historical, social and cultural context. Therefore, the reading and writing assignment can help the students expand the knowledge and understanding to the broad areas of the field, and not be limited to the specific technology.

Moreover, the discussion and critiques can help the students to develop both individual and group communication skills. The student can develop the skills of rational and logical arguments to express their thoughts or defend their works of art. In the process, the students can also develop the vocabulary in the field of art. Besides, collaboration has become an important element in the field of computer graphics. As the field has become more specialized in and integrated with various technologies, the collaboration has become second nature in many areas. No one person can do everything. Whether it is a project for interactive multimedia or a 3D animation or Web design, people need to work as a team. In this team-oriented working environment, collaboration is a must. In the classroom, the students need to develop the skills for
working together as a group. The instructors should encourage the students to do group projects as course assignments just like they are done in the real world. The students in this environment need to know how to share and cooperate with other students as coworkers. By learning how to work alone and collaboratively, the students can strengthen their communication skills and work habits as professionals in the field. The needs for developing strong interpersonal communication skills for negotiation and persuasion should and can be embedded into the course structure, as the students are required to develop and present their group works in the classroom.

**Design of the Computer Lab**

As a classroom for studio art courses, the computer lab should be designed to meet the needs of teaching and learning computer graphics, accommodating a variety of educational activities. As previously mentioned, the teachers in computer graphics classes should act more like facilitators than lecturers in many traditional lecture-type classes. The design of the computer lab, which can accommodate various class activities, can significantly influence teaching and learning computer graphics in the visual arts. For the computer graphics courses, the computer lab means more than a place where the students come and learn how to work with hardware and software. A computer lab is a studio art classroom where critical exchanges of teaching and learning of art take place. The design of the computer lab is a critical pedagogical concern that must be addressed.

First of all, there must be a good projection system for lectures, demonstrations, and presentations. Unlike traditional classrooms, the students in computer graphics
classes are sitting and working in front of individual computers. Working with the computers, the students need to continuously change their attention from the projected screen to their individual computer screens. They need to watch the projected images of the instructor's computer to follow the lessons while working on their own computers. This is not easy for students. In this step-by-step mode, the students need to hear the instruction and watch the projector screen. At the same time, they need to see and work on their own computer screens. This is when students often miss the demonstration and get frustrated. It will be better for class instruction if the instructor's desk is set at a place where the instructor can have an overview of the whole computer lab, including the students' individual screens. In that case, when any students have difficulty following the instruction, the instructor can easily notice and address the problem. For the physical settings, a good quality projector in proper lighting is a must. The room should have dimmable lights to control the amount of light. Also, the light should be more of natural light in order to see the works of art appropriately. In the case of the projector, high resolution such as True XGA (1024 x 768) or SXGA (1280x1024) should be considered, as graphics software packages require the computer monitors set to high resolution.

Another important function of the projection system is sharing the works of art for presentation and critique. A computer lab is a classroom for the instruction of interactive multimedia, which needs an environment of integrating various elements including video, audio, and data source materials. Good color representation with no distortion of image is required. In addition to projecting visual images, the computer lab should have capacity for multimedia including the sound system. Videotapes are frequently used for
classes such as computer animation, video editing, and multimedia. A computer network that allows the interaction among the computers and their users is also very important. Through the network the students can not only download the course materials from the instructor but also share their ideas and the actual works among them. In addition, access to and the use of the Internet for every computer is critical. The Internet/World Wide Web provides invaluable course materials from visual resources to multimedia data. The lessons of the computer graphics classes should utilize the Internet as an integral source of course materials.

Finally, the computer lab must have enough space for a class conference. When the students are sitting at their computer desks, they cannot easily see each other in most settings. A space for a large circle for roundtable meetings is necessary to have face-to-face discussions and critiques. Moreover, this space can be used for the small group conferences for the students when they need to work as a group. They can meet and discuss the issues without leaving the computer lab. The computer lab should be the place where the students can interact with and learn from each other. Once the demonstration is done the students can work alone or collaboratively, freely walk around and interact with each other and the instructor. The design must focus on students' experiences and learning. In particular, the computer lab should provide an environment where the students can develop self-guiding work habits, and where cooperation among the students is encouraged.
Resources: The Needs for the Program

Facility, Equipment and Maintenance

Creating and developing a computer graphics program requires a serious initial investment for the academic institutions in order to provide an appropriate facility, which constantly necessitates even more investment to stay functional. As mentioned in Chapter 5, the amount of the annual equipment budget in the case study was $12,000 for the Department of Art and Visual Communication for the 1996-1997 academic year. The total amount for purchasing the computers and peripherals for the animation lab in 1998 was $142,558.75. This is more than eleven times the annual equipment budget of the Department. Furthermore, that amount was only for the computers and peripherals. The University of Saint Francis is a small, private, and not research-oriented institution. Its external funding has been limited. Developing the computer graphics program required a serious financial commitment from the school since it took a significant amount of money to start and maintain. In addition to the tasks of finding the space and power supply, schools need to find financial resources for the actual computers and peripherals. They are big budget items because current graphics software packages require high quality settings in system configuration for the hardware. Workstations for graphics generally require more expensive settings than those for general-purpose. Faster Central Processing Units (CPU), larger storage space (hard disk), large Random Access Memory (RAM), multimedia capabilities such as a sound card, and higher than entry-level graphics cards are required. Other recommended peripherals include computer monitors larger than 17 inches, pressure sensitive tablets, large-format color printers, slide projectors, and other equipment necessary for the animation course.
scanners, film recorders, etc. Depending on the size of the class, the lab will usually need a large number of units. While the price of well-equipped computers has recently lowered significantly, the establishment and maintenance of a computer lab still necessitates a large commitment of a school's resources.

Unlike other art studios, the maintenance of the computer lab may exceed the initial cost for setup within a very short period of time. As computer technology advances, the life cycle of the computer shortens. Every two or three years the computer lab may need new sets of computers in order to keep up with the current technology. This is a daunting reality that the administration often overlooks. The cost for the initial settings usually overwhelms the administration even though most administrators nowadays well understand the necessity of the use of computers in academics. Gradually the top administrators have also realized the mandatory cost for maintenance and operation of labs. One of the problems for operating the Animation computer lab in the case study occurred in 1999 when the annual maintenance fees were due for the Alias/Wavefront animation software package. The amount for the package was $5,000 for 5 to 10 licenses. In the proposal for setting up the Animation computer lab, the necessary annual operating cost was clearly stated. However, no one in the administration understood that they were in effect renting, rather than owning, the software. As the due date neared and the anguish of the computer graphics faculty heightened, the administration finally agreed to pay the bill. The same thing happened for the annual maintenance fees for the Silicon Graphics (SGI) O2 workstations. There were $860 annual maintenance fees for each O2 workstation, a total of $7,740 for nine
O2s, which provided the upgrade of the operating system (OS) and technical support. Again the administration failed to recognize the cost. If there was not sufficient money available from the regular budget, the Department of Art and Visual Communication usually tried to seek a series of one-time supplemental budgets for justifiable causes. Because the computer labs need constant upgrades and maintenance, a supplemental one-time budget cannot provide a permanent solution. Only the recognition and establishment of funds for proper maintenance and operation can provide a secure future for the function of the computer lab.

Another concern for the computer lab is the flexible lab hours for the students. Computer graphics courses are in general studio courses that require long hours from the students outside of the official class period. Contrary to the common belief, computer technology does not necessarily cut the time for the art-making process. Computer graphics technology can provide overall savings for the production time and cost by providing abilities of reproduction, correction, addition or any other manipulation of the original works. However, the same ability of manipulating images with ease provides more choices to the users to explore. The users, who do not need to worry about losing the original images, can experiment with the images to endless visual possibilities. This initial art-making process in computer graphics is likely much more time consuming than ever before. Therefore, it is essential to provide open lab hours as much as the students need. In some colleges and universities, the labs are open 24 hours a day. That requires more resources, including power, lab monitors, securities, and technical assistants. Many
schools may not be able to afford to open the labs 24 hours a day for various reasons. However, the schools must do their best to provide enough computer lab hours for the students.

**Faculty**

When it comes to implementing computer graphics technology, recruiting appropriate faculty is the key to the success of the program. Faculty are generally required to teach the courses, advise the students, develop the curriculum, and administrate the program. Faculty are also expected to demonstrate an active engagement with the fields of study, as their creative and scholarly work is an extension of the classroom, laboratory, or studio. In the field of computer graphics, finding and recruiting qualified faculty becomes harder than ever. One of the difficulties is directly related to the advances and diversity in the field of study. As the applied areas of computer graphics technology are rapidly expanding, the field of study in computer graphics is getting diversified, specialized, and fragmented. In the case of 3D computer animation in the production company, for example, the focus can go to modeling, animating, and rendering. What used to be one animator’s job is now divided into several specialized areas. Technical directors (TDs) in production companies may work on even more specialized areas of the rendering. There are several areas of specialty including shaders and lighting, particles and dynamics, and Pixar’s Renderman programming. For the students who want to join the 3D animation industry, it is essential
to find an academic institution that can provide specialized classes in order to be more marketable. Therefore, it is necessary for the colleges and universities to find an equally diversified group of faculty who can address such diverse computer graphics courses.

However, it will not be easy for academic institutions to find talent fluent enough to teach specialized courses, as schools are competing with production companies that pay more and are more glamorous. It will be very hard to find individuals who can develop and teach all specialized classes in 3D animation including character animation, advanced rendering, and special effects. It will be extremely difficult to find someone who can teach courses for 3D animation, interactive multimedia, and virtual reality. Yet, that is what many academic institutions are expecting from their faculty. Sometimes the problems stem from a lack of knowledge in the administration. Administrators often do not realize how fast and wide the developments are in the field. Compared to most academic disciplines, the field of computer graphics has experienced unprecedented speed of advancement both in breadth and depth. The number of faculty required depends on the number of specialized courses and the size of the student body in the program. Unfortunately, some administrators assume that potential faculty will provide classes for all applied areas just because the faculty in computer graphics has used computers as an art medium. This is the time for administrators to analyze and understand the field and decide where their colleges and universities want to be. They also need to find out if the schools are committed enough to achieve the goal. Without knowing the direction and goals of the program, finding qualified faculty can make things more complicated and dissatisfactory.
There has been a shortage of qualified educators who can lead and organize computer graphics education (Ollila & Carling, 2000). Finding qualified faculty is getting harder in the diversified field of computer graphics as there are plenty of opportunities other than academia that have lured potential faculty to more lucrative industries. Schools often find that only a handful of applicants is qualified for a vacant faculty position. There are limits for academic institutions of giving incentives, promotions, and salaries that are hardly competitive with those of industry when it comes to recruiting true talent unless the person understands and is dedicated to education. For some small colleges and universities, the situation is much more difficult. In some, there is no dedicated computer graphics faculty in the art department despite the desire of the department to hire talent. In such schools, art faculties whose specialties are other than computer graphics, or adjunct faculty cover the foundation courses. It is not uncommon that only one full time computer graphics faculty serves an entire department. When a computer graphics program is developed in those schools, the lone faculty member takes full responsibility of directing a one-person program.

Furthermore, the existing faculty members have faced a lot of challenges of their own (Rubin et al. 1995). In addition to working on everyday tasks and teaching a list of diverse computer graphics courses, faculty in this changing field face enormous challenges of continually researching the field and reeducating themselves for the newest technology. Eber (2000) notes, “computer hardware and software technologies become obsolete so fast that those who work with the medium must constantly re-train themselves, often many times per year” (p.920). The contents and technologies in most
computer graphics courses are quickly outdated. The major graphics software packages
are usually upgraded every six months. New technologies continuously come and some
of them are gone without even being noticed in the field of computer graphics.
Accordingly, academic institutions initiate new courses and adjust the existing ones.
These processes are necessary for the future of the institutions. On the other hand,
changes are minimum in many traditional studio art courses. The course contents remain
the same and materials are reusable. Computer graphics faculty in the visual arts are
usually assumed to be practitioners in the field. Their roles in the institutions are mainly
limited to teaching. Research is not necessarily part of the job description. The faculty
are assumed to have the responsibilities of researching the field and reeducating
themselves as any other faculty in the art department are doing. The problem is that the
level of constant development and expansion is too big and fast in the field of computer
graphics. Just to stay current the faculty member must make significant efforts.
Acquiring new knowledge and skill in computer graphics necessitates a great deal of time
and energy, and many times money. However, with shrinking budgets and increasing
workloads in academics, the faculty in the field of computer graphics are under great
pressure to keep up with the explosive growth in computer graphics technology.

In addition, there has been a lack of proper staffing for taking care of computer
facilities. When the computer graphics faculty is hired in small colleges and universities,
he/she many times inherits the additional workload of maintaining the department’s
computer labs. While the newly acquired computers and peripherals in the computer labs
are highly visible, the needs for operating them properly are usually forgotten.
Unfortunately, they often end up on the job lists of new computer graphics faculty. Instead of hiring a system administrator or technical assistant, the administrators of the institutions and the departments simply add the responsibility to new faculty. The daunting task of maintaining computer labs can be enough of a workload to require additional staff. However, most often no reduction in teaching is considered for the faculty to take care of the computer labs. In addition, being in a small college often requires the member of the faculty to be as versatile as one can be, doing everything and anything that needs to be done. In the field of computer graphics, the uses and functions of computers have widened and deepened so that no one person can possibly know everything. Yet, the faculty are forced to face those tasks everyday.

The Effects of Culture and Decision-Making for the Developments

While developing the new computer art major, the faculty of computer graphics worried about the uncertainty of getting financial support in time. The senior faculty members in the Department, however, assured him that the support would be there. They understood the system and culture of the organization well that they were sure that the administration would support the development of a computer graphics program even if such development might require tightening up the belt in some other areas of the campus. There is no doubt that the culture of the organization influences the role of decision-making among its members. However, defining the culture and understanding its influence on each member of the organization is not easy. Often the culture is deeply embedded into the values of the organization, which are mostly unspoken and
unperceivable. They are simply taken for granted. At the same time, the values of the organization outline the expected role of the member. This, together with the idea that each member of the organization, whether the administrator or the faculty, has his/her own value, philosophy, and interpretation about the organizational culture, makes the decision-making process more dynamic and complex, thus, making understanding even harder.

In 2000, the computer graphics program at the University of Saint Francis flourished, attracting students and growing very quickly. It is a common belief that the academic institution will thrive if it has promising programs or services that no other place can offer. Indeed, no other schools in the close area offered the similar curriculum and services. In 1984, on the other hand, the new computer graphics program at the University did not enjoy the same success. Why did the program not thrive back then even though it was the unique academic program that no other schools in the region offered? Was the program too early and too much ahead of anyone, including the industry? If so, why did similar computer graphics programs in some other academic institutions in the nation develop to be leaders in the field? A lone faculty member could not keep up with the developments in the field of computer graphics without the cooperation of other faculty members of the Department. It was apparent that the lack of support caused the program no significant development. The lack of support in the late 1980's might be in part the result of the ideological differences and the lack of communication among the faculty members in the Department. The commercial art faculty member failed to get consent from the other faculty members of the Department.
While the department chairperson offered some support, the fine art faculty member was not interested in the development of the program at that time. For the computer graphics program, the fine art and commercial faculty had philosophical differences on the use of computers in visual arts. The fine art faculty expressed strong skepticism about the functions and questioned the legitimacy of computers as an art medium. This attitude and bias of the fine art faculty toward the use of the computers was not surprising and was widely shared with the fine art community at that time.

The lack of communication between the faculty members of fine and commercial art could stem from differences in personality. While the commercial art faculty member was passionate and innovative, the fine art faculty member was organized and reflective. The commercial art faculty member was known for his artistic talent especially in sculpture and busy with out of campus activities and commissioned works. He was energetic and spontaneous about various things at the same time. The fine art faculty member, on the other hand, was devoted to the Department and the University. Along with the department chairperson, he organized activities and meetings for the Department for routine matters such as student recruitment, preparation of school brochures, and fundraising events. He established himself as the mastermind for the future of the Department. The fine art faculty member was younger in age but senior at the Department. In most cases, two faculty members were indifferent to each other's areas. Unfortunately, the fine art faculty member not only paid no attention to the development of the computer graphics program but also showed no support for it.
Not everyone's voice is equal in the real world and to real people. The fine art faculty member was a political figure both in the Department and the University. He was part of the decision-making body in the Department along with the Department chairperson, and a trusted advisor to the administrators of the University. Even though the fine art faculty member had personal biases against the value of commercial arts in general, he was not a person who could not work with others. In fact, the fine art faculty member was a persuasive negotiator and was for the most part very reasonable. He was very much interested in being the next chairperson of the Department. Among the faculty in the Department, his future chairpersonship was almost taken for granted. The administrators of the University supported this direction. As a matter of fact, he became the next chairperson later by the request of the administration. By the same token, the development of the computer graphics program since 1995 stemmed from the realization of that fine art faculty member about the importance of integrating computer graphics technology for the future of the Department. He became the number one advocate of the program. His enthusiasm, organized efforts, and power of influence pulled the cooperation of the administration and other faculty in the Department, and developed the computer graphics program into a new major in the visual arts.

There is another question about the role of the administration to pursue the development of a computer graphics program. No matter how great or urgent the needs are, not all requests for the development in academic programs are granted. Even with the powerful influence of the faculty in favor of the development, the plan would have not worked if the administrators had not been convinced that the development would
contribute to the well-being of the whole institution. In recent times, the culture of the academic institution has been changed to that of a corporation. Most schools remain as non-profit organizations but more and more schools are using (or are forced to use) business techniques and vocabulary. The language used on the academic institutions' internal documents resembles those in many profit-oriented companies. For example, the schools discuss marketing tactics and strategies. The institution (college) provides the quality products and services (academic programs) for its clients (students) at appropriate prices (tuitions and fees). Each unit (academic department) needs to have quality control intact (assessment), and is required to develop its own business plan, which includes defining the target market and analyzing the market share. The institutions also discuss the possibilities of downsizing in its management (closing the academic departments or eliminating the positions of faculty and staff) for operational efficiencies and may need to look for options of outsourcing. The president of an academic institution has become a chief executive officer (CEO) more than a chief educational officer.

In the University of Saint Francis, this corporate culture had a strong impact as the administrators looked for a more viable future of the institution based on a sound financial system. Better financial condition was an essential part of the administration, especially when the institution had to deal with some financial difficulties. As a small private university, the most income came from tuition and fees of the students. The size of the endowment was small and little support came from the state or federal government. Therefore, the administration considered the increase in student enrollment as the top priority of the University. For the development of the computer graphics program, much
of the underlying concern was the economy of the program. In addition to the officially described objectives and goals of providing a quality professionally oriented academic program, the development focused on the goal of balancing between the investment and the performance. The investment was the required resources such as faculty, facility, equipment, power, space, etc. The performance would be judged by the number of students enrolled in the program. The administrators in both the Department and the University were anxious about the performance of the program. Even though the administrators in the Department had high hopes and confidence, they were also anxious whenever there were some unexpected challenges or spending sprees. They believe the program would be very attractive to students and would find no problem recruiting and retaining the students. Then, in the middle of a cost-benefit analysis, however, they could not understand the short-term cost of hiring technical supporting staff for the two computer labs in the longer-term context. The administration would claim that the position would be too much of an investment for the program. Even though they had the option to share the system administrator’s working time with other computer labs of the University, the administrators refused the investment. While this cost savings might work economically better in a short period of time, the University eventually lost the initial investment, the faculty. The faculty in academic institutions are often asked to share the responsibility for promoting the well-being of the institutions especially when the decision may undermine the individual faculty and academic programs. When it comes to sharing the pain, the faculty are asked or encouraged to cooperate with the
decision of the institution (administration). However, when it comes to authority and
decision-making, the opportunity of the general faculty to participate in the governance
of the institution is generally very slim.

Decision-making in an organization is a living and dynamic process that reflects
the various aspects of the organization as a social entity, including the economy, values,
and culture. The organization consists of individual members with various contributing
factors. The decision-making in academic institutions is not free from its bounded
underlying rationale and culture, despite wishful beliefs of the ivory tower. There are
always preferences among the members of the organization. Those preferences may not
always be given for the broader well-being of the organization by high philosophical
missions and goals but may be from personal interests, convenience, interpretation, and
aversion to risk.

The Future of the Program

The development of the computer graphics program at the Department of Art and
Visual Communication in the University of Saint Francis has been no less than
remarkable. Among the colleges and universities in Northeast Indiana, the University is
neither big in size nor the one of the wealthiest in resources. When the Art Department
initiated the development of a new computer graphics program in 1995, nobody in the
region seemed to notice it. However, when the Department officially began to offer the
degree program of Bachelor of Art in Computer Arts in 1998, it quickly became a
celebrated academic program in the greater Fort Wayne area and the surrounding region.
Within three years student enrollment jumped from zero to sixty-five, attracting students from the region further than the Department's traditional student base. This successful integration of computer graphics technology for a visual art program in a small academic institution has been a result of the total dedication of a group of people who have been involved with the development. Despite many obstacles including the lack of funds, time, and resources, they have tried all the possible options to achieve the goal. Most of all, they believed that the program would be realized. Of course, the belief and a well-defined goal alone cannot bring results. There have been many other things involved with the developments including opportunistic timing and a supportive environment.

Now is the time to look ahead. While starting a new program is difficult, keeping pace with the current developments and innovations in the field of computer graphics is even harder. The field of computer graphics is continually changing. The conceptual and technological innovations in the field are suggesting new aesthetic possibilities. Programs in computer graphics for the visual arts should be open to new developments. It is a challenge that the program must face as the advances of the field constantly demand adjustments in content and direction. New classes should be developed and existing ones need to adopt new developments in the field accordingly.

In any given educational program, the mission is to provide its students the best learning environment possible. Finding how the program functions for that mission and how the students in the program are doing is a critical part of the program especially when it is a new program. The Computer Arts major is the newest program in the case study's Department of Art and Visual Communication. As it is still in the
implementation period, the total assessment of the computer graphics program may not be possible to see the whole picture. For example, assessing the specific program's performance in the Department may be determined based on the graduation rate, and the success rate in job placements of the students after graduation. Additional information may come from ongoing contacts and involvement of alumni, regarding their success in business. However, from the current practices and accumulated data from day one, a progress report may portray the direction, achievements, strengths and weaknesses of the program. Each academic program needs to establish clear goals and objectives, which will be the base for assessing the program and student achievement. It is also important to establish systematic mechanisms within the Department for collecting internal assessment data of the academic program and student academic achievement. The Department has utilized several instruments for collecting internal data, both qualitative and quantitative. They include the academic report (grades in the classes), portfolio reviews, senior exit exam, and participation of extra curricular activities. With a complete set of data collecting methods and analysis, the computer graphics program in the University of Saint Francis can be assessed. The assessment will redirect the goals and objectives of the program and identify the activities and means for the future.

Conclusion

Issues and Process

The field of computer graphics is one of the thriving areas in our society. More and more students show interest in the field as they can find the uses and applications of
computer graphics in their everyday lives. For academic institutions in higher education, it is a responsibility to address the needs of the students. It is also an opportunity for the institutions to grow. Developing a new academic program, however, requires painstaking efforts. In this research, I address how one small liberal arts college has adopted computer graphics technology for its visual art program. The research attempts to reflect on the series of practical and theoretical concerns about preparation and implementation of computer graphics technology in the visual art program. This research also endeavors to portray the institution in a holistic view, trying to uncover the contextual, economic, political, and cultural factors that shape the outline of the computer graphics education.

The first part of the research relates to the issues for implementing computer graphics technology for the visual art program in a small college. Such practical and theoretical issues include the balance between the artistic creativity and learning the computer graphics technology, curriculum design, pedagogy, necessary resources, and promoting the program. Not every school does or can develop a program to the level of a specialized academic department. The level of development depends on each institution's situation. Depending on the goals and available resources of the institutions, the possibilities lie from a few foundation classes to specialized degrees. Some of the findings in this study can be applied to any school no matter what shape or size it is. For example, schools should fully understand the potential of computers in art and art education in order to prepare academic programs. The role of computers in visual art
needs to be scrutinized in a broader context rather than the potentially limited vision of
technical and technological aspects. Also, programs and financial support must be
flexible enough to adopt the ever-changing technology.

On the other hand, some findings are more directly related with small colleges
and universities like the University of Saint Francis. As many small colleges and
universities are either willing or forced to develop computer graphics programs of their
own, they face even more challenges than the specialized art schools and large
universities. For the development, smaller schools may need to limit practical and
achievable goals for the program. Perhaps the most distinctive characteristic of computer
graphics in the visual arts is the use of technology that is continuously evolving. As
computer technology is advancing, the field of computer graphics is constantly
experimenting with new ways of using computers for art and design. Much of the
difficulties in developing computer graphics education lie on these ever-evolving
technologies. The speed of the development in the field of computer technology is
overwhelming. The applications for computer graphics technology are so wide and
specialized that it is not possible to mention them all. New technologies necessitate
changes in education, including continuous investments for the program. The advances
in technology also bring challenges to the schools to find qualified faculty and support
their continuous reeducation in order to reflect the changes. Facilities and equipment are
required to be upgraded every so often. While more and more small academic
institutions are eager to expand their computer graphics programs, they face stiffer
challenges from limited financial resources to the lack of qualified faculty to inadequate

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facilities. In order to overcome such obstacles and provide a meaningful education for their students, small colleges and universities are required to be more resourceful and inventive than larger universities.

Another challenge for computer graphics education in small colleges and universities is also based on the technology. As new technology is continuously being developed and the new aesthetic possibilities of the computer in art have inspired the art community, the programs can easily branch out into other areas of music, dance, architecture, telecommunication, and performing arts. In addition, other disciplines including science and engineering utilize computer graphics technology for visualization. The applications of computer graphics technology have been so deepened and widened that no standard set of curricula can address all concerns in this vast field of study. While large universities and specialized art schools may be able to develop a variety of specialized areas, no one school can completely cover the ever-changing field of computer graphics (Jansen & Van Nieuwenhuizen. 1995). Consequently, small colleges and universities have faced even more difficulties to reflect the current interdisciplinary approaches in the field to their curriculum. It is up to available resources of each academic institution to decide the direction and outline of the program.

The second part of the research addresses the process of the developments in various contexts. At the outset, the institution must search for the well-being of the institution in addition to the goal of providing a quality education. The educational developments are required to be economically justifiable for the continued existence of the institution. Academic institutions of higher education usually find it difficult to
rationalize establishing a new program merely because the current job market looks promising. Most often the schools require a waiting period until there are enough precedents. Only after analyzing the history and trend of the field carefully, do the schools decide the next move. The development in computer graphics requires a significant amount of resources. Unlike many other traditional studio art courses, the amount of available resources is critical for the development of the computer graphics program in the visual arts. The each of available resources can hinder much of the program quality. The considerable size of resources required for one program puts some constraints on the administration. While many schools are non-profit organizations, sound economic management has become a mandatory agenda with which the administration must contend. It is a hard fact that the institution must search for the well being of the institution in addition to the goal of providing a quality education. Even though the rationale for developing a new program is acceptable to the campus community, the excessive use of limited resources can create some resistance.

An academic institution is a social organization, which is bound by its own rationale and values. The decision-making in it is a qualitative process that also involves the social and cultural aspects of the institution. The dynamic organizational culture and decision-making are forces in command of the development. No matter how great the needs are or how good the quantitative figures sound, the actual interpretation is up to each member of the institution. And the members as real people have their own value systems bound by the rationale, personality, ideology, bias, preferences, etc. Often the personal value system unintentionally or intentionally leads the members to logical
fallacies. The same market analysis of the computer graphics field, for example, can be used for or against the development of a specialized program. One may pay attention to the continuous growth of the field, while another can argue about the recent slowing of the growth rate. Other members can simply ignore the analysis. There could even be the danger of false analogy from the beginning in order to pull a more favorable decision. While the numbers and figures are essential for development, different members can interpret the same numbers differently based on personal preference. Double standards, hidden agendas, prejudice, and ignorance can also play a role. Moreover, not all opinions are of equal significance. In social entities, the hierarchy in decision-making imposes an unspoken rule of behavior of the member. Those who do not follow this assumed code of behavior will face the consequences. Without the blessing of the decision-making body, the effort of developing a program may be impossible.

Suggestions for Future Studies
This research mainly focuses on the issues and process of the development of a computer graphics program at the University of Saint Francis. While it is my hope that this detailed description and analysis can provide educators and researchers in the field with useful information about implementing computer graphics technology for the visual art program, further research must be carried out to provide a more complete picture. For example, assessment of the program was not available because the development was fairly new. There has not been enough time to evaluate the performance of the program.
including the job success rate of the graduating students and alumni. Future research can also focus on what to teach and how to teach for computer graphics as the computer technology keeps on advancing.

In addition, I hope that administrators and researchers in the field can notice the process in various contexts. This research provides an opportunity to observe the dynamics of policy-making and decision-making in an educational institution as a social unit. Even though these issues are subtle and almost invisible to outsiders to the institutions, they often are the most important factors. Through this analysis of the cultural and social aspects of an educational institution the research attempts to illustrate a more complete picture of what is involved in computer graphics education for the visual arts. Thus, this study fosters awareness of the complexity of education in general, which suggests a sensitive and insightful approach.

Furthermore, this research can be a framework for the future development and evaluation of computer graphics education in various academic settings, especially for small colleges and universities. While each academic setting has its own unique challenges and goals, through this research, educators may have a chance to look at and compare programs from different perspectives. This study encourages educators and researchers in the field of art to take a close look at the small colleges and universities that are often ignored in the horizon of academic research and literature of computer graphics education. Perhaps this research can be more beneficial to the educators and administrators in small colleges and universities as it can provide practical references. The study can help in particular for those who are interested in the development of the
computer graphics program in the small academic institutions. The study provides
detailed information for the achievements and mistakes of one institution, thus offering a
ground to compare.

Literature on computer graphics in higher education is becoming extensive
(Owen, Sunderraman & Zhang, 2000). A variety of topics are covered, ranging from new
developments in technology to interdisciplinary education to future directions of
computer graphics education. Despite the large volume of literature and references
currently available in the field of computer graphics, educators in small colleges and
universities still have a hard time finding literature that specifically deals with the issues
of developing computer graphics education from the perspective of small colleges and
universities. Literature in art and art education generally introduce cutting edge
technologies, innovations, practices, and success stories in rather large academic or
There is an apparent lack of literature and references that cover the issues of
implementation, the practice, and development of computer graphics program in small
colleges and universities. Much of the literature is from research that portrays trends of
computer graphics education in general (Faison 1996) or those educational institutions
that already have well-developed programs. Because the field is very new, researchers
and practitioners are still busy understanding the influences and importance of computer
graphics technology in the visual arts along with its impact on our society.

Most small colleges and universities are teaching oriented. The faculties in
teaching oriented schools are typically teachers and practitioners rather than investigators
or researchers. Even though the faculties in such environments regularly research their field of study, the research usually focuses on practical purposes of improving the existing programs. Seldom is the research done for publication or presentation. As computer graphics technology has become a vital component for visual art programs in higher education across the country, the issues involved with implementing the technology are no longer just for larger universities and specialized art schools. There is an urgent need for more research and publication about computer graphics education in small colleges and universities. This research topic reflects direct interest in the development of a computer graphics program at USF from a small college's perspective. Part of the motivation comes from the desire to share my own experience of developing a computer graphics program in a small college, a topic rarely in print in the field of computer graphics education. From curriculum design to corporate culture and its influence on decision-making, educators and researchers should investigate the various issues of computer graphics education especially from the perspectives of small academic institutions.
Fort Wayne, Indiana, July 21, 1998

Even though this faculty titled as the director of the commercial art program, he had fine art background (sculpture). In addition to the commercial art curriculum, he taught various fine art classes. He was especially in charge of 3D programs such as sculpture and ceramics.

Q: Please explain how the computer graphics program began in Saint Francis College. What happened when you started?

A: I started a course of computer graphics in 1984, which was basically a digital painting class. During the early 80s, I saw the computer graphics was happening as a painting on the computer but soon I saw the possibilities or the functions of typography, text typing and layout and so on. As a director of commercial arts program, I investigated the possible use of computers in commercial arts. I thought the commercial art program would die without it.

I wrote a grant proposal to Cable Access, a local cable television company about starting computer graphics classes. In the proposal I mentioned that the computers could be used for creating broadcasting materials. They did not care about the computers. They wanted to use the grant for audio/video production program in order to develop some television program they could air on the public network. They gave me the grant total of $45,000. It was not for computer graphics program. So, I bought one Sony U-matic recorder deck, three CCD cameras, an A/B Video editing system, and one computer with two monitors for the television studio.

It was IBM AT (286) computer with Targa board and a computer monitor and a video monitor. The software was TIPS. I also bought one computer for my own at home to learn and study the program. I got the money from my friend who was also a patron.
for the Art Department. He donated the money for the computer. You know, the computer was expensive at that time. I bought one for me because I didn’t know anything about the computer. I knew what the computers could do but I had no experiences of computers before. I learned how to use it at home. I just used the program.

Q: Were there any formal studies about the new program?

A: I was very much interested in the computers. During the early 80’s I saw it is coming. So, I wanted to know better. I applied Lilly personal grant (fellowship) to understand the use of computers in art-making process. My proposal was accepted. They gave me $36,000 to study the use of computers and its psychological effects on the artists. I had sabbatical coming in 1983. I took a year off to study new things. I got the half of my salary from the College so I traveled to many places to see how the computers were being used. I visited Harvard University, Century 21 Studio in Florida, and Europe.

Q: What did you find it?

A: I was particularly interested in how the computer changed the way artists think and work. Do the computers have any affect on the artists when they are using it? I think it did tremendous effects on the way the artists work. You know, when you paint with traditional art mediums such as oil paint or watercolor, you lose your original concepts and ideas if you repaint it. You can change it anytime when you are working but you cannot have your original work back. Then, you lose your original thought forever. But for the computer, you can save different versions as you go along. Your canvas is never lost. This can help the artists to have different sets of mind when they work with computers instead of traditional art mediums. You don’t have to worry about losing your ideas in the original work. With a computer, whatever comes it never go away. The concept never dies.

After the research I wrote a report to Lilly Foundation about what kind of psychological effects the uses of computer had on the artists. Unfortunately, I did not publish the report. I researched but I did not publish because it was like my own personal research. I did not care about publishing or being famous. I had requests from many people nationally and internationally to publish the paper with Lilly. But, I did not want to do that. You know, you do your own research for the area you are around.

Q: What kind of reaction did you get when you started the computer graphics course?

A: The (Art) Department was all against it. When I showed the computer and the image creation to the college at the demonstration, (the fine art faculty) said everyone that it was not art. He claimed that computer did everything. I explained him that the
computer was only a machine and did not do anything. It was the artists who used
the computer. He did not listen. He said all the students needed to be in fine arts
program. He told (Art) students not to take the class.
The Department chairperson was very afraid to make any commitment for the
computer graphics program because he was afraid of the fine art faculty. He (the
chairperson) knew that the fine art faculty would go to anyone in administration or
the president if the fine art faculty felt like it.

Q: How about the administration?

A: I first reported about what I found with the Lilly grant to (then) the president. But the
president said, “We do not appreciate any research that we do not support.” The
president had a problem with the computer. She thought the computer was only a
temporary trend and did not want to do anything with it. At the several meetings she
said, “I do not want to deal with it. When this computer thing comes to end?”
I wanted to do something good with the computers on the campus. But, I did not
know much about the computer. I think the College sort of took advantage of my
lack of knowledge and did not take my suggestion seriously. They (the College) kind
of did fool around me. When you are a pioneer at the academics, you need to make
the academics go around.

Q: How about the reactions from the industry?

A: We were ahead of anyone in town, maybe too much ahead. The companies and
agencies laughed at us. They said the computers could not do anything. They said
they never going to use the computers for their business.

Q: How did you start the class without any support?

A: I already got the grant from the Cable Access (to start the program) so they did not say
anything about it. As long as the College did not pay anything it was OK. They did
not care.

Q: What was the name of the course and why?

A: Computer graphics. That was what everybody used to call at that time.

Q: Would you describe the first class?

A: The computer was in the room that was used to be a weaving room. There were 10
students in that first class. They couldn’t take their eyes off. They couldn’t stay
away from it. We had only one computer so the students had to take turns to use the
computer. It was a three-credit hour class mostly for Fine/Commercial art majors as an elective.
The class was offered once a year. In the class we used the computer as a painting tool. The class was labeled as a studio art course.

Q: That was one computer for 10 students. How did you develop the program in later time?

A: It was always a struggle. For the first three years, the grant from Cable Access provided for the addition and upgrades of the computers. I wrote the second grant proposal to Cable Access, asking for computers. They allowed the grant a couple of times. I think I got $8,000 in 1985 and $10,000 in 1996. We had two computers in 1985 and another two in 1986. Every year they were upgraded. Later, the College paid the upgrade and purchased three more computers to eight computers total. I wanted to have one computer for one student. But the College said one computer for three students.

Q: What do you mean “the College”?

A: The president and the head of the Business Department.

Q: Since 1984, what else did you try for the program?

A: I always wanted to develop the program more. I wanted to do something. But, I did not have any time. There was no time for me to learn all the (available computer graphics) programs. I was teaching full time. I kept on asking the school to give me some time off so that I could research the field and learn the program. I asked them give me a sabbatical so that I can come up with a new program. They never allowed me to do that. I asked all different kinds of things for the computer graphics. They did not listen. They were all skeptical about the computer graphics.

Q: What other developments were there in terms of classes?

A: As I saw the development in the field, desktop publishing was the next one we needed for the commercial art program. I thought that the commercial art program would not survive without the computer.

In case of typographical use of computer, the fonts on the computer were not compatible with ones for printing at the time. Our printer was dot matrix so the resolution and printing quality was not compatible with commercial printers. You know, computer type was not same on the printed materials. That class was an elective. When we got a new laser printer and the quality of printing was good enough, the class became a requirement.
Q: What kind of technical support did you get for the maintenance of the computer?

A: I did not get any support. There was no one who knew anything about the computer in the campus. I was not a computer guy. If something was broken I had to find someone to come and fix it or send it to fix it. I told the school, “Look, I am not a technician. I am a user. Give me a program that I can use. Don’t make me fix the computer”. The only technical supports for the computers were some minor upgrades.

Later, the College hired the director of the Academic Computer Center. He was the director but the only person in there anyway. He did not have any official education or training for the computers. He was a former student of the College and taught himself about the using PCs. The College hired him because of the cheap labor.

Q: Do you have any afterthoughts?

A: I regret that I did not learn how to use 3D modeling. I wanted to create 3D models for my sculpture. (He has been one of the most well known sculptors in the region.). When you are ahead of time, it is hard to be.
APPENDIX B

MANUSCRIPT FROM THE PERSONAL INTERVIEW
WITH THE DEPARTMENT CHAIRPERSON

Fort Wayne, Indiana. July 10, 2000

Q: How did the computer graphics program begin at Saint Francis? Who started the program?

A: The commercial art faculty and I did. We were ahead of everybody in the region. We just saw it (computer) was coming and used in the commercial arts. He was in charge of commercial arts program and interested in the computers. During the 1980s, we saw how computers are being introduced and used in graphic design.

Q: Were there any formal studies for developing the new program?

A: The commercial art faculty researched himself on his own. Also, some of the advertising and graphic design agencies in town suggested the use of computers.

Q: Why was the faculty a director of the commercial arts? I thought he had a fine art background especially in sculpture.

A: Although he had degree in fine art, he had a lot of experience in commercial arts. He was a director of advertising agency. He came to the Department as a commercial art faculty.

Q: In the department, was there any consensus among faculty members about the computer graphics program? How did the Department get into the whole process? Was there any opposition?
A: The Department had no problem. The commercial art faculty and I did everything. There was no objection in the Department. The fine art faculty was not interested in the computers. He did not care.

Q: How about the administration? I have heard that the former president did not like the computer.

A: They did not care. I don't think the (former) president had any bias against the computer or the use of it for academics. I think it was just a matter of finance. The computers would cost too much money for the school.

Q: What was the initial reaction from other parts of the campus community?

A: No objection or problems. Again, we were ahead of everyone in the college also. They did not care.

Q: How was the program developed?

A: We started a course of computer graphics in 1984. We had computer graphics class for a while. It was just one class for a year for 4-5 years without any changes. It was electives at the beginning. After 2-3 years, it became a requirement. Then, we add desktop publishing. Both computer graphics and desktop publishing were given with Adobe software on PCs.

Q: How many students enrolled in the class? Who took the class?

A: There were about 12 students per class. They were almost always commercial arts kids. It was a popular class.

Q: What kinds of equipments were there?

A: We created the computer lab just for art-making only. It was located the place where used to be a weaving room. I do not remember what exactly was in the computer lab. I think we had a computer lab with six to eight computers with TIPS. There was one computer connected with a video camera for scanning (digitizing). In 1990's we had regular PCs and Adobe programs. I think it was either 1993 or 1994. You need to talk to the commercial art faculty for the details.

Q: How much did it cost and where did the fund come from?

A: We had a patron of the department who regularly donated the money for the department around $25,000 to $30,000 a year. *His donation was used to set up the
lab plus some of the department's annual equipment money. Other faculty members did not object or mind of using the money for the computer.

*This part of the memory was not correct. It was later time in 1988 when the computer lab was upgraded by the donation and the Department equipment budget.

Q: What else was in the campus?

A: There was one general computer lab for word processing and business program such as database and spreadsheet. The computers were not as good as ones in the art computer lab.

Q: What happened to the program?

A: The commercial art faculty gave up. He was really busy of what he was doing. He taught fulltime. He had a lot of commissioned (sculpture) works. The computer things were getting sophisticated and he did not have time to learn it. He did not get the sabbatical. Later, he did not do anything about the computer. He wasn't doing anything at all. For the desktop publishing, one of the part time faculties taught the class.

Q: What did prompt the new development in computer graphics program?

A: It was a 'supply and demand'. During the late 80s and early 90s, regional advertising and graphic design agencies asked or told the school that they wanted the students who could work with the computers. The alumni in the industry such as (Alan Nauts) and (Audrey Riley) who also served the Art advisory board of the Department strongly recommended the developments in computer graphics. The fine art faculty also researched some publications and other schools about the computer graphics during his sabbatical. The department made a major commitment to computer graphics because all researches in the publications (jobs, agencies, market places, etc.) indicated that the computer graphics would be the future.

Q: What was done for the new development?

A: We asked the College a new faculty in computer graphics. And we asked a new Art computer lab.

Q: What happened?
A: The administration knew that we desperately needed a new faculty and granted our request. The classes were filled up and we could justify the cause. They (the administration) understood that the Art Department had too many students to handle with the existing faculties.

The school also paid $100,000 for a new computer lab that could be used for both art department and general purposes. There were 16 Pentium 75 PCs with 2 flatbed scanners and a laser printer.

Q: Were there any master plan for the development?

A: No, we had no direction or a master plan. We hoped the new faculty could lead us.

Q: Why did the Department consider 3D animation an important part of the future program?

A: We surveyed the high school seniors in regional high schools, who wanted to be in art major. We found a lot of high school seniors were interested in the animation program. The enrollment in other schools looked good, too.
Although I describe this faculty as a person in charge of the fine art, he also taught some commercial art courses especially in later time. In a small college, the faculty was required to be as versatile as possible and teach many different classes.

Q: Who started the computer graphics program and how?

A: The commercial art faculty and the Department chairperson started the program. The faculty had a research during his sabbatical and came up with computer graphics program at the end.

Q: It was 1984. I believe it was one of the earliest on in this area?

A: The commercial art faculty was truly the visionary. He researched the field and knew that the computer was coming. It was too bad that he did not get much support to develop the program. Maybe it was too early. The industry in town did not like the use of computer in their business at that time. They said they did not need any computer person but the ones with traditional art and design skills.

Q: What was your idea of the computers in art?

A: I did not know anything about the computer. I did not care about the program.

Q: You researched about the computer graphics and hand in the report in 1994. What made you do that?
A: I was teaching commercial art classes such as Graphic Design. During the early 90's, the graphic design industry in town moved to computers. They wanted the Department to teach the student more computer classes. Our alumni and directors of the industry recommended that we (the Art Department) needed to change our commercial arts program more computer oriented.
In 1993 I had sabbatical and I had Lilly fellowship to study the decorative art. I visited the museum and galleries. I also visited many colleges and universities in the West Coast. In there I was surprised to find that many good schools had a lot computers in their art programs.

Q: What did you do and what did you find?

A: During the summer 1994 I had the development grant from the College for new directions in the visual arts. I checked and researched the various publications for the current trends and the future in art and jobs. I researched some leading schools in computer graphics also. They had well developed programs of the computer graphics. I just collect the printed materials from them including brochures and catalogues. Their numbers of student enrollment were impressive. I though if we wanted to grow we must have computer graphics program.

Q: How did the Department hire the new faculty specialize in computer graphics?

A: The Department was growing and we had more students than the existing faculties could possibly handle. The administration knew that, too. Originally we thought we needed a person in graphic design. But, with the all new developments in the art and design field, we decided to have a new faculty in computer graphics area.

Q: What happened during the process of the hiring?

A: We had a national search and put the advertising in the Chronicle of Higher Education, College Art Association (CAA), and some local newspapers. Six people were considered. We had three people for the interview. We made a decision based on what the new faculty could bring to the Department. We were excited to find that one applicant had the background in 3D computer animation. Other applicants had similar backgrounds of working with the computers. They all used computer for drawing, painting, image processing, and so on.

Q: Why was 3D animation important?

A: We looked at the enrollments of the schools. And we thought 3D animation attracted high school students really well.
APPENDIX D

MANUSCRIPT FROM THE PERSONAL INTERVIEW WITH A FACULTY
AT THE DEPARTMENT OF ART AND VISUAL COMMUNICATION

Fort Wayne, Indiana. July 17, 2000

The fulltime faculty in this interview also took the computer graphics classes as a student. This faculty provided a unique point of view as a student and a faculty.

Q: Would you describe the Department when you were first with Saint Francis?

A: The department was more fine art oriented when there were only two fulltime faculties. The Department chairperson and the fine art faculty taught all the classes. But more and more students wanted to be in commercial arts because of the better chance for getting a job. They demanded more availability of commercial arts classes. Also, the main competitor in town, IPFW, had the commercial arts program set. So the College hired a new faculty for commercial art as such. The new faculty was the only one teaching commercial arts for a while.

Q: What do you know about the computer graphics program at Saint Francis?

A: Well, I do not know the detail about how it started. I know computer graphics class because I took it in 1991. It was called computer graphics. It was taught by the commercial art faculty.

Q: What other classes were there?


Q: Would you describe the class?
A: Computer graphics class was given at the computer lab. The computer lab was located at the same place as where the current computer lab is. We used TIPS and Aldus Photostyler and Painter software. I don’t know why we used the Photostyler. There were about fifteen to eighteen students in each class. And I think we shared 10 computers. Some sat alone with a computer, some shared the computers. We used computers to create images on the screen. It was digital painting with tablet and stylus. We used it for images without any text. There was no text. It was a requirement for the commercial art students and electives for the others.

Q: What were students’ responses about the classes?

A: Curiosity at first. But the students soon lost the excitements. There were several reasons. The students did not see the benefit of the courses. The works looked flat. It did not look sophisticated. There was no practical use for it. For the final output we had to either take pictures directly from the screen or go to some commercial printing services such as Wolf Color Graphics or AccuColor. We saved the file on the floppy disk and brought to the company. We did not have a color printer until 1995.

The faculty knew a lot about the computers and the program but the computers and equipments in the lab were terrible. The students did not like his ‘layback’ teaching style of the faculty, either. I think his (the faculty) heart was not there. He did not come to class with passion. The students felt abandoned and ‘ripped off.’ Some students were very upset and wanted their (tuition) money back.

Q: How was the class given?

A: Demonstration and practice. He showed us what to do it and we practiced. But, there were no books or manuals available. We were very frustrated with the programs.

Q: Do you know who started the program?

A: The commercial art faculty. He knew things.

Q: The commercial art faculty asked some time off to study the new programs in computer graphics. He did not get it. Do you know why?

A: He asked several times during the department meetings. But, the other faculties rejected his requests. They said everyone did the same thing, learning the new program while doing the regular workload, and asked him why he should be different. You know, he (the commercial art faculty) was an underdog in the department.

Q: What was the response from the outside of the school?
A: The (graphic design and advertising) agencies thought it was not a big deal but electronic 'cut and paste'. They wanted the students who could draw and paint. But, later they wanted more computer literate students.

Q: What prompted the new development in computer graphics program?

A: The agencies recommended the Department develop for more computer graphics courses. We had more students. So, the Department needed a new faculty and we wanted to have computer graphics person. The Department chairperson pushed for more development in the commercial art. In 1993 the fine art faculty had sabbatical and researched about the decorative art. During his research he visited many good universities in the West Coast for their art program. He said he found a lot of computers in those art programs. I think that time he realized the importance of computers for the future of the art department. The fine art faculty researched the computer graphics in other colleges during the summer of 1994. He became very supportive to develop the computer graphics program in the Department. He pushed for the computer graphics. You know, he is a climber. If he liked something he pushed the things really hard to get there. He could make enemies but he did not care. It was a good thing for the Department that he really worked hard. I think he really wanted to be the next Department chair. For the high school students, they had no problem with the computers. Many of them already know how to work with the computers. They were not afraid of the computers. I believe MTV has a huge impact on students’ desire to do something with computer stuff. MTV showed a lot of things done with computers and kids liked those kinds of things.

Q: What was the response from the administration?

A: We had a new president on 1993. I think the change of the president had a good influence for the computer graphics developments. The previous president was not interested in computer at all. She thought the popularity of the computers was only a trend. At the meeting, she said, “Computers are nothing but fad and I don’t want to deal with it. Computers won’t be anything.” But, the new president understood the importance of computers in academics. She was sympathetic to the technology and supportive for computers in the campus. She was very supportive to the developments of the Art Department also.

Q: What happened next?

A: With the industry recommendation and momentum (more students) the Department pushed for the commercial arts development. After several meetings, administrator
and the department agreed that the department would have a new faculty in computer graphics.  
But, we could not agree about the function of the new computer lab. The Department wanted to have an “Art” computer lab for the art department only. The administrators wanted the lab open for the general purposes even though the Art Department would have priority. We had several meetings. The Department Chair really pushed for the Art computer lab. And they argued and argued. The administrators were very rigid about the use of the lab. The president was supportive for the Department but persistent and said that, “You cannot have art lab only.” The negotiation was so intense that the department chairperson stood up and walked away from the meeting room in the middle of it. You know him. He is the most relaxed and easy person. Nothing upsets him. But he was so frustrated and furious about that meeting that he just walked away. I have never seen him doing like that. At the end, nothing was agreed. It was left as kind of gray area. The computer lab was open but it was called art computer lab even though it was open to general purposes. It was ok to use the lab. The lab was adapted as an art lab to the College and used for the art classes. We used the lab most of the time. It was mostly used by our kids (art students) because the other general lab was not equipped to meet the requirements of art classes.

But, the ugly part was the maintenance. The director (of academic computer center) did not want do anything with the Art lab. He said it was our (the Art Department) responsibility. And the school (administration and the business department) charged the cost of the computer lab as the Art Department’s expenses. You know, they said one thing in front of you then, turned around and said another. They insisted the lab was open to the general purposes but they charged the Department and said the Department should take care of it.

Q: Where did the fund come from?
A: The school paid it. Later, it showed up as a part of the Art Department’s expenses. In terms of money, one day there was no money then turn around there it was. You know, the administration can decide whatever they are pleased to do. They said there was no money. But, if they like it they can find money.

Q: What other influences were there, if any?
A: We had NASAD consultation and evaluation for the Department in 1996. The fine art faculty really wanted to get NASAD accreditation for the Department. He worked hard for that. The consultant recommended several things such as safer and healthier environment and more diversity in the faculty. She also praised the department’s efforts in developing computer graphics program. She said the Department was heading right direction. I think her recommendation helped a lot.

Q: Who made the decision for hiring the new faculty in computer graphics?
A: It was the Department. We had several meetings to discuss about the necessary quality that the new faculty should have. We knew we wanted the new faculty in computer graphics but we did not know much about it.

Q: Was there any master plan for the development in computer graphics?

A: No plan. We wanted to let the new faculty guide us through. The fine art faculty did some research. But, we did not know anything about the computer graphics. We were clueless. You know, we were all 40-50 years old faculties who did not know anything about the computer graphics, then.

Q: How many applied for the job?

A: Six people applied. And we interviewed three of them.

Q: How do you see the future of the program?

A: As a result of these current developments we have a lot of students in computer graphics program. Both the commercial art and fine art students use the computer for their works. Using computer in the Department is such a common thing that I don’t know what we can do without it. Kids are using it for all part of art-making from illustration to painting to photography. I think there will be more students in the program.

Q: What future development do you want for computer graphics and photography?

A: We need high-end digital cameras for the photography students. Of course we always need to upgrade the facility. We need more faculties for sure.
APPENDIX E

SURVEY: MIDTERM CLASS EVALUATION

Midterm Class Evaluation

Semester: Year:

Class: Art

This midterm evaluation is designed to improve the class structure and the performance of the instructor. No other purposes it will be used.

Please, feel free to evaluate the class and the instructor. Add any suggestions or constructive thoughts.

Possible topics:
Covering the syllabus.
Knowledge, performance (presentation), enthusiasm of instructor.
Course materials, resources, contents, organization, assignments (Are you challenged?), critiques, and grades, etc.
### Existing courses (* Changes)

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credit Hour</th>
<th>Software</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Graphics Computers</td>
<td>* From 1 to 2</td>
<td>Microsoft Windows</td>
<td>Introduction to Computers</td>
</tr>
<tr>
<td>Computer Graphics</td>
<td>3</td>
<td>TIPS</td>
<td>Raster images, Digital Painting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Add Painter and Photoshop</td>
<td></td>
</tr>
<tr>
<td>Desktop Publishing</td>
<td>3</td>
<td>PageMaker</td>
<td>Desktop Publishing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Add Quark Xpress</td>
<td></td>
</tr>
</tbody>
</table>

### New courses

| Advanced Computer Graphics        | 3           | CorelDraw or Freehand or Illustrator           | Vector images, Drawing    |
| Multimedia                        | 4           | Based on 3D modeling and animation software   | 3D animation and multimedia |

Table 1: The Outline of the Computer Graphics Concentration Proposed by the Commercial Art Faculty in 1995
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credit</th>
<th>Semester</th>
<th>Software</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art 100: Introduction to Computer Operation</td>
<td>1</td>
<td>Fall, Spring</td>
<td>DOS, Windows, Macintosh OS</td>
<td>Introduction to fundamentals of computers</td>
</tr>
<tr>
<td>*Art 210: Computer Graphics in Studio I</td>
<td>3</td>
<td>Fall, Spring</td>
<td>CorelDraw, Corel Photo-Paint, Corel Move</td>
<td>Introductory study of using computers for creating art for 2D graphics and animation</td>
</tr>
<tr>
<td>*Art 212: Graphic Design &amp; Desktop Publishing</td>
<td>3</td>
<td>Fall, Spring</td>
<td>PageMaker, Illustrator, PhotoShop for scanning</td>
<td>Creating presentational materials using 2D graphics and desktop publishing software</td>
</tr>
</tbody>
</table>

**New Courses**

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credit</th>
<th>Semester</th>
<th>Software</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art 310 Digital Image Processing</td>
<td>3</td>
<td>Fall</td>
<td>PhotoShop</td>
<td>Manipulating and enhancing photographic images digitally</td>
</tr>
<tr>
<td>Art 320: Interactive Multimedia Presentation</td>
<td>3</td>
<td>Fall</td>
<td>Macromedia Director Multimedia Studio</td>
<td>Interactive multimedia presentations and installations</td>
</tr>
<tr>
<td>Art 410: Computer Graphics in Studio II</td>
<td>3</td>
<td>Fall, Spring</td>
<td></td>
<td>Project based class for computer art</td>
</tr>
<tr>
<td>Art 411: Fundamentals of Films and Video for creating Animation</td>
<td>3</td>
<td>Fall, Spring</td>
<td></td>
<td>Learning about the fundamentals of films and video for creating traditional animation.</td>
</tr>
<tr>
<td>Art 412: 3D Modeling &amp; Animation I</td>
<td>3</td>
<td>Fall</td>
<td>3D Studio or LightWave 3D</td>
<td>Creating 3D models and animation for experiments</td>
</tr>
<tr>
<td>Art 414: 3D Modeling &amp; Animation II</td>
<td>3</td>
<td>Spring</td>
<td></td>
<td>Project based 3D modeling and animation</td>
</tr>
</tbody>
</table>

Table 2: The Proposed Outline of the Long Term Development Plan for the Computer Graphics Concentration in 1996
1996- Summer 1997 (Done)
- Develop a curriculum for a Computer Art Program
- Sequenced course offerings of computer art major program
- Submit a new initiative proposal for funds for Phase II of the computer arts equipment proposal to the business office ($81,573.75)
- See how many new instructors would be needed to implement the Computer arts major program

Fall 1997
- Approval for formal proposal

Spring 1998
- Seek outside funding for Phase II & III of Computer Arts equipments
- Seek university and outside funding for refurbishing television studio

Summer 1998
- Purchase needed equipment for Phase II: Computer Arts equipment

Fall 1998
- Implementation of Computer Arts major: Offered as a new program with working computer animation lab
- Seek university funding for Phase III of the computer arts equipment proposal ($60,985.00)
- Seek additional outside funds and grants

Spring 1999
- Examine current program requirements and course prerequisites
- Purchase and install new equipment for the television studio

Summer 1999
- Purchase needed equipment for Phase III

Fall 1999
- All changes made in courses and programs

Table 3: The Development Timeline for Computer Arts Major

218
### Table 4: The Curriculum and Course Structure for the Computer Arts Major

#### Art Foundation (30 hours)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Credit Hour</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art 106</td>
<td>3</td>
<td>2D Composition</td>
</tr>
<tr>
<td>Art 107</td>
<td>3</td>
<td>Drawing</td>
</tr>
<tr>
<td>Art 108</td>
<td>3</td>
<td>3D Composition</td>
</tr>
<tr>
<td>Art 143</td>
<td>3</td>
<td>History of American Art</td>
</tr>
<tr>
<td>Art 180</td>
<td>3</td>
<td>Photography</td>
</tr>
<tr>
<td>Art 205</td>
<td>3</td>
<td>Graphic Design</td>
</tr>
<tr>
<td>Art 218</td>
<td>3</td>
<td>Advanced Drawing</td>
</tr>
<tr>
<td>Art 343</td>
<td>3</td>
<td>History of Art 1</td>
</tr>
<tr>
<td>Art 351</td>
<td>3</td>
<td>Sculpture</td>
</tr>
<tr>
<td>Art 443</td>
<td>3</td>
<td>History of Art 2</td>
</tr>
</tbody>
</table>

#### Major courses in communication (*changed courses, *new courses*)

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Credit Hour</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comm 121</td>
<td>3</td>
<td>Techniques of Speech</td>
</tr>
<tr>
<td>Comm 211</td>
<td>3</td>
<td>Introduction to Mass Communication</td>
</tr>
<tr>
<td>^Comm 230</td>
<td>3</td>
<td>Electronic and Digital Media Theory</td>
</tr>
<tr>
<td>^Comm 330</td>
<td>3</td>
<td>Introduction to Audio/Video Production</td>
</tr>
<tr>
<td>^Comm 335</td>
<td>3</td>
<td>Advanced Audio/Video Production</td>
</tr>
<tr>
<td>*Comm 340</td>
<td>3</td>
<td>Introduction to Traditional Animation</td>
</tr>
<tr>
<td>^Comm 450</td>
<td>3</td>
<td>Mass Communication and Multimedia Law</td>
</tr>
</tbody>
</table>

#### Major courses in computer graphics (*changed courses, *new course*)

- Art 100: Introduction to Computer Operation (1) was eliminated in 1999 and replaced by CIS 190: Introduction to Computer (3) for Computer Art degree

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Credit Hour</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Art 491-499</td>
<td>3</td>
<td>Senior Project</td>
</tr>
<tr>
<td>*Art 340</td>
<td>3</td>
<td>Publication &amp; Design in the Internet</td>
</tr>
<tr>
<td>*Art 411</td>
<td>3</td>
<td>Interactive Multimedia Presentation</td>
</tr>
</tbody>
</table>

Multimedia Concentration

- Art 435: Introduction to 3D Computer Animation
- Art 445: Advanced 3D Computer Animation

- New Courses

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Art 411: Interactive Multimedia Presentation (3)
(Fall, every year)
Prerequisite: Art 100, Art 208 and Art 308

Art 435: Introduction to 3D Computer Animation (3)
This course is designed to give students a comprehensive overview of the 3D computer animation production process and hands-on experience of creating 3D models with surface control. The principles and process of creating 3D computer animation will be discussed (story boarding, modeling, camera, lighting, surface control, motion scripting, and rendering). Examples of high-end 3D animation of current professional practices will be presented and discussed to develop the knowledge and skill of students. Students will prepare the story board and create 3D models which will be used for animation in advanced class. (Fall, every year)
Prerequisite: Art 100, Art208, Art308, Intro. to Traditional Animation
Students can take this course with Comm 330: Intro. to Video/Audio Production.

Art 445: Advanced Computer Animation (3)
After successful completion of introductory class, students will have hands-on experience of creating computer animation of their own. Students will explore the advanced techniques of modeling, animation and rendering. Movement of objects, actors and cameras along with animated effects of attributes will be demonstrated and discussed. Students are strongly encouraged to have finished animation projects on videotape. (Spring, every year)
Prerequisite: Introduction to 3D computer animation
Students can take this course with Comm335: Advanced Video/Audio Production.
Students must learn how to manage the whole animation process including postproduction process. (i.e. Digital editing)

Art 340: Publication and Internet/WWW design (3)
This class introduces students what WWW is and how to create a web site. Beginning with a basic review of HTML, students will learn how to make their own home pages. Researches and learning continues on the Internet, looking for applications and styles of various web sites. Students will focus how various producers have configured web sites for unique appearances and develop skills and knowledge for creating their own. (Spring, every year)
Prerequisite: Interactive Multimedia Presentation

Comm 340: Introduction to Traditional Animation
Acquaint students with primary animation techniques and internationally known animators. Study the history of animation. Students experience the process of animation through practice. (Spring, every year)
Prerequisite: Comm 330 and Comm 335
### Changes On Existing Courses

**Art 100: Introduction of Computer Operation** (or new)

**Computer Operation and UNIX Scripting**

This course currently focuses on operation systems of PC and Macintosh. With the introduction of Macintosh for AVID and SGI for 3D animation programs, students must learn about more Macintosh operating system and UNIX. Specific topics include UNIX editors and utilities, networked computing, multiple processes and shell scripts. Either current 1-credit hour course needs to be 3 credit hour course or need to create a new class for UNIX operating system.

**Art 491-9: Senior Projects (multimedia/computer animation)**

Students create their final interactive multimedia projects for graduation. Students will present their work in true professional production forms. Students create their final animation projects in the form of demo reels. Students document and organize their work in presentation forms as a portfolio.

**Comm 230: Electronic and Digital Media Theory**

(from Communication Theories in the Modern World)

Study of the relationships between communication, electronic and digital media and human perception. Students learn to critically examine research in mass communication and the role of the media in society and popular culture. Analysis of idea, form, media and audience.

(Spring, ever year)

**Comm 330: Intro. to Video/Audio production**

(from Radio and Television Production)

Introduction to the equipment and technology in video and audio production. Practical application in both studio and location shooting. All phases of production emphasized.

(Spring, every year)

**Comm 335: Advanced Video/Audio production**

(from Broadcasting/TV producer)

Advanced study of the process of audio/video production in relation to planning of programming, documentaries and broadcasts. Pre-production, production, post-production and evaluation techniques emphasized. Concentration on editing styles and technologies.

(Fall, odd years)

Prerequisite: Comm 330

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Comm 450: Mass media Multimedia Law
(from Media Law)
(Fall, even years)
<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Freshman Year</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art 106</td>
<td>Art 108</td>
<td>Art 206 Desktop Publishing (2 sections)</td>
</tr>
<tr>
<td>2D Composition</td>
<td>3D Comp.</td>
<td>Art 208 Computer Graphics</td>
</tr>
<tr>
<td>Art 107</td>
<td>Art 143</td>
<td>Art 411 Interactive Multimedia Design</td>
</tr>
<tr>
<td>Drawing</td>
<td>History of American Art</td>
<td></td>
</tr>
<tr>
<td>CIS 190</td>
<td>Art 218</td>
<td>Art 435 Introduction to 3D Computer Animation</td>
</tr>
<tr>
<td>Intro. to Computer</td>
<td>Advanced Drawing</td>
<td></td>
</tr>
<tr>
<td>Eng 101</td>
<td>Comm. 121</td>
<td></td>
</tr>
<tr>
<td>English Comp 1</td>
<td>Techniques of Speech</td>
<td></td>
</tr>
<tr>
<td>SFC 101</td>
<td>Eng 102</td>
<td></td>
</tr>
<tr>
<td>Freshman Seminar</td>
<td>English Comp 2</td>
<td></td>
</tr>
<tr>
<td>Art 180</td>
<td>Art 205</td>
<td></td>
</tr>
<tr>
<td>Photography</td>
<td>Graphic Design</td>
<td></td>
</tr>
<tr>
<td>Art 206</td>
<td>Art 208</td>
<td></td>
</tr>
<tr>
<td>Desktop Publishing</td>
<td>Computer Graphics</td>
<td></td>
</tr>
<tr>
<td>Comm 211</td>
<td>Comm 230</td>
<td></td>
</tr>
<tr>
<td>Intro. to Mass Comm.</td>
<td>Elec. And Dig Media Theory</td>
<td></td>
</tr>
<tr>
<td>Comm 330</td>
<td>Comm 335</td>
<td></td>
</tr>
<tr>
<td>Intro. to Audio/Video</td>
<td>Advanced Audio/Video</td>
<td></td>
</tr>
<tr>
<td>Math</td>
<td>Literature 1</td>
<td></td>
</tr>
<tr>
<td>By placement</td>
<td>Choice</td>
<td></td>
</tr>
<tr>
<td>Fine Art(?)</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>Choice</td>
<td>Choice</td>
<td></td>
</tr>
<tr>
<td>Art 308</td>
<td>Art 351</td>
<td>Art 445 Advanced Comp. Animation</td>
</tr>
<tr>
<td>Digital Image Processing</td>
<td>Sculpture</td>
<td></td>
</tr>
<tr>
<td>Art 343</td>
<td>Art 443</td>
<td>Art 491-499 Senior Project</td>
</tr>
<tr>
<td>History of Art 1</td>
<td>History of Art 2</td>
<td></td>
</tr>
<tr>
<td>Comm 340</td>
<td>Foreign Language 2</td>
<td></td>
</tr>
<tr>
<td>Intro. to Trad. Animation</td>
<td>History</td>
<td></td>
</tr>
<tr>
<td>Foreign language 1</td>
<td>Choice</td>
<td></td>
</tr>
<tr>
<td>Philosophy</td>
<td>Art 435</td>
<td>Comm 450 Mass and Multi Law</td>
</tr>
<tr>
<td>Choice</td>
<td>Intro. to Comp. Animation or</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>Art 411</td>
<td>Religion Choice</td>
</tr>
<tr>
<td>Choice</td>
<td>Interactive Multimedia</td>
<td></td>
</tr>
<tr>
<td>Art 445</td>
<td>Art 491-499</td>
<td></td>
</tr>
<tr>
<td>Advanced Comp. Animation</td>
<td>Senior Project</td>
<td></td>
</tr>
<tr>
<td>Or</td>
<td>Comm 450</td>
<td></td>
</tr>
<tr>
<td>Art 340</td>
<td>Religion</td>
<td></td>
</tr>
<tr>
<td>Publication &amp; Design in Internet</td>
<td>Choice</td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>Science</td>
<td></td>
</tr>
<tr>
<td>Philosophy</td>
<td>Science</td>
<td></td>
</tr>
<tr>
<td>Choice</td>
<td>Math or Computer</td>
<td></td>
</tr>
<tr>
<td>Soc. Govt. Economics</td>
<td>Science</td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>Religion</td>
<td></td>
</tr>
<tr>
<td>Philosophy</td>
<td>Choice</td>
<td></td>
</tr>
<tr>
<td>Choice</td>
<td>Science</td>
<td></td>
</tr>
<tr>
<td>Choice</td>
<td>Science, Math or Computer</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Course Sequencing for Computer Arts Major
Bachelor of Arts in Computer Arts

<table>
<thead>
<tr>
<th>A. General Requirements</th>
<th>B. Major Foundation Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral and Written Expression</td>
<td>Art 106 3 2D Composition</td>
</tr>
<tr>
<td>English Composition: 2 courses (6 hrs)</td>
<td>Art 107 3 Drawing</td>
</tr>
<tr>
<td>1.</td>
<td>Art 108 3 3D Composition</td>
</tr>
<tr>
<td>2.</td>
<td>Art 143 3 History of American Art</td>
</tr>
<tr>
<td>Speech (2-3 hrs)</td>
<td>Art 180 3 Photography</td>
</tr>
<tr>
<td>1.</td>
<td>Art 205 3 Graphic Design</td>
</tr>
<tr>
<td>Reading (0-2 hours determined by placement)</td>
<td>Art 218 3 Advanced Drawing</td>
</tr>
<tr>
<td>1.</td>
<td>Art 343 3 History of Art 1</td>
</tr>
<tr>
<td>2.</td>
<td>Art 351 3 Sculpture</td>
</tr>
<tr>
<td>Humanities: 8 courses</td>
<td>Art 443 3 History of Art 2</td>
</tr>
<tr>
<td>Fine Arts (art, music, drama)</td>
<td></td>
</tr>
<tr>
<td>1. Major</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>Literature</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>Philosophy</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
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<tr>
<td>Foreign Language (Same language)</td>
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<tr>
<td>Social and Behavior Science: 5 courses</td>
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<tr>
<td>History</td>
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<tr>
<td>Sociology, Govt., Economics</td>
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<td>Psychology</td>
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<tr>
<td>Science, Math, and Computer: 4 courses</td>
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<tr>
<td>Science</td>
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<td>Math (by placement)</td>
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<tr>
<td>Science, Math, or Computer</td>
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<tr>
<td>Religious Studies (6hrs)</td>
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<tr>
<td>Physical Education: activity courses (2hrs)</td>
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<table>
<thead>
<tr>
<th>Major Courses</th>
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<tbody>
<tr>
<td>CIS 190 3 Introduction to Computer</td>
</tr>
<tr>
<td>Comm 121 3 Techniques of Speech</td>
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<tr>
<td>Comm 211 3 Introduction to Mass Comm</td>
</tr>
<tr>
<td>Comm 230 3 Electronic/ Digital Media Theory</td>
</tr>
<tr>
<td>Comm 330 3 Intro. to Audio/Video Production</td>
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<tr>
<td>Comm 335 3 Advanced Audio/Video Production</td>
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<tr>
<td>Comm 340 3 Introduction to Traditional Animation</td>
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<tr>
<td>Comm 450 3 Mass and Multi Law</td>
</tr>
<tr>
<td>Art 206 3 Desktop Publishing</td>
</tr>
<tr>
<td>Art 208 3 Computer Graphics</td>
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<tr>
<td>Art 308 3 Digital Image Processing</td>
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<tr>
<td>Art 491-9 3 Senior Project</td>
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<tr>
<td>Choose from</td>
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<tr>
<td>Art 340 3 Publication &amp; Design in the Internet</td>
</tr>
<tr>
<td>Art 411 3 Interactive Multimedia Design</td>
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<tr>
<td>Art 435 3 Intro. to 3D Computer Animation</td>
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<tr>
<td>Art 445 3 Advanced 3D Computer Animation</td>
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</tbody>
</table>

Table 6: COMPUTER ARTS PROGRAM REQUIREMENT SHEET

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LIST OF REFERENCES


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