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Student Learning through Engaged use of 3-D Modeling and Animation Software in a High School Art Class

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Introduction

A casual observer of popular visual culture could not avoid noticing the incredible impact digital 3-D CGI (three-dimensional computer graphic imaging) has made on the visual content and appearance of popular culture imagery in the last 25 years. First reaching a mass audience in the early 1980's with Disney's *TRON*, 3-D CGI continued to evolve over the next decade into films including Spielberg's *Jurassic Park* and Pixar's *Toy Story.* These films showcased what had become possible through the modeling, texturing, lighting, and animation of entirely digital or composite digital/film productions. Digital methods of image making also proliferated quickly into television and advertising, driven by the need for novel and unique imagery to attract the fleeting attention of the American consumer. One early example was the Coca Cola Polar Bear commercial in 1993 (Kerlow, 2000). Scenes and action that were previously technically impossible could now be imagined and produced using the computer. At the same time, the genre of 3-D computer and console games came of age, which relied solely on the creation and rapid display of computer produced 3D models and animations.

With the proliferation of image-based media forms relying on electronic means of production in the last 25 years, a new rationale for art education has emerged (Hicks, 1993, Ohler, 2000). To address this need, a new paradigm of teaching art in the public schools was proposed by Freedman (2003) and others (Boughton et al., 2002) that seeks to expand the curriculum of art education to include a careful and measured study of images and means of production in new media. The study of visual culture in art education is a student-centered approach to art education that values the students' interests and knowledge of the media imagery they see daily, and respects their desire to

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participate in the production of such media. For some students, this includes seeking a career in producing electronic forms of art, including 3-D CGI.

Need for the Study

The proliferation of the virtual imagery created with computers into television and movies, as well as the explosive growth of video games has demanded a workforce of trained artists to produce it. The nature of the computer production process demands that these artists work together in managed teams with a common goal for the production (Gardner, 2002). Training to become a computer artist has meant learning the skills of traditional graphic communication and expression, as well as developing traditional animation skills and the requisite understanding of the tools of 3-D CGI. Today, colleges and universities are developing professional education programs to prepare artists to participate in this booming creative workforce, and high schools must likewise prepare art students for those programs.

One of the widely distributed and popular (Wolff, 2004) tools for creating 3D modeling and animation is Autodesk *Maya* (formerly Alias *Maya*). The software, currently in version 7, has its origins in Hollywood digital film studios, and was preceded by Alias' *Power Animator*. The software allows the artist to create digital models of real or imaginary objects or beings, add colors and textures, lighting, and virtual motion to the models. The digital animation process is reminiscent of some traditional means of animation, such as claymation or stop-motion animation, but is done entirely within the three-dimensional virtual space displayed on the computer monitor. The output is in the form of a digital movie file that can then be finished with sound, credits, and music.

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Despite the popularity of 3-D CGI in cinema, television, and video games, there is a lack of literature in the field of art education on the subject. Exceptions include Sakatani's (2005) description of his 1994-1996 classroom project with virtual reality in San Francisco, and Bushweller's (1997) discussion of a Vermont high school's 3D computer animation course. Informal surveys illustrate that few public secondary schools have attempted to offer art courses that explore 3D modeling and animation. There are several reasons why school districts have been reluctant to offer courses in 3D CGI until now. First, only recently have mainstream and affordable computers and their graphic sub-systems become powerful enough to handle the requirements of 3D modeling and animation. Secondly, the software tools of 3D modeling and animation were prohibitively expensive until recent pricing structures included an educational license. Thirdly, many art teachers have been unfamiliar with digital means of artmaking and been reluctant to invest the time needed to feel comfortable teaching such a course (Delacruz, 2005). Finally, the students' expectations have evolved, and previously minimal demands for hands on experiences in technology-rich environments have increased in recent years. Meanwhile, the computer-technological fluency of most students has improved, and with it, positive attitudes and expectations about that technology have proliferated, (Tapscott, 1998) as more internet-connected computers appeared in schools and homes.

The popularity and expressive power of 3D CGI in cinema, television, and video games, and the increased demand for courses teaching artists how to participate in the medium dictate that research be undertaken to better understand what and how students in the arts learn from and about 3D CGI software. There is a need for such research from

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secondary art educators whose responsibility it is to develop courses and strategies for teaching 3D CGI concepts and software.

Research Questions

My initial literature review in 2005 revealed a lack of such research in the field of art education, and I took steps to begin a research project. To begin to understand the complexities of teaching digital 3D CGI in a secondary public school, I spent a school year observing an introductory and advanced class in a suburban public high school near a large mid-western city, taught by a cooperating teacher I had met through supervising student teachers in the region. This school year culminated with a case study focusing on a spring semester advanced class of students in 3-D CGI using *Maya*. Previously, I taught a pilot project in 3-D CGI and observed four college-aged participants during a four-week summer course. Themes appearing in that study were instrumental in focusing on pertinent issues during my current project.

With the current study, I intend to begin an examination of student learning in the 3D CGI course in question. The exploratory nature of the research project dictated that my project take the form of a thematic case study focusing on the following four research questions:

1. How does the engaged use of 3D CGI software like *Maya* by secondary public school art students affect their perceptions and attitudes about the popular visual culture, especially video games, cinema, and television they encounter?

2. What visual tools do secondary public school art students learn in order to communicate their ideas through 3D CGI software like *Maya*?

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3. What are the strategies and skills secondary public school students learn or employ in order to be successful at 3D CGI software like *Maya*?

4. Does working in a digital 3D environment for a semester-long course have visual spatial cognitive benefits for secondary public school art students?

Method

The participants in the study were 20 high school students enrolled in the spring semester course in advanced digital imaging, and the cooperating teacher for the course. The students consisted of 19 males and one female, ranging in age from 14 to 18. The other participant in the study was the male cooperating teacher for the class who had 7 years of teaching experience and was generous with his time and insight into the history and methods of the course. Students began the 18-week course by forming collaborative groups of between three to five students to create a 4-5 minute animation using the *Maya* software. The design of the class is project based, practical, and student-centered, and allows the students to devise, plan, and create the animation on their own terms.

The classroom for the study is a dedicated art computer lab with 29 networked IBM workstations, with a digital projector and screen for the instructor's machine. Each workstation has access to software including Autodesk/Alias *Maya 6,* Adobe *Photoshop CS, and* Microsoft *Movie Maker,* along with the Microsoft *Windows XP Professional* operating system and *Internet Explorer* web browser. This means that while the students work in groups, they can all work independently and simultaneously, exchange work via the network, and store work in secure network locations. The school has at least one full-time technical support and networking professional on staff.

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A thematic case study design was warranted to address the research questions most directly. Freedman and Liu (1996) and Freedman and Relan (1990, 1992) employed this design in their explorations of issues surrounding art students using digital paint software when that technology was new. The qualitative emphasis and public school setting for the research allowed the researcher to see first hand what students encounter, their learning outcomes, and their solutions to problems. The grounded theory case study of a class in a real-world setting (Robson, 2002) demanded that the researcher be able to adapt the research methods to the conditions that are discovered during data collection. Eisner (1996) states, "I can think of no more important research agenda for art education than the fine grained study, description, interpretation, and evaluation of what actually goes on in art classrooms" (p.54). His ideas about educational connoisseurship were important to the design and implementation of the study.

In order to thoroughly describe the phenomena observed in the classroom, and keeping in mind the limited time duration and resources of the study, I employed procedures to maximize the amount and interrelatedness of data I could collect, while keeping the observations as focused on the real-world activities of the classroom as much as possible. Triangulation of data (Sevigny, in Hardiman and Zernich, 1988, Robson, 2002, Mertens, 1998) will be possible through the combined observations of the researcher-cooperating teacher team, the voices and words of the participants, and multiple forms of written and digital work from the participants.

My research design included the collection of a variety of different forms of data, collected in phases throughout the eighteen-week semester. Paying heed to Robson's (2002) warning about the need for timely handling of large volumes of data in a

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grounded-theory qualitative study, I took measures to be able to manipulate and store it. Using a digital voice recorder allowed high quality recordings to be made unobtrusively, and those recordings could be easily downloaded into a PC, archived on CD-RW media and indexed, analyzed, and selectively transcribed using recording and playback software. The use of a USB flash storage drive permitted easy retrieval of student digital files from their computer workstations at regular intervals with subsequent downloading, archiving, and backups. A digital camera allowed for easy archiving of large drawn storyboards. Lastly, the use of Dragon's *Naturally Speaking* voice recognition software will allow for timely transcription of handwritten field notes.

Once consent/assent forms were returned, the first research instrument was a twenty-question survey that helped guide interactions in subsequent unstructured interview sessions with participants. The multiple-choice questions ranged from queries about participants' technology backgrounds and attitudes about media forms to preferences for learning in technology-mediated situations. Later, I conducted a second survey that included questions about which resources the participants were relying on to learn the software. A post-survey of seven items measured changes in patterns of media involvement by students following their class experience.

The second instrument used was a pre- and post-test from the *Kit of Factor Referenced Cognitive Tests* (Ekstrom et. al., 1976), an extensive battery of a pencil and paper cognitive tests purchased from the Educational Testing Service. From this I selected two tests that had the most relevance to the type of experience the students would be having in the class, tests of spatial orientation and visualization cognitive abilities. These tests represent the only quantitative component of the study.

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Direct observations, by the researcher and cooperating teacher, provided the bulk of the data for the study. For this, I maintained a handwritten journal of my observations, written either during the class or in the hour after it. The cooperating teacher did not keep a journal, but frequent conversations with him before and after class time provided adequate insight into his observations.

Next, I conducted unstructured and structured interviews with students and the cooperating teacher at various times during the 18-week course, beginning with the cooperating teacher in the weeks before the class began. With students, these interviews could only begin once rapport was established, a process I had begun with a few students in the previous semester. As part of the course structure, each group elected a leader, called a producer, who then met with the cooperating teacher semi-weekly to provide progress reports and feedback. In interview fashion, I recorded and participated in these meetings.

The student-participants' work throughout the semester formed the remainder of the data. This work took three forms, written and visual documents, plus computer files. The visual documentation work began early in the semester with a set of storyboards and character designs done by each student group. The process of planning the *Maya* animation continued with a series of worksheets completed by each student group in preparation for the producer meetings. Following the example set by Kafai (1995) in her study of students creating computer games, I designed the worksheets to include written and storyboard planning, and a review of work completed so far. The computer files the students worked on were also collected at regular intervals throughout the semester. These took the form of *Maya* scene files and 2-D images in various image file formats.

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These 2-D images could be used both as photographic references for *Maya* model building, and for creating textures that can be applied to those models.

Analysis and Preliminary Findings

Grounded theory thematic case study begins with gathering data in the field, in this case the high school art classroom, with which to analyze and formulate theory in an iterative fashion. An open coding (Mertens, 1998) system was used to label the findings as themes when they came up. Carpenter and Taylor's (2003) ideas about hypertext were useful for this phase of the research project and I constructed a hypertext database using web authoring software from Adobe called *Go Live.* This allowed the creation of searchable hypertext documents that could be site-mapped, which in turn made visualizing themes in the data easier. In the way suggested by Robson (2002), labeling or coding each relevant piece of data as it emerged is possible using hyperlinks between the various hypertext documents for relational information. The database is endlessly editable and flexible. Completing theoretical and selective coding will be facilitated with the study's hypertext database.

For the remainder of this paper, I will discuss preliminary findings based on an incomplete analysis of the data collected during the 18 weeks of the course. While the findings presented here are speculative, they represent major themes in the data and will no doubt be represented in the final report. Most importantly, the role of video games in the lives of students of *Maya*, especially those games that utilize 3-D CGI, emerged as a theme in the research. All the students in the class reported playing video games to some degree, and the impact of these games on the lives of the students who play them cannot be understated. First, players of 3-D video games come to the class with an intuitive

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understanding of the virtual 3D space depicted and used in *Maya*. Students know how to move around and change viewpoints within the flat, video monitor displays of virtual 3-D forms, often dividing their attention between perspective and orthogonal viewpoints as they might in a video game. Second, students in the class learned *Maya* software using the same strategies they use to learn video games, including a reliance on inductive discovery as they create, peer teaching, and transference of intuitive knowledge from physical systems to their virtual counterparts. Lastly, many student groups created narrative animations based on largely non-linear narratives found in games of all sorts, including video games.

There is a small body of literature dedicated to understanding the role of video games and how they might affect education generally. McClurg and Chaillé (1987) found that "certain computer games may enhance the development of spatial ability" (p.95) regardless of grade level or sex. Greenfield et al. (1994) found that video gamers in Italy and the United States became adept at understanding iconic codes that computer programs, including games, commonly use in the user interface. At the same time, they found that players of video games learn those games through inductive discovery. Subrahmanyam and Greenfield (1994) found that spatial cognitive skills were improved after playing a video game regardless of gender or pre-test abilities. Gee (2003) methodically examined a variety of video games and found 36 learning principles the game designers use to teach players the game in an inductive fashion. Gee (2005) explores the idea that, "Good video games are good for your soul" (p. 1) as long as players socially share the interests.

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The student-participants in the current study enjoyed working in collaborative groups. If inductive discovery methods of learning *Maya* were inadequate to the problem they needed to solve, their first resource for help would almost invariably be one of the students within their own collaborative group of between three and five individuals. They tended not to go outside their group for help, even when prompted by the cooperating teacher or myself in specific instances. Only after their work group failed to resolve the problem would they go to the instructor. If that failed, they would either consult the help files for the software or an Internet resource for help. Manuals and books, although available in the classroom, were generally shunned. This pattern of research was common, and at first I attributed it to student laziness. Later, after lengthier observations, it became apparent that their strategy is the most efficient one from a time management sense given their circumstances.

There is a growing body of literature dealing with the so-called .net generation and their preferences for learning. The participants in my study all grew up with the Internet and computer technology, and they take it for granted. Tapscott (1998) found that the educational expectations of students in schools today requires a different approach by teachers to accommodate their learning styles. Foreman (2003) extends this work by questioning the efficacy of the lecture halls common in colleges and universities, as this same generation graduates to higher education. Collaborative learning has been thoroughly researched; Johnson and Johnson's (1989) meta-analysis reviewed hundreds of studies of group dynamics in schools. Slavin (1995) discusses Group Investigation, the method used in the classroom under consideration. Less well understood is the effect of technology-rich environments (Tiene & Luft, 2002) on the group dynamic, also studied

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by Freedman and Relan (1990) in their examination of social aspects of computer learning in art class.

Student learning in this art class was not limited to the *Maya* software. Their understanding of issues surrounding popular media, especially violence in video games and cinema, increased as a result of their participation in class. For example, several student groups began the semester with project ideas that included rather gratuitous violence. During the development of their ideas, these groups eventually came to the conclusion that the violence for it's own sake was inadequate, and chose contexts for the violent images that was more sophisticated. All student groups developed a deeper appreciation for the level of artistic expertise seen in movies and games, especially as deadlines loomed and the number of hours they put in on their projects mounted.

Conclusion

Much more study is needed to determine the value and best practices for 3-D CGI classes in the secondary school art classroom. I would encourage teachers considering creating such a class to do so for a number of reasons. Teaching in a technology rich environment is a rewarding, if sometimes tiring experience, but seeing students excited and consistently working on their projects is an indication of just how powerful the medium is. As an addition to an established traditional art curriculum, the CGI component can help insulate the art department against cuts to staff and budget, as parents and administrators are attracted to the technological component in the arts and will listen to the students excitement about the prospects of participating in an artform they see everyday.

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References

Boughon, D., Freedman, K., Hausman, J., Hicks, L., Madeja, S., Metcalfe, S., Rayala, M., Smith-Shank, D., Stankiewicz, M., Stuhr, P., Tavin, K., & Vallance, E. (2002). *Art education and visual culture. Advisory NAEA*. Reston, VA: National Art Education Assosiation.

Bushweller, K. (1997). Wizards of animation. *American School Board Journal*, *184*(10), 32-35.

Carpenter, S. & Taylor, P. (2003). Racing thoughts: Altering our ways of knowing and being in art through computer hypertext. *Studies in Art Education, 45*(1), 40-55.

Delacruz, E. (2004). Teachers' working conditions and the unmet promise of technology. *Visual Arts Research, 46*(1), 6-19.

Eisner, E. (1993). The emergence of new paradigms for educational research. *Art Education, 46*(6), 50-55.

Ekstrom, R., French, J., Harman, H., & Dermen, D. (1976). *Kit of factor-referenced cognitive tests*. Princeton, NJ: Educational Testing Service.

Foreman, J. (2003). Next generation educational technology vs. the lecture. *Educause Review, 38*(4), 12-22.

Freedman, K. (2003). *Teaching visual culture: Curriculum, aesthetics, and the social life of art*. New York: Teacher's College Press.

Freedman, K., & Liu, M. (1996). The importance of computer experience, learning processes, and communication patterns in multicultural networking. *ETR&D, 44*(1), 43-59.

Freedman, K., & Relan, A. (1990). The use of applications software in school: Paint system image development processes as a model for situated learning. *Journal of Research on Computing in Education, 23*(1), 101-112.

Freedman, K., & Relan, A. (1992). Computer graphics, artistic production, and social processes. *Studies in Art Education, 33*(2), 98-109.

Gardner, G. (2002). *Computer graphics and animation: History, careers, expert advice*. Washington DC: GGC Publishing.

Gee, J.P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave MacMillan.

DOI: 10.17077/2326-7070.1387

Gee, J.P. (2005). *Why video games are good for your soul: Pleasure and learning*. Australia: Common Ground.

Greenfield, P., Camaioni, L., Ercolani,P., Weiss, L., Lauber, B., & Perucchini, P. (1994). Cognitive socialization by computer games in two cultures: Inductive discovery or mastery of an iconic code? *Journal of Applied Developmental Psychology 15*, 59-85.

Hicks, J. (1993). Technology and aesthetic education: A crucial synthesis. *Art Education 46*(6), 43-47.

Johnson, D., & Johnson, R. (1989). *Leading the cooperative school*. Edina, MN: Interaction.

Kafai, Y. (1995). *Minds in play: Computer game designed as a context for children's learning*. Hillsdale, NJ:Lawrence Erlbaum.

Kerlow, I. V. (2000). *The art of 3-D computer animation and imaging*, (2nd ed.). New York: John Wiley & Sons.

McClurg, P., & Chaillé, C. (1987). Computer games: Environments for developing spatial cognition? *J. Educational Computing Research, 3*(1), 95-111.

Mertens, D. (1998). *Research methods in education and psychology: Integrating diversity with quantitative & qualitative approaches*. Thousand Oaks, CA: Sage Publications.

Ohler, J. (2000). Art becomes the fourth r. *Educational leadership*, *58*(2), 16-19.

Robson, C. (2002). *Real world research* (2nd ed.). Oxford, UK: Blackwell Publishers.

Sakatani, K. (2005). Harmony quest: An interdisciplinary arts based project incorporating virtual reality. *Visual Arts Research, 31*(1), 53-62.

Sevingny, M. (1988). Triangulated inquiry: An alternative methodology for the study of classroom life. In G. Hardiman & T. Zernich, *Discerning art: Concepts and issues*. (pp. 614-632). Champaign, IL: Stipes Publishing.

Slavin, R.E. (1995). *Cooperative learning: Theory, research, practice* (2nd ed.). Boston, MA: Allyn and Bacon.

Subrahmanyam, K., & Greenfield, P. (1994). Effect of video game practice on spatial skills in girls and boys. *Journal of Applied Developmental Psychology 15*, 13-32.

Tapscott, D. (1998). *Growing up digital: The rise of the net generation*. New York: McGraw Hill.

DOI: 10.17077/2326-7070.1387

Tiene, D., & Luft, P. (2002). Classroom dynamics in a technology-rich learning environment. *Learning and Leading with Technology, 29*, (4), 10-13, 60.

Wolff, E. (2004). Crazy for those killer apps: CG artists pick their favorite digital tool kits. *Animation Magazine, 18*(5), 34-6, 38.

DOI: 10.17077/2326-7070.1387