

## TECHNOLOGY IN DANCE EDUCATION

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### Introduction

Historically, as artists have grown dissatisfied with the current tools available, they have created, expanded, invented, and defined new technology to enhance their art. In the last 45 years, many choreographers and dance educators have investigated methods for implementing computer technology. Technology presents new methods for creating, instructing, and assessing dance as well as opportunities to expand dance resources and redefine the learning process. Some exciting innovations, which are discussed in this chapter, include LifeForms animation, networked performances, and distributed choreography that transport dances to new audiences around the world. This chapter identifies five major themes in the areas of technology for dance education: choreography, dynamic environments, multimedia, and online and distance pedagogy. The chapter discusses each theme and concludes with their implications for dance pedagogy and a discussion of future trends in each area.

### Choreography

The earliest explorations in computer animation came from scientists, architects, and choreographers who developed methods allowing computers a voice in the construction and performance of dance. In the late 1960s, Cunningham and Tharp (Tharp, 1969), choreographers known for their technological investigations, created choreography by experimenting with the concepts of indeterminacy and chance-generated compositional processes. Both choreographers found interesting ways to bring digital technology into their work.

### *LifeForms*

Cunningham (1968) wrote about the influence of chance methods and computer technology, stating that "the use of chance methods demanded some form of visual notation ... a crude computer in hieroglyphics" (n. p.). A year later, Tharp created the *History of Up and Down*, in which she used a computer program to make selections from a list of movement elements. The selections (computer lists) offered unusual juxtapositions of movement, which Tharp used as thematic material for the choreography. Not only were the movement choices generated by the computer, but the stage lighting was determined by the computer, as well. Twenty-two years later, Cunningham further utilized the computer as a choreographic tool. In 1991 he created *Trackers*, the first dance choreographed with the assistance of LifeForms, a human animation software. In *Trackers*, one third of the movement was created using LifeForms on Cunningham's SGI personal computer.

LifeForms, developed by Calvert (Calvert, Wilke, Ryman, & Fox, 2005), is a tool for creating and planning human movement in dance and choreography. Singular to Calvert's design, LifeForms makes it possible to present a three-dimensional virtual performer (with unique physical abilities) alongside the choreographic organization of creating movements, structuring motifs, and forming choreographic studies. Schiphorst (1992) eloquently describes technology's appeal for the choreographer: "In dance, where the creative idea is a movement idea, the goal is to be able to visualize and create movement on the body in an immediate and responsive way, so that the computer can become a visual idea generator" (p. 46).

In dance education, LifeForms is widely recognized as the first readily available software for dance educators. It opened up possibilities of dance unbound by the physical body and the forces of gravity. Online college-level courses have been developed for its instruction. Like Cunningham, enthusiastic educators have found ways to adapt the software to meet the needs and interests of younger students, allowing upper elementary and middle school students make discoveries and express themselves with computer choreography (Manley, 1995; Rose, 1994; Unrau, 1996). In order to meet the needs of professional and educational populations, Crédo Interactive released an upgrade for LifeForms and the new K-12 friendly DanceForms software. According to A. Marston from Credo Interactive (personal communication May 6, 2005), 47 educational institutions, organizations, and school districts currently use DanceForms primarily in the United States, United Kingdom, South Wales, and Australia. However at this time there is little research on the implication of DanceForms and student learning in dance education.

### *Telematics and Distributed Choreography*

"Telematics" is a term created to describe the blending of computers and wireless communication technologies to convey information over a vast number of networks. Initial investigations in dance telematics incorporated video and dual site performance. Galloway and Rabinowitz's *Satellite Arts Project '77* brought dancers from California and Maryland together through simultaneous live video using satellite

technology provided by the National Aeronautics and Space Administration (NASA) (Galloway & Rabinowitz, 1992). Early Internet collaborations using text and ASCII-based imagery include Ascott's *La Plissure de Texte* where collaborators from remote locations participated as different characters to create a "planetary fairytale."

The birth of the World Wide Web permitted dancers from different locations to perform for live audiences in real time across time zones. With the development of Internet2, teleconferencing and webcasting technologies artists (Birringer, 2002; Naugle, 2002) began to question the body's relationship to physical sensation, technology, and performance. In simple terms, telematics is a videoconference call that sends and receives information over the Internet.

One of the leading research teams in dance telematics is the Association of Dance Performance Telematics (ADaPT). ADaPT brings together artists, technologists, and scholars from educational institutions to explore performance in telematic space. ADaPT partners transmit choreography which can be simultaneously viewed at each location. Formed in 2001, the ADaPT partners comprise technology specialists from universities across the United States. According to John Mitchell the objectives of ADaPT are as follows (1) to create a site for telematic collaborative inquiry for the purpose of developing new models of practice and training techniques for the creation of networked dance and performance; (2) to explore embodiment and somatic intelligence through reconceptualization of spirit, body, and machine in the Internet2 culture – develop a shared mediated space for investigating performance and creative collaboration through a distributed environment across time zones; and (3) to situate research within a larger cultural and political context that acknowledges how mediated performances both frame and are framed by issues such as identity, privilege, and access (personal communication June 8, 2005).

ADaPT researchers offer international conferences, workshops, and online performance events. ADaPT workshops inform and educate students, artists, and technologists about the possibilities of performance telematics. Over the past 6 years, leaders have examined dance performance using integrated media technology to create interactive, simultaneous, transcontinental, and virtual dance performances. During these workshops participants from around the globe acquire hands-on practical knowledge in applied telematics through collaborative creative projects alongside leading researchers. Gottesman, an ADaPT member from Wayne State University, addresses telematics's ability to augment the elements of dance performance. He suggests that with telematics, choreographers can do more with music and graphics to expand dance and other performances (Simmons, 2005).

Nancy Happel's (2004) research addresses the elitism of dance telematics and the scarcity of dance companies able to afford the equipment and personnel to work in telematics. Happel's graduate thesis performance investigates the issues surrounding affordable telematics for interactive choreography. She outlines teleconferencing between two locations with free or low-cost software to create low-budget telematic performances she calls "guerrilla telematics." Choreographers, artists, and educators, with access and availability to telematics students, will be inextricably linked to the outside world as they reshape the new frontiers of dance telematics and distributed choreography (Happel, 2004; Wolfram, 2003).

## Dynamic Environments

Dynamic performance environments ask us to question traditional relationships of audience and performer, and encourage flexibility and flow as nonlocal, untrained, and virtual participants enter the digital stage. In the 1990s, interactive environments, motion capture and computerized performance spaces became popular, guiding performers in a 'sensory' experience, with their bodies activating various computerized sensors for sound, light, and images. Artists like Mitchell (1992), Lovell and Mitchell (1995), Povall (1995), Naugle (2002), Birringer (2002), and Crawford (2004) are reexamining dance performance using integrated media technology to create interactive, simultaneous, transcontinental, and virtual dance performances. Numerous digital artists, choreographers, and collaboration teams are working with real-time interactive performance technologies.

### *Responsive Environments*

*Active Space: Interactive Videodance* (Crawford, 2004) is an intelligent installation and performance work that realigns the role of the technology and responsive environments. Crawford and Naugle's interactive physical environment employs a hybrid space utilizing Motion Capture animation, Motion Tracking, real-time computer graphics, and special effects to generate visual effects and music. The research seeks to balance artistic vision and technological innovation by allowing the performer to influence and interact with the technical elements in an immediate way. As the mover's actions generate new internal imagery, Crawford and Naugle suppose that the resulting experience enhances the performer's motivation. Media elements are accessed from a library of analyzed video clips, thus creating a library of accompaniment. Visitors can activate, respond to, and ultimately create new relationships with the space. "The active space system responds directly to visitors and their motion, creating visuals and sounds that can influence the way people see and move in the space" (Crawford, 2004, p. 1).

Teaching and learning are dynamic and interactive processes. In this context, immersive and dynamic environments provide opportunities to nurture dance students by developing a knowledge base and problem solving and thinking skills using responsive movement/motivation. *Community Connections: Creating Partnerships in Dance Performance Telematics* (Parrish, 2001) investigates learning through performance technology. Mitchell, Parrish, and the ASU Institute for Studies in the Arts (ISA) joined to investigate movement possibilities in a real-time responsive environment and to develop K-12 curricular materials from a series of motion studies. Mitchell and Parrish's *Community Connections* research uses dynamic telematic learning environments in all stages of dance performance (creating, collaborating, rehearsing, and performing). Sixteen high school dance students used motion sensing, motion capturing, and the multi-media, immersive feedback systems.

### *Virtual Reality and Dynamic Textiles*

Early interactive installations led to virtual environments and VRML "democratic" internet performance spaces. Artists like Sharir and Gromala (1995), Schiphorst,

Naugle, and Mah (1999), Garland and Naugle (1999), and Naugle (2002), redefining traditional performance venues, advocate on-line collaborative performance that is democratic and collective, allowing anyone to participate. Sharir, Lycouris, and Wijnans (2003) use the movement reactions of the audience members as triggers for multimedia. Sharir and Layne (2005) amplify and extend the human body into real and virtual performance environments on the Internet.

Funded through Cultural Initiatives Project grants and the Department of Communications in Canada, *Dancing with the Virtual Dervish Virtual Bodies* (Shamir & Gromala, 1995) is a pivotal work that explores the possibilities of Virtual Reality (VR). It is one of the first VR dance projects to investigate a performative environment that includes a head mounted display, data glove, interactive video, and an enormous animated Virtual Dervish. The *Virtual Dervish* functions as a VR environment. To create the *Virtual Dervish*, Gromala "texture mapped body organs with topography related to the *Dervish* as well as X-rays and abbreviated MRI data" (Sharir, 2003, p. 2). *Virtual Dervish* investigates the ideas of embodiment and disembodiment and creates new prospect for experiencing artwork. VR challenges include the need to wear restrictive equipment which hinders the dancer's range of motion, creative process, and performance.

*IntelligentCITY* (Sharir et al., 2003) explores the connection between responsive technology and architecture. The research team looks at the perception of commonplace everyday environments (shopping malls and supermarkets) and translates the sounds and space through multiple video screens and surround sound so that the "presence and the reactions of the audience generate virtual space which unfolds as part of an entirely physical space" (Sharir et al., 2003, p.1). The collaborative *IntelligentCITY* team examines (1) the potential for real-time manipulation of virtual space using wearable computers and (2) interactive responsive architecture. The result is an interactive place where anyone can feel the impact of responsive motion within the environment. It is a kind of an 'intelligent' site-specific, public artwork.

Another exciting example of wearable computing is *Twining* by Sharir and Layne (2005). A responsive device using dynamic textiles, *Twining* possesses a full functioning computer, and a wireless communication system for interactivity. Dynamic textiles are created by integrating Light Emitting Diodes (LED's) and electronic circuitry into the structure of hand woven fabrics. Sharir and Layne propose that animated garments have the "potential for a new level of user authorship and added possibilities for improvisations, playfulness, and provocation" (Sharir & Layne, 2005, p. 1).

### *Motion Capture and Tracking*

Motion Capture and Tracking are interactive systems that analyze and translate the movement of the human body into digital representations of human movement. Motion Capture is a technique of digitally recording three-dimensional movement of real things. Motion Tracking involves real-time sensing of a mover's speed, duration, and location as part of an interactive motion system. Popular examples of motion capture animation include Tom Hanks' performance of several animated characters in *Polar Express* and Andy Serkis' performance as Gollum in the *Lord of the Rings* trilogy.

Motion Capture has many advantages over traditional computer animation and is ideal for dance, as it is capable of capturing difficult actions of the body as seen in the layered details of holding props, complex inversions, and partnering. However, it records a finite number of points on the dancer's body, while some nuance and agility is not recordable. Motion Capture equipment is very expensive. Currently, such systems can cost over \$80,000 for the cameras, lights, computers, software, and staff to create a Motion Capture studio; the field is advancing quickly and motion capture systems will change dramatically as new and better technology and software become available.

Choreographers and dance technologists have examined the incorporation of Motion Capture and Tracking in the development of new performance environments (Birringer, 2002; Naugle, 2002; Sharir, 2003). Ingalls et al. (2004) are developing a Motion-Capture-based, gesture recognition engine that extracts structural information from dance performance.

Two critical research projects, Cunninghams' *Biped* (Kaiser, 2004), and Arizona State University's *Motion-e* (Motion-e, 2005) offer an inspiring impression of the field. *Biped* is a performance work that uses video projections of Motion Capture representations of dancers. *Biped's* real and virtual dancers form a haunting community. Large, extraordinary dancers soar, settle, and commune with the live dancers, giving the impression of otherworldly dancers moving through evocative spaces. Dunning (1999) describes the digital canvas as having a rare human quality evoked by the towering gleaming digital dancers.

Collaborative research from Arizona State University unites the Arts, Media, and the Engineering Program. *Motion-e* examines the physical-digital art-making process with real-time Motion Capture technologies and motion analysis techniques. Funded through the National Endowment for the Arts and National Science Foundation grants, *Motion-e* connects modern dance choreographers with visual artists, composers, lighting designers, and a team of technologists seeking new possibilities for interactive art works with ground-breaking digital sensing, processing, and design.

Rikakis, director of ASU's art, media, and engineering program and principal investigator of *Motion-e*, identifies three areas in this research (1) real time capture and multi-layer analysis of movement; (2) structurally consistent, multimodal, physical-digital environments; and (3) creating an aesthetically coherent, engaging, physical-digital experience. Rikakis further believes that this research may support the development of interactive systems for movement rehabilitation, K-12 education, communication, and movement training and dance analysis (<http://ame.asu.edu/motione/>). At present, American educational investigations for K-12 Motion Capture dance pedagogy are non-existent. Yet, as premiere artists and choreographers create engaging collaborative performances, we have to wonder how Motion Capture technology will influence dance education pedagogy in the future.

## Multimedia

Technology has been used in dance education since the mid 1980s. Fortunately, the development of CD-ROMs, DVDs and high speed Internet allow developers to be able

to present related graphic images, sounds, and most importantly, full quality video within the documentation process. Currently, CD-ROMs and DVDs on dance artists and technical dance styles are available and are being developed (Fisher-Stitt, Warner, & Martin, 1992; Kaplan, 2001; Maletic & Smith, 1999; Maletic & Sutherland, 1995; Mockabee & Parrish, 2002; Ryman, 1999; Smith-Autard, 1999, 2003). Multimedia in dance education supports multimodal student learning. It is possible for a student to learn a dance style, hone their rhythmic performance, and analyze movement elements and phrasing with multimedia technology.

### *Documentation and Preservation*

In the 1990s, the dance community experienced the loss of several prominent choreographers. The dance community realized that its rich and diverse dance history was slipping away. At the same time multimedia software such as Macromedia Director became commercially available giving dance researchers new tools for creating interactive dance archives. This urgency to preserve dance history and to create integrated resources led dance researchers toward multimedia technology, and documentation and preservation efforts led the field of dance and technology. Two influential projects include *Shadow on the Prairie: An Interactive Multimedia Dance History Tutorial* at York University in Canada and *Multimedia Dance Prototype (OSU-MDP)* at The Ohio State University.

*Shadow on the Prairie* is the first hypermedia program developed for dance. The project written in HyperCard software (no longer available) was developed from 1989 to 1992 by Fisher-Stitt et al. (1992). The project focused on the Gweneth Lloyd ballet *Shadow on the Prairie*, choreographed for the Royal Winnipeg Ballet in 1952. *Shadow on the Prairie* was the first multimedia project to incorporate QuickTime video along with text, graphics, and sound. Additionally, it not only provided the student with information on the history of the ballet, the choreographer, dancers, the music, sets, and costumes, but also presented the ballet in digitized video clips. This research encouraged others to examine the potential of technology as a new method for teaching and preserving dance history.

The Ohio State University *Multimedia Dance Prototype (OSU-MDP)* was the innovation of Maletic and Sutherland (1995). In 1991, they conceived of an interactive multimedia dance documentation model. Within their nonlinear multimedia framework, the MDP team was able to document the historic, aesthetic, and cultural importance of a choreographer or a choreographic work. Their model served two functions (1) profiling a contemporary dance artist and (2) educating others about the field of dance. First, the OSU-MDP team developed a CD-ROM on a significant dance artist, Victoria Uris. Second, out of the process of their research and development for the Uris CD-ROM, they produced a reusable multimedia "shell" for other artists to document their own choreography called *DanceCodes* (Maletic & Smith, 1999).

The Uris CD-ROM, completed in 1997, includes multilayered information on Uris's choreographic tradition, cultural background, press clippings, interviews, and reviews of her work. The CD-ROM holds over 80 video excerpts. "Interactivity is the key mode of presentation" as students can navigate freely, "choosing the depth of information in

which they are interested" (Maletic, 1996, p. 14). Further, the OSU-MDP model presents a branching-linking interface that offers the ability to interconnect multiple media sources. For example, the Labanotation score, musical score, and performance video are all linked to run simultaneously. While using the Multimedia CD-ROM, students can cross-reference information on a choreographic work with dance history, movement analysis, Labanotation score, and criticism.

Dance multimedia has been slow to come to the market due to issues of copyright and the need for more technology specialists in dance. Support media and teaching guides (electronic or printed), as resources for dance educators using multimedia with students are highly limited. Further, most multimedia products lack formative and summative evaluation in real classrooms and insufficient research testing of the CD-ROM's influences on student learning.

### *Notation, Choreography, and Performance*

Labanotation is a codified system for recording human movement developed by Rudolf Laban. It is the most widespread notation method in use today with university courses, K-12 curricula and conferences devoted to the application and advancement of the system. Recording dance onto paper in symbolic notation is a time-consuming and arduous process. A single Labanotation score may take over a year to complete, with revisions further extending the process. Technological developments in software have enhanced the writing and reproduction of dance notation. For instance, software applications such as LabanWriter, LabanReader, and LabanDancer have changed the quality and accessibility of Labanotation.

LabanWriter is a software program designed to record dance in Labanotation. The program includes more than 700 symbols that indicate human movement such as direction, level, body part, type of movement, and duration. The software facilitates fast and consistent notation, providing the notator (and student) ease in recording, editing, copying, and storing their work on a computer.

LabanReader (Marion & Smith, 1999), is a tool to assist in teaching and learning Labanotation. Making notation more accessible for nonnotators to use, LabanReader allows LabanWriter documents to be opened and to have the numerous notation symbols grouped together. Students are able to learn patterns of the feet without being overwhelmed by the complex action of the arms. This technique can allow a student reader to more rapidly translate the symbols from paper into actual physical movement.

LifeForms and LabanWriter have become the two most widely used software programs in dance notation and choreography. The developers, listening to requests from the field, have developed a translator to run between these two applications. LabanDancer allows Labanotation scores written with LabanWriter to be directly interpreted into three-dimensional human animation. The reverse also works, allowing LabanDancer animations to be translated into LabanWriter Labanotation scores (Fox, Calvert, & Sutherland, 1999, p. 18). Hopefully LabanDancer can successfully inspire students to learn both choreography and notation simultaneously. Therefore, like musicians, students of dance can create and record their dance studies in Labanotation, as they are recording and composing them in LifeForms.



CD-ROMS, DVD's and the Internet are quickly becoming a preferred method of dance documentation, preservation, and analysis. One example of the dance multimedia is *Improvisation technologies* created by Haffner. It is a CD-ROM that illuminates William Forsythe's improvisational pedagogy. With a fresh look and dynamic interface, it sets a new standard for educational multimedia in dance. The CD holds over 60 video chapters to demonstrate techniques and dance sequences beautifully performed by Frankfurt Ballet members. Jacqueline Smith Autard's *The Wild Child* CD-ROM (1999, 2003) was one of the first educational technology resources exclusively geared for upper elementary and middle school dance curricula. The accompanying resource pack includes basic frameworks for dance instruction and worksheets for class preparation and assessment.

*Process-Based Dance Documentation CD-ROM* and Labanotation score by Mockabee and Parrish (2002) examines the dance work *Prey* by Modern Dance choreographer Bebe Miller. The multimedia CD-ROM examines Miller's choreographic process as she creates a new dance.

### *Performance and Dance Technique*

Several technology projects have focused on building the skills and knowledge for technically proficient dancers, including: acquiring anatomical awareness, learning vocabulary, and studying skill sequences necessary for learning dance technique. The *Ballet is Fun* CD-ROM was created in 1996 by nationally known ballet dance teachers Etgen and Atkinson. It provides a detailed comprehensive archive of over 300 beautifully performed ballet steps. The contents are divided into lessons by type of movement action and technical expertise. Each step is represented by video and text. The description of terms is lengthy and written for high school or college students and is unsuitable for young children.

The *Repertory Etudes*<sup>TM</sup> project is committed to present, preserve and, provide access to important modern dance works. Under the guidance of the American Dance Legacy Institute (ADLI), the project seeks to "nurture the art of dance through education, access, and presentation (Strandberg, 1994). The ADLI *Repertory Etudes*<sup>TM</sup> project works with American modern dance pioneers or a designated to create a quintessential excerpt, which is then learned by students and teachers.

The *Repertory Etudes*<sup>TM</sup> project also offers teacher education by guiding the instruction surrounding a seminal choreographic work (McGhee, 2005). The ADLI has provided teacher training with the choreographer, and then the teachers return home with resources to help guide student experiences. The innovation and strength of the program is its fusion with accessible communication and learning technologies.

## **Online and Distance Pedagogy – Internet-Based Learning**

Internet communication has become an effective medium for the exchange of knowledge and ideas about dance, as it opens the lines of dialogue, bringing contact between artist, student, and teacher. Naugle (1998) points out that "technology can help build

bridges between art forms, and it offers artists and educators expanded options for expressing ideas" (Naugle, 1998, p. 15).

### *Interactive Classrooms*

Access to a global dance community heightens students' perception of dance in their external environment and broadens their dance community. Eliminating the privileges of geography, the Internet encourages dance students to see beyond themselves and their surroundings and enter dialogues with the world. Garland and Naugle (1997) and Vissicaro (2003) led the field in online instruction for university dance education. Garland offered the first fully online distance education course in LifeForms animation and Vissicaro led fully online courses in dance appreciation and cross-cultural studies using the application Blackboard (Blackboard, 2004). More recently Kasch, Enders, and Parrish (2004) used two-way videoconferencing, over broadband networks, to generate collaborative dance education pedagogy. During the videoconference, university and high-school students examined the information gap between high-school and college through shared improvisation, reflection, and choreographic problem solving.

Keitha Manning modernized the dance studio to facilitate interactive and dynamic pedagogy. She developed a dynamic classroom where dance studios have computers that allow choreographers to move easily back and forth between developing movement in their bodies and on the computer (Wolfram, 2003).

Extensive dance research in this area is scarce, however some research investigations hold important pedagogical implications in dance. For example, the Performance Lab (TPL), formerly Dance Partners, developed a technology network for interactive exchange to provide rural areas with access to the arts. Funded through the Federal Technology Opportunities Program, TPL's Director Marcia Chapman and Artistic Director Rick Hauser use videoconferencing to coach dance and other performing arts over distances and foresee a network of interactive studios linked together for sharing innovative and challenging works in the performing arts. TPL's video conferencing supports vibrant interactive two-way real time video/audio broadcast. TPL has conducted interactive exchanges around the United States with master teachers. In 2005, students from New Jersey and Minneapolis were connected to world-performer/teacher Risa Steinberg in New York City to learn the subtleties and technical style of Limon's choreographic masterwork, *A Choreographic Offering*.

Learning dance by videoconferencing is by no means easy. It requires letting go of old learning modalities and students taking greater responsibility for their learning in dance. Concern that technology would create social distance is disproved by TPL's research. Hauser and Chapman observe student participants as more engaged, responsive, vocal, inquisitive, and participatory. Students express a deepened sense of focus and a greater sense of engagement in the learning process with interactive exchange. In fact, several TPL students have said that they prefer this method of instruction (Jansen, 2004, p. 47). The U.S. Department of Commerce Technology Opportunities Program (TOP) report, *Networking the Land* (2004), identified TPL as exemplary "groundbreaking" research. "Distance dance ultimately may involve much more than conveying expertise from a handful of experts in cities to disadvantages groups in rural

areas. Early experiments suggest that combining videoconferencing with dance could ultimately evolve into a new art form" (p. 54).

*Dance in Australia and New Zealand (DANZ): International Partnership in Technology-Rich Education* (Mandile, 2004) is another distance education videoconferencing for dance education. DANZ research uses distance education to bring diverse groups together and to promote cultural understanding of "real people in real time." Four groups participated in the DANZ study, including 12 students (11 indigenous) from a state school in Queensland (QLD), a dance teacher from the Virtual Schooling Service, and two different groups of Maori students studying in New Zealand. In addition, principals, teachers, staff, community elders, and parents supported and supervised the students.

DANZ students met once a week for 12 weeks to create a collaborative dance work. In the process, they exchanged ideas, planned activities, solved problems, offered feedback, shared cultural aspects unique to their community, and gained cultural understanding of different cultures through dance (p. 3). The project was considered successful by Mandile, participants, and the observers. All (100%) of the students stated that they were "happy to participate" and that their dancing improved over the 12 weeks. Further, they stated that they felt more confident in themselves.

### *Distance Learning and Webcasting*

Technology has changed the way students learn, think, form relationships, and the way they express themselves. While there is relatively little published information specific to dance, there is worldwide interest among those in the dance community to design internet courses. Such virtual education environments restructure interactions teacher-to-student and student-to-student promoting increased collaboration and open discussion that are not found in traditional dance classrooms.

One of the first totally online university courses for dance education was *Dancing in Cyberspace: Creating with the Virtual Body* led by Garland at Simon Frasier University in 1997 (Garland & Naugle, 1997). Thirty-five participants from Spain, France, the United States, and Canada learned how to design choreography creating their own LifeForms 3-D computer dance animations. Benefits expressed by participants included flexible access to all class materials, collaborative assignments, discussion groups and e-mail critique. Online discussion sessions or "café conferences" offered an opportunity for members of the class to socialize to post messages, express frustrations, tell stories and share individual experiences. The researchers observed that "Cyberspace" students contributed more than was required and that the online environment created a community of supportive peers. Garland elaborates, "Collaborative assignments allow class members to work with others in asynchronous time. Critical feedback and shared progressive assignments are incentives for continuous learning over a shorter, more intense time period" (p. 244).

The advent of distance learning has forever changed higher education. Since 1997, most universities offer distance learning courses specific to dance. The University of North Carolina at Greensborough offers the first fully online certification program in dance. Other online dance training programs include the Royal Academy of Dancing (RAD) in England that has an online component for their Ballet Curriculum and Dance Degree.

Webcasting has become popular instructional modality for dance instruction. A webcast is a one-way transmission live or delayed audio or video broadcast over the Internet. Interactive Gateway is another long-term research project, which examines how webcast technology can support students' acquisition of cognitive skills, nonverbal reasoning, and expressive ability in dance. Parrish and Lindholm Lane (2003) have developed an interactive postmodern dance curriculum incorporating multimedia and online technology for high school dance education. The Interactive Gateway (IG) curriculum was implemented in twenty three-hour workshops with ten area high-school dance students and ten ASU dance education students. All workshops, rehearsals, and performances were Webcast on the award-winning IG web site. Educational innovations extend from Webcasting rehearsals and performances to 2 DVDs documenting the choreographer's directives, and improvisational strategies employed in the reconstruction of celebrated Postmodern choreographer Yvonne Rainer's work *Chair/Pillow*.

IG breaks new educational ground by allowing students and teachers access to the world of the choreographer, dance notator, restager, performers, and performance. The IG curriculum is currently being tested in public and private high-school institutions across the country in the following states: Arizona, Michigan, Rhode Island, Tennessee, Utah, Pennsylvania, and Wisconsin. The evaluation brings credibility and advocacy to this emerging innovative dance instruction. IG melds technology and pedagogy to create compelling arts experiences that dissolve the economic, cultural, and geographical barriers (Parrish & Lindholm Lane, 2003).

When designing an online course, the teacher must consider how the learner will control the experience, provide feedback, participate socially with other class members and communicate with the instructor (Vissicaro, 2003). It is essential to distinguish quality of learning experience vs. mere interactivity. Successful online instruction requires higher-order thinking skills: synthesis, application, and interpretation. Telecommunication offers great opportunity for dance choreography, instruction, and documentation; furthermore, by removing the social, political, and physical boundaries, online classes have the potential to help form communities in dance. The next section will address some of the implications and challenges when integrating technology into the teaching and learning of dance.

At present, adequate field-testing of technology-based curriculum is nonexistent in dance. Formal evaluation is greatly needed if we are to learn the issues surrounding technology delivery systems for dance education.

## Challenges of Teaching and Learning Dance with Technology

Investment in educational technology is increasing with widespread interest in its ability to facilitate teaching and learning. Yet many issues remain unclear and deserve careful examination.

### *Professional Development*

Computer integration has been mandated on a national level at all age levels and within all subjects. But teachers' readiness in operating computers is a concern. Most of the teachers in today's classrooms have had limited training in technology. Struggling with a lack of professional development opportunities and resources, all educators are working to find appropriate strategies for integration. New initiatives include offering technology workshops at national dance conferences for teachers to learn the tools of technology while earning CPU credits.

### *Quality Hardware and Software*

Outdated hardware and limited computer lab access hinder dance teachers' ability to integrate technology into their curriculum. A strong incentive for computer use in dance is the capability of interactive video and sound. Successful presentation of video and sound require 'state of the art' computer hardware. Without quality hardware, digitized dance video appears choppy and clipped, or it does not play at all. With the proliferation of DVD and online technologies, a need for better computers and fast Internet connectivity has schools working hard to meet the ever-escalating demands of industry.

### *Lab Access*

Computer lab access remains limited and controversial. Teachers often compete for lab time. A disproportional designation for math and science computer lab allotment is a concern. These subjects often receive priority, making access difficult for dance personnel. Time is a requirement for teachers to integrate technology in meaningful ways. Dance personnel need support from school administrators to reserve substantial and consistent time in the computer lab or to equip their classrooms with a group of computers for students (Parrish, 2000).

### *Inequity*

Perhaps the most pervasive discord in integrating technology in education is access inequity. As technology promises to revolutionize the way we work, learn, and live, statistics underscore our need to create policies for equal access. A 2000 U.S. Department of Education Report on Technology and Post Secondary Education identified that one third of all children ages 3 to 17 live in a household without a computer. Not surprisingly, the White and Asian children are more likely to have Internet access than Black and Hispanic children. Issues of inequity are strikingly apparent. Information technology continues to divide our society into not only those with access and those without access, but by how the computer functions in one's learning.

### *Safety*

The inclusion of dance movement in the computer lab presents several safety concerns. Advocating for students' movement explorations in the computer lab is important. It is equally critical to discuss appropriate parameters for student exploration. First, teachers must advise that the skilled performers viewed in the video clips are trained to make the movements appear effortless. Second, some movements may surpass children's physical skills and should be discouraged. Third, the computer lab, confined as it is by desks and chairs, allows for very limited (traditional) space for movement explorations. A consequence of having to work in the lab may result in students' modification of movement action, "crimping" their developing movement vocabulary.

### *Passive Learning*

Teachers are concerned that instructional technology in the dance class will create an imbalance between intellectual and physical learning in dance. Educators associate technology with sitting, clicking, observing, and typing. They have an authentic concern that technology will remove the need for kinesthetic experience altogether. Additionally, it must be remembered that videotape does not represent dance, as it flattens the three-dimensional image into a two-dimensional image. According to choreographer Wendy Rodgers reflecting on the dominant role of video in contemporary culture,

Video is video and dance is dance, video uses the human body, but the sense of time and space are entirely different. In terms of creating a rich, physical, aesthetic life for people, it could do as much harm as good. Even with the best video in the world, you are still teaching people to watch TV. (Brooks, 1994, p. 50)

Dance must be experienced in students' own bodies. Teachers are justly apprehensive that with technology, students may view digitized videos of dance, and write reflective essays on dance without physically experiencing anything (Parrish, 2000). There is just concern that computer-assisted instruction will value a more ordered digital knowledge, thrusting apart the mind and the body, or worse, giving the faulty impression that the need for the body can be extinguished altogether. Teachers can effectively conduct initial dance investigation in the computer lab but in order to encourage the making and performing of dance physically expressed in the body a safe unrestricted space is required.

### **Conclusion**

Current educational research praises the value of kinesthetic intelligence (Gardner, 1993), believing that rich knowledge can be gained from the physical embodiment of ideas and feelings. This metacognitive knowledge can then be transferred and applied

to a wide variety of learning contexts. It is unknown how students learning dance may be changed by the integration of technology. Could they become disinclined toward natural kinesthetic movement? Will dance-technology in education further divide dance students from their physical selves, causing them to lose contact with their bodies? Will it remove the joy of improvisatory expression – of “thinking in the moment?” In a society that is already distanced from active physical participation and that prefers television, will dance-technology in dance education create a spectator sport? Might computer-supported dance education encourage teachers who feel uncomfortable with dance or who dislike the creative chaos (and noise) which comes in the dance-making process to conclude that physical expression of dance is inconvenient and therefore unnecessary? Or worse?

Researchers have described dance as an integrated mind-body connection, allowing the dancer to concentrate on available possibilities in space, and at the same time to be relaxed and able to meet and respond to opportunities as they come. Finding and maintaining this synchronous mental state is essential in all types of dance. To achieve this balance, there needs to be sufficient concentration so that the mind and the body are synchronized and the mind is open to impulse and flow of movement of ideas from the body (Rugg, 1963). This cannot happen in a top-down “head-first” manner. The moment of movement is united with the purpose to create and express. It would be dangerous to use the “top of the head” as a filter for the dance experience.

There is just concern that technology promotes a more ordered digital knowledge, thrusting the mind and body apart, or extinguishing the need for the body altogether. Likewise, the computer as a creative tool may inhibit those students who are inclined to be predominately physically expressive, by expecting them to first create in their minds and on screen. That is, technology may prevent and delay some dancers from direct and free expression on the dance floor, by asking them to “think too much.”

Therefore, we – as dance educators and researchers – must remember that technology is merely a tool to improve dance and dance instruction, and that it is meant to be used to *enhance* real, physical movement, not *replace* it. When given its proper place in dance education, technology has much to offer. It maximizes the variety of possible dances that students can create. It enables students not only to execute others’ dances online but also to create their own dances, thereby showing that they have a vital place in dance as choreographers, critics, analysts, and performers. With regard to the dance education profession, technology can offer a bigger picture of what teaching is all about: not only instructing and transmitting knowledge and skills, but evoking within each student what he or she is capable of doing, being, and becoming as a future dance professional.

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