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A Creative Organizational Learning: A Discourse on the Development and Possibility in Applying Computer-Aided Creativity Training for Creative Industries

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Abstract: *This paper has discussed and explored the opportunities and implementations of applying virtual environment in creativity education for facilitating organizational learning, in particular to facilitate employees' creativity, by reviewing the historical development of virtual environment as well as research and practices in applying such technologies in education, and then apply these theories, achievements and cases into the organizational learning domain. This study extracts various notions and experiences in applying computer-aided learning historically in order to explore how virtual technologies can bring change to community of practice in organization. The study found that it is possible to use computer as a creative learning partner for developing creativity training program within an organization. The paper suggests eight directions for actual implementation in organization. One of the important directions from this study is that the use of virtual environment can possibly provide employees with a unique and personal learning experience that could change the future development of creative industry.*

Keywords: *[Organizational learning; Creativity education; Computer-aided training programs; Virtual technologies; Creative industry]*

1. INTRODUCTION TO VIRTUAL LEARNING

Organizational learning is defined as a learning process for building, arranging, adapting knowledge, skill and routing for an organization (Dodgson, 1993). It is not a solitary process but rather every individual employee is learning within an organization together thought social sharing (Bechky, 2003; Simon, 1991). The outcome, the cumulative effect of every individual learning, creating a system for developing an organization (Easterby-Smith et al., 2000). And this system ultimately formed the *communities of practice* (Brwon, 2003). In this case, virtual community is potentially helping every employee learn from each other through this social network within an organization. This research is going to explore the possibilities of applying virtual technologies to undertake creativity education in organizational learning in order to form a creative community of practice for creative industry. The accent of this research is trying to, apply the theories, achievements and cases in implementing technological education into organization learning domain.

Indeed, technology has a long history in changing the way of learning. In 1922, Thomas Edison foresaw that the education system would be changed totally by applying the motion picture in teaching and learning. More than twenty years later in 1946, William Levenson, who was the director of the Radio Station of the Cleveland Public School, highlighted that the educational system was under a revolution because of the portable radio receivers that were installed in the conventional classroom (Levenson, 1946). Psychologist Skinner (1960) introduced his "*Teaching Machines"* in the late 1950s and 1960s, which brought tremendous modifications to traditional teaching methods. Apparently, the popularity of using computer-aided learning approaches since the 1980s brought enormous possibilities to education. Dreyfus and Dreyfus (1986) described *two uses* of computers in education, as overseers of drills and as tutors of learning. The idea of Computer Aided Instruction (CAI) can be used as a tutor, of the successful cases being the LOGO project which has applied the designed computer language and environment as tutee (Dreyfus & Dreyfus, 1986). One of the significant steps of computer-aided learning in education was the invention of the World Wide Web

(WWW). WWW can possibly work as a tool that can enhance collaborative learning intrinsically in diverse perspectives due to its inherent characteristics, such as the interactivity, multi-level communication and autonomous environment. Tim Berners-Lee, the inventor of the WWW, created a set of agreed protocols and standards for users to store their documents on web servers anywhere in the world. Moreover, the WWW is a two-way process in which users not only read web pages, but also can actively create, amend and link new pages (Berners-Lee & Fischetti, 1999). The interactivity of the WWW enables facilitation of any type of educational activities. One of the earlier comments from Dreyfus and Dreyfus (1986) was that learners can actually learn useful things whenever interacting with the computer; the computer is able to help learners to apply what they have learnt to real situations by doing diverse experiments. Nonetheless, the most essential focus is to understand the learning processes of learners, and identify clearly different types of skills before using virtual technology in education (Dreyfus & Dreyfus, 1986). In addition, Dreyfus and Dreyfus foresaw that the computer-aided education will possibly be developed to understand the learners' strengths and weaknesses during their learning processes in order to provide tailor-made instruction, advice and hints, and pose problems, appropriate learning speed and proper pedagogical order. Furthermore, another significant feature of the computer-aided education is the hypermedia technology which facilitates different forms of human communication virtually, such as synchronized and asynchronized communications. Cotton and Oliver (2000) underlined *five* significant characteristics of using hypermedia for communication and learning:

(1) It takes advantage of gathering powerful functions of computers and other telecommunication technologies;

(2) It offers an interactive platform which allows individuals to make active contributions;

(3) It is a very interesting medium which has a non-linear form with no beginning, middle or end;

(4) It allows combinations and chemical reactions by employing multiple media together; and

(5) It is a hybrid medium that leads individuals to experience the medium and create experiences at the same time.

After all, these characteristics of hypermedia are able to provide possibilities for developing any kind of computer-aided educational activities including the creativity training.

In views of the development of virtual environment, Vannevar Bush published an influential essay called *"As We May Think"* in the Atlantic Monthly in 1945, which elaborated the birth of hypermedia and how this new medium contrasts the rigid and hierarchical systems of information retrieving and storing in conventional human thought. Bush (1945) simply pointed out the way in which hypermedia works totally differently from how human mind does.

"It operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate Web of traits carried by the cells of the brain…trails that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory…yet the speed of action, the intricacy of trails, the detail of mental pictures, is awe-inspiring beyond all else in nature" (Bush, 1945: Atlantic Monthly).

Bush (1945) introduced the system called the *Memex* in 1945, which was a new vision of a personal memory system. The *Memex* allows individuals to store, construct and retrieve trails of their associations. By creating these associations, the *Memex* works as a permanent tool of recording for creative researchers (Cotton & Oliver, 2000). Various experiments and studies have been carried out in the development of virtual environment in subsequent years. For instance Douglas Englebart, who is a pioneer of designing office automation, namely mouse and multi-window screens, developed the *Augmentation System* in the early 1960s in order to enhance individuals' abilities to augment human intelligence. According to Englebart, the *Augmentation System* involves knowledge of procedures, human custom, languages and methods, and all training skills. Likewise, Ted Nelson, who coined the term "*hypermedia"* in 1965, introduced a very ambitious project called the *Xanadu* which tried to collect and link together with the total sum of human knowledge. This system, as a hypermedia tool, allows individuals to study, compare, recombine and re-use the accumulated knowledge of mankind. In 1991, Tim Berners-Lee developed the World Wide Web project in order to foster the knowledge exchange and collaborative working within a matrix. Additionally, a very interesting discovery has come from Nicholas Negroponte's Semantic Compression. Negroponte believed that human beings can apply the multisensory capabilities of the hypermedia to express and compress huge amounts of

information and ideas (Cotton & Oliver, 2000). In view of the ways of using computer-aided communication nowadays, some behavioral icons in the systems of MSN or Skype, individuals can apply a smiling or crying icon to present their complicated feelings and opinions in a simple action. If Negroponte is right, the concept of multisensory in computer-aided communication could be a way to develop computer-aided education in a more sophisticated level by applying these simulated emotional displays to facilitate virtual communication among computers, learners and educators. After all, Cotton and Oliver (2000) classified all sorts of research in hypermedia into *five* major directions:

(1) To find out effective ways to map the linked ideas and information in meaningful connections;

(2) To provide multisensory simulation to creative thinkers in various thinking exercises;

(3) To use multiple media to express ideas addressing problems;

(4) To develop forms of using the Semantic Compression in order to simplify any complex systems; and

(5) To foster collaborative activities for working and thinking effectively and creatively.

In addition to the aforesaid characteristics of research focuses in virtual environment, one of the key factors of developing hypermedia is helping learners to think effectively and creatively (Cotton & Oliver, 2000).

2. USING VIRTUAL ENVIRONMENT AS A LEARNING TOOL IN ORGANIZATION

Peter Weibal, who is an artist, curator and theoretician, made use of the term "virtual" early in the 1960s but, in fact, the term "virtual" was already being used in creativity education in the 1920s (Arnheim, 2007). Sutherland coined the term, "virtual reality" as early as 1963. He also designed the prototype head mounted display (HMD) for rendering visual stimuli. His work was followed by other researchers (e.g. Heim, 1998; Strangman & Hall, 2003) who simply defined virtual reality as a computer technology. Fitzgerald and Riva (2001) pointed out that the fundamental nature of virtual reality is a computer-synthesized, three-dimensional graphical environment with visual and auditory output devices. With these systems, users can experience immersive virtual environments as if they were actually there. Graves and Kupsh (1994) suggested earlier about the use of multimedia presentations can give learners valuable experiences that simulate real-world learning through giving them opportunities to guide their own learning. Therefore, the learner-computer interface is one crucial factor in developing a rich computer-mediated world and providing rich information in any virtual platform (Draper, Kaber & Usher, 1999). In other words, in a highly interactive virtual environment, individuals are able to change the visual and spatial sense of the space autonomously in order to create multisensory and highly interactive experiences (Grau, 2004; 2007). Therefore, *images* are now advancing into a completely new arena in which everyone is living within this matrix of artificial images (Grau, 2007). This artificial visualization is indeed shaping the future digital world. Furthermore, interactivity is one of the key components in providing the sense of immersion in virtual environment. Sastry and Boyd (1998) stressed that the individuals' feeling of presence, particularly within real world applications, is determined by the level of interactivity. In other words, learners are able to interact with other people, objects and environments spontaneously.

Some writers (e.g. Steuer, 1992; Lombard & Ditton, 1997; Heeter, 2000; Burnett & Marshall, 2003) have defined interactivity as being a characteristic of any medium in which the user can influence the form and content of the mediated presentation or experience. Johnson and Levine (2008) explained that the fundamental nature of virtual environment allows individuals to interact with other participants, objects and spaces in order to influence the subsequent course of events. According to Johnson and Levine, the current virtual environments, which are attracting masses of users, allow participants to build friendships, communities, societies and even cultures that enrich their experiences, just like in the real world. Furthermore, virtual environment not only establishes highly social environments for participants, it also provides richly expressive environments in which the participants become immersed, by applying multi-sensory simulations such as sound and visual cues, hypperealic perspectives, high levels of interactivity and rich textures (Johnson & Levine, 2008).

More and more research on defining virtual environment, or might it called virtual reality, (e.g. Steuer, 1992; Seidel & Chatelier, 1997; Riva & Mantovani, 2000; Fitzgerald & Riva, 2001) is considering virtual reality as a human experience. In other words, it is a unique experience between the participant and the virtual environment. For instance, Seidel and Chatelier (1997) defined virtual reality as a multi-dimensional human experience which can be generated totally or partially by computer; In line with the comments about the importance of *presence* in the section above, Fitzgerald and Riva (2001) pointed out the fundamental nature of virtual reality is a computer-synthesized, three-dimensional graphical environment with visual and auditory output devices. With these systems, users can experience an immersive virtual environment as if they were actually there. Exploring the understanding of virtual reality further, Slater (1999) highlighted the concept of *presence* as crucial. He emphasized that the concept should included *three* aspects, they are;

(1) The sense of being there in the environment depicted by the virtual environment;
(2) The extent to which the virtual environment becomes the dominant one, for example when participants respond to events in the virtual environment rather than in the real world; and
(3) The extent to which participants, after the virtual environmental experience, remember it as a place they have visited rather than just as images generated by a computer.

However, some researchers (e.g. Rizzo & Buckwalter, 1997; Riva, 1998; Gaggioli, 2001) have argued that the participant's experiences in virtual reality are limited when compared with real-world situations. This is because real-world experiences have sensory richness. Thus, as Gaggioli (2001) reminded us, the application of virtual reality has limitations when it comes to the generalization of research results. Similarly, interpersonal interaction is one of the key components of simulations in virtual environments. For example, most of the multiplayer simulated virtual environments only offer players a basic level of personal reactions (Thorsen, 2006). From a broader point of view, different from creating simulations in pure science domains, Thorsen (2006) highlighted that the problem of communication in the simulation environment for the social sciences is that participants are frequently using verbal rather than numerical communication methods during the process. Moreover, tracking the participant's gaze (frustum) in virtual reality is a big problem. Gaze is one of the key factors for effective communication in real-world face-to-face practices (Yee et al., 2007; Tampone, 2008). A possible method, which may not be a solution, is the application of the Cave Automated Virtual Environment (CAVE) technology, which is a system providing visual information in virtual environments (Blascovich & Bailenson, 2006). This CAVE system allows participants to change their gaze directions at will. Despite the use of CAVE, researchers (e.g. Loomis, Blascovich, & Reall, 1999; Blascovich & Bailenson, 2006) proposed the use of a small light-emitting diode (LED) device to track their movements and gaze directions in a more cost-effective manner.

From the point of view of computer-aided education, the virtual reality system has a huge capacity to measure and record naturalistic behavior within simulated scenarios (Gaggioli, 2001). The highly flexible and programmable nature of virtual reality systems enable researchers to collect, measure and present a wide variety of controlled stimuli and responses made by the subject (Riva, 1999). Therefore, a huge number of educational research studies on the uses of virtual reality have been carried out in many forms and for many purposes (e.g. Ali, 2002; Monahan, McArdle & Bertolotto, 2008). For example, Monahan, McArdle and Bertolotto (2008) applied the virtual reality and multimedia systems as a communication tool to support collaboration among learners; The Florida Virtual School project was designed to develop learners' skills and to provide them with learning resources for a lifelong learning process through the construction of learning communities (Friend & Johnston, 2005). Another similar project, funded by the U.S. Department of Education Technology Innovation Challenge Grant, is The Virtual High School (Pape, Adams & Ribeiro, 2005). This project has shown that one of the key factors in developing a virtual learning community is giving a balance of authority and responsibility for learners' learning. Additionally, researchers (e.g. Lotens & Riemersma, 1997) have agreed that one of the powerful uses of the virtual environment in training and education is to simulate large scale exercises cheaply and effectively For instance control training, battlefield simulation, disaster control training are dangerous to the participants. Moreover, the virtual environment enables the participant to experience some learning contexts that are impossible or difficult to experience in real life (Mantovani, 2001). Mantovani (2001) indicated that another potential application of the virtual environment in learning is that it allows disabled people to participate in various experiments or learning environments easily. Undoubtedly, when we compare

traditional web-based and multimedia technologies in education, computer technologies are more functional and effective for various aspects of training and education. However, Lotens and Riemersma (1997) argued that the perceptual quality of the presentation system in the current state of computer technology is very limited, especially in the communication of haptic, force and vestibular information.

Nonetheless, as suggested by many researchers (e.g. Bruner, 1966; Roussos et al, 1999; Winn, 1993; Standsfield, Sobel, Prasad & Tapia, 2000), virtual environment has the potential to modify and enhancing learners' learning experiences by giving them a rich, interactive and immersive learning environment as well as supporting experiential learning. One of the effective ways of applying virtual reality in organizational learning is to create a unique experience for learners. This makes learners' learning become a personal experience during the learning process.

3. USING COMPUTER TO CREATE AN IMAGINATIVE LEARNING ENVIRONMENT IN ORGANIZATION

Dewey (1956) described *technology* as an art of experimental thinking. *Technology* is an all-pervasive aspect of the human being in daily life (Green, 1999). The Conseil Européen pour la Recherche Nucléaire (CERN) (In English: European Organization for Nuclear Research) created the World Wide Web (WWW) in the 1990s, and web-based learning was applied quickly into educational areas and became one of the promising education tools (e.g. Cailliau, 1995; Brooks, 1997; Sloane, 1997). In fact, after the popularity of the personal computer since the 1980s, more and more people have been able to experience and have used their personal computers in their own ways. In the 1990s, the computer emerged as an expressive medium with the help of color screens, powerful graphics displays and CD-ROMs (Turkle, 1995). Besides, software for creative design and image retouching became a crucial tool in helping artists and designers in creation and artistic expression since 1990. With the assistance of computer technology, artists and designers can share their creative achievements with other individuals whilst appreciating other creative artifacts through virtual platforms and the Internet. Kroll (1995) stated that the computer is popular in creative art development and has completely changed the understanding of the artist-viewer relationship and interaction. Creativity is no longer a passive experience; viewers can be involved in creative exploration with the assistance of computers (Kroll, 1995). Digital creative software are not only assisting professional designers and artists to complete their creative work, but also helping the layman to make creative art pieces easily. An example from a collaborative artwork project called the *Listening Post*, which is designed by a New York artist and a research statistician, was built by generating thousands of people typing away in chat rooms, online forums and search engines, and transforming the data into a symphony of sounds that pulse in time with the flow of data (Andrejevic, 2000). This project made use of the interactions among participants to compose unpredictable musical patterns. Andrejevic (2000) explained that the *Listening Post* project was a representative of digital aesthetics by underlining several characteristic elements of the hyper medium, for instance, the interactivity, ability of digitization and transformation, and open-ended format. Apparently, computer technology, especially the Internet, gives opportunities to individuals to produce creative and expressive creative art pieces, namely paintings, poems and amateur magazines easily (Gauntlett, 2000). In view of education, especially creative education, Schank and Cleary (1995) have introduced their concept of *Engines for Education* in their hyper-book. Some examples of these learning engines can be found inside their studies, for instance demo software called *Broadcast News*, which makes the learning process become an interesting activity by presenting a good demonstration of *Leaning by Doing* to learners. In this engine, learners are able to organize their news-shows with some disparate elements of the program. The *Broadcast News* has applied four learning approaches to the digital platform, which are (1) learning by doing, (2) incidental learning, (3) learning by exploring and (4) case-based teaching. Other cases from Schank's engines include an engine called *Yello* that works for creating social simulation to learners. The engine provides a virtual educational environment that helps learners to understand some business problems and obtain hands-on experiences which are similar to the actual business world. Nonetheless, though the above cases, namely the *Broadcast News* and the *Yello*, are not related to any creative subjects in creativity education, these engines require learners to solve problems by using their creativity and imagination. Such concepts could possibly be applied to teaching and learning creativity education because creativity training is indeed a part of the problem-solving process.

However, how are these computer-aided learning activities possible to facilitate the creative thinking and imagination of learners in creativity subjects? Andrejevic (2000) stated that cyberspace is an imaginative environment because this space is not constrained by the laws of physics. Andrejevic (2000) listed two interesting assumptions about using computer to create a creative learning environment in facilitating learners' creative thinking: (1) if a sculptor wants to create a virtual sculpture, he can ignore the laws of gravity in building it in the virtual environments; and (2) a composer could possibly create a song that is impossible for a human to sing in the virtual space. Andrejevic (2000) explained that the virtual environment is *an externalization of fantasy* which only happens in the human mind. In other words, the virtual space is a place for learners to *realize* their fantasies and explore their creativity and imagination.

4. DOES COMPUTER FACILITATE ORGANIZATION LEARNERS' CREATIVITY?

Researcher (e.g. Lau, 2003; 2006a; 2006b) has asked an interesting question in the era of information age, particularly in the area of fostering E-Learning in creativity education. Does computer facilitate learners' creative thinking? If it is possible, in what ways can the computer helps? What is the role of the computer in conducting the creativity training? To address these questions, Edwards (2000) stated that the computer does help a learner to explore general principles of creativity in a broad sense, and technology is able to assist learners to become creative in society. In the early research, Machrone (1994) explained one of the functions of using technology and the computer which could facilitate *creativity* in the workplace by demonstrating a graphical organization, a mind-map or graphical representation of ideas, to help individuals to structure their thinking and thought processes. Machrone noted that, with the help of these graphical organizations, individuals are able to find out links and relationships between their concepts and ideas in order to seek creative solutions (Machrone, 1994). Similarly, Boden (2004) pointed out that computers are able to facilitate the combinational creativity by putting all prior concepts and ideas to form certain patterns. In other words, computers plays a role as an effective tool for constructing creative solutions for ill-defined problems; either tangible or intangible mind mapping facilitates individuals' creative thinking processes by providing a clear and systematic schema against interwoven difficulties. A practical case can be found in the early research of Proctor (1991), in which he demonstrated the significant function of using computers to enhance learners' creativity by applying a computer program called "*Brain*" in producing creative thought. Proctor's hypothesis is that computers can help learners to destroy thought patterns in solving problems along the process of generating new insights. In his report, Proctor (1991) concluded that creative insights can be generated by gathering linked concepts and ideas into a schema. Proctor strongly supported that the use of computers in creative thinking is to make use of pictures and images as a problem-solving tool.

In addition to the concepts of using the computer as an organizer for mapping individuals' creative thoughts, Huber (1990) underlined the use of computer facilitated project-based creative thinking in many ways. For instance the electronic communication facilitates communication effectively and inexpensively without limitations of time and space; the computer provides recording and index systems for communication in a more reliable and cheaper way; and the computer manages the accessibility of participants in electronic networks. Relevant practices can be found in the computer-based instruction in a creativity training program (Clements, 1991), which combines modeling, coaching and feedback systems in order to teach young children how to apply analogies and metaphors in solving problems (Castillo, 1988). Henderson and Venkatraman (1994) agreed that the computer is able to facilitate individuals' collaboration in disseminating project members geographically due to the function of distributing quantity of data and information easily and effectively. Moreover, individuals' psychological readiness in collaborative creative works can be facilitated through the sharing within this organizational arena, namely the individuals' self-esteem, mutual respect among members, sense of commitment and organization identification (Orr, 1989). Individuals' motivation can also be reinforced through this organizational citizenship (Bateman & Organ, 1983).

Dewett (2003) explained that both time and collaboration factors are some important components of developing individuals' creativity in the organizational arena; collaboration provides new perspectives and knowledge to learners while time is the key to understand how a project is developing. Dewett (2003) suggested that technology could play an essential role for facilitating learners' creative processes by offering an organizational learning mode during the progress especially in large-scale

project-based work. Apart from that, the computer allows individuals to share their beliefs, values and norms quickly and effectively among group members (Dewett, 2003). I argue that the creative thinking process needs certain formal and informal knowledge for learners to acquire and explore. In this case, a common way of using the computer is working as a database because it stores information and knowledge which allows learners to access them in anytime and anywhere. It is important to note that computer not only allows learners to retrieve their prior information and knowledge conveniently, but also helps learners to search for and absorb new knowledge related to the actual problem. Computer works for knowledge codification indeed (Tushman, 1977). Huber (1990) agreed that the computer is able to codify knowledge because the human memory is imperfect and can easily make mistakes; Huber admitted that the computer facilitates individuals to store and retrieve quantities of data in a quicker and inexpensive manner. Additionally, the computer is a labor-saving device that obviously frees people from complex and boring tasks (Edwards, 2000). In this sense, individuals can focus on the essential parts of the creative thinking process, such as problem identification and incubation, instead of dealing with simple calculative analysis, memory and data storage.

Based on the above discussion, the virtual technology seems to play a very positive and functional role in facilitating learners' creative thinking for creativity education in any organization. However, Feldhusen and Clinkenbeard (1986) gave a reminder that different computer-aided creativity training programs obtain diverse results and performances due to the diverse applications and technologies that are employed. McLaren (1993) argued that the computer is not able to facilitate moral guidance in the use of human creativity. McLaren pointed out that since society is enjoying the advantages of using computers in all aspects, people are not willing to realize the side effects of using technology, and this is what McLaren called *The Dark Side of Creativity* (McLaren, 1993). According to McLaren, the computer hinders the development and exploration of emotional factors and human touch within the creative thinking process. Nonetheless, computer technology is only a tool that society can apply to shape the environment, which has neither positive nor negative effects (Papert, 1990). Papert (1990) took a positive view on using the computer for developing individuals' creativity. He pinpointed that people have to think about how to explore the opportunities which computers and technologies can offer instead of worrying about their side-effects on human beings. Despite the argument about the side-effects of using computers and technologies, the computer indeed works as a learning partner of creativity thinking activities for learners by means of playing neither an instructive role nor guidance during the thinking process, but assisting learners in visualizing their thoughts by schema, releasing simple tasks and routines, and fostering effective communication among group members.

5. CONCLUSION AND IMPLICATION

The above sections have discussed and explored the opportunities and implementations of applying computer technologies in creativity education for organization learning, in particular to facilitate employee's creative thinking. It is undoubtedly possible to use computer as a creative learning partner in creativity education within any organization. For instances, computer facilitates the problem-solving processes of employees and to help them to identify wicked problems by mapping problem attributes. In view of employees' learning experiences during the creative training program, the computer can facilitate project-based creativity in many ways, such as enabling effective communication overcoming some of the problems associated with group work amongst busy and distributed learners, and fostering collaborative learning among employees within the community of practice. The virtual environment and multi-users domains could enhance collaborative learning among employees during the creativity training programs.

All in all, to summarize various notions from researchers (e.g. Schank & Cleary, 1995; Andrejevic, 2000; Cotton & Oliver, 2000), eight directions can be suggested for further implementation of virtual learning in creativity education in order to facilitate organizational learning, they are;

(1) The interactivity of computer technology helps employees to be the active contributors of their learning process in creativity training in the organization.

(2) The power of telecommunication technologies in computing facilitates multi-users communication and group discussion within the internal creativity training programs. In other words, computer fosters collaborative learning among employees in creativity training effectively.

(3) The rich media, includes text, image, animation, movies and sound, enhances employees' creative learning experience in their learning process.

(4) The virtual environment is an autonomous environment that facilitates learning by doing and explorative learning. These are essential to creative thinking since creativity involves active and explorative manners.

(5) The computer technology provides employees with an imaginative virtual environment to explore their creative ideas as well as developing their unique learning experience.

(6) Computer technology helps employees to link and map their ideas in an informative and systematic way.

(7) The virtual technology provides employees with multisensory simulation. It triggers employees' idea generation through these multi simulations.

(8) The *presence* in virtaul environment creates a unique and personal learning experience to employees in creativity training programs.

Among these suggestions, it is one of the important to note that the use of virtual environment can possibly provide employees with a unique and personal experience in creativity training program within an organization. A unique and personal learning experience is essential in creativity education since creativity itself is looking for unique execution and originality.

REFERENCES

Andrejevic, M. (2000). Art in Cyberspace: The Digital Aesthetic. In D. Gauntlett & D. Horsley (Eds.), *Web Studies*. USA: Oxford University Press.

Arnheim, R. (2007). The Coming and Going of Images. In O. Grau (Ed.), *MediaArtHistories*. Cambridge, MA: MIT Press. 15-141.

Bateman, T. S., & Organ, D. W. (1983). Job satisfaction and the food soldier: The relationship between affect and employee "citizenship". *Academy of Management Journal, 26*, 587-595.

Bechky, B. (2003) Sharing meaning across occupational communities, *Organization Science*, 14(3), 312-330.

Berners-Lee, T., & Fischetti, M. (1999). *Weaving the Web: the past, present and future of the World Wide Web by its inventor*. London: Orion Business Books.

Blascovich, J., & Bailenson, J. (2006). Immersive Virtual Environments and Education Simulations. In S. Cohen, K. E. Portney, D. Rehberger & C. Thorsen (Eds.), *Virtual Decisions: Digital Stimulations for Teaching Reasoning in the Social Sciences and Humanities*. New Jersey: Lawrence Erlbaum Associates, Inc. 229-253

Boden, M. A. (2004). *The creative mind: myths and mechanisms* (2nd ed.). London ; New York: Routledge.

Brooks, D. W. (1997). *Web-teaching: a guide to designing interactive teaching for the World Wide Web*. New York: Plenum Press.

Brown, J. S. (2003) Foreword: Innovating Innovation, *Open Innovation*, Cambridge MA: Harvard Business School Press.

Burnett, R., & Marshall, P. D. (2003). *Web Theory. An Introduction*. London: Routledge.

Bush, V. (1945). As we may think, The Atlantic Monthly. Retrieved September 18, 2000, from http://ccat.sas.upenn.edu/~jod/texts/vannevar.bush.html

Cailliau, R. (Writer) (1995). A Short History of the Web: Text of a speech delivered at the launching of the European branch of the W3 Consortium. Paris.

Castillo, L. C. (1988). The effect of analogy instruction on young children's metaphor comprehension. *Roeper review, 21*, 27-31.

Clements, D. H. (1991). Enhancement of creativity in computer environments. *American Education research Journal, 28*, 173-187.

Cotton, B., & Oliver, R. (2000). *Understanding Hypermedia 2000*. London: Phaidon.

Dewett, T. (2003). Understanding the relationship between information technology and creativity in organization. *Creativity Research Journal, 15*(2 & 3), 167-182.

Dewey, J. (1956). *Philosophy of Education*. Ames, Iowa: Littlefield, Adams.

Dodgson, M. (1993) Organizational Learning: A review of some literatures, *Organization Science*, 14(3), 375-394.

Draper, J. V., Kaber, D. B., & Usher, J. M. (1999). Speculations on the value of telepresence. *CyberPsychology & Behavior, 2*, 349-362.

Dreyfus, H. L., & Dreyfus, S. E. (1986). *Mind Over Machine: The Power of Human Intuition and Expertise in the Era of the Computer*. USA: The Free Press.

Easterby-Smith, M., Crossan, M., Nicolini, D. (2000) Organizational learning: Debates past, present and future, *Journal of Management Studies*, 37(6), 783-796.

Edwards, S. M. (2000). The Technology Paradox: Efficiency Versus Creativity. *Creativity Research Journal, 13*(2), 221-228.Feldhusen and Clinkenbeard (1986)

Fitzgerald, M., & Riva, G. (Eds.). (2001) Telemedicine Glossary. European Commission-DG INFSO.

Gaggioli, A. (2001). Using virtual reality in experimental psychology. In G. Riva & C. Galimberti (Eds.), *Towards cyberpsychology: mind, cognition and society in the internet age* (pp. 157-174). Amsterdam: IOS Press.

Grau, O. (2004). Immersion and Interaction: From circular frescoes to interactive image spaces. In K. N. Medien & i. Ü. Medienkunst (Eds.), *Rudolf Frieling and Dieter Daniels, eds. Wien*. New York: Springer-Verlag. 303-304.

Grau, O. (2007). *MediaArtHistories*. Cambridge, MA: MIT Press.

Graves, P. R., & Kupsh, J. (1994). Multimedia presentations. *Instructional Strategies: An applied research series, 10*(4), 1-6.

Gauntlett, D. (2000). Web Studies: What's New. In D. Gauntlett & D. Horsley (Eds.), *Web Studies*. USA: Oxford University Press.

Heeter, C. (2000). Interactivity in the Context of Design Experience. *Journal of Interactive Advertising, 1*(1). Retrieved December 5, 2001 from the World Wide Web: http://www.jiad.org/vol1/no1/heeter/.

Heim, M. (1998). *Virtual realism*. New York: Oxford University Press.

Henderson, J. C., & Venkatraman, N. (1994). Strategic alignment: A model for organizational transformation via information technology. In T. J. Allen & M. S. S. Morton (Eds.), *Information technology and the corporation of the 1990s* (pp. 202-220). New York: Oxford University Press.

Huber, G. P. (1990). A theory of the effects of advanced information technologies on organizational design, intelligence, and decision making. *Academy of Management Review, 15*(1), 47-71.

Johnson, L. F., & Levine, A. H. (2008). Virtual Worlds: Inherently Immersive, Highly Social Learning Spaces. *Theory Into Practice, 47*, 161-170.

Kroll, J. (1995). Computers and creativity: The arts. *Newsweek,* 68.

Lau, K. W. (2003). *Can computers assist creative thinking? An investigation into eLearning in art & design*. Paper presented at the CITE Research Symposium CITERS 2003. Hong Kong.

Lau, K. W. (2006a). *Can computers assist design students to develop their creative minds? An investigation into computer-aided pedagogy in design education.* Paper presented at the ED-MEDIA 2006 - World Conference on Educational Multimedia, Hypermedia & Telecommunications, Orlando, USA

Lau, K. W. (2006b). *Designing a Ubiquitous Learning Workspace for Conducting Creative Thinking Exercise in Tertiary Design Education.* Paper presented at the WMUTE2006 - The 4th IEEE Intl Workshop on Wireless, Mobile & Ubiquitous, Athens, Greece.

Levenson, W. B. (1946). Educational Broadcasting: The Cleveland Plan. *Hollywood Quarterly, 1*(3), 303-311.

Lombard, M., & Ditton, T. (1997). At the Hear of it all: The Concept of Presence. *Journal of Computer Mediated Communication, 3*(2).

Loomis, J., Blascovich, J., & Beall, A. (1999). Immersive virtual environment technology as a basic research tool in psychology. *Behavior Research Methods,Instruments, and Computer, 31*, 557-564.

Machrone, B. (1994). Computer and creativity. *PC Magazine,* 87.

McLaren, R. (1993). The dark side of creativity. *Creativity Research Journal, 6*, 137-144.

Orr, J. E. (1989). Sharing knowledge, celebrating identity: War stories and community memory among service technicians. In D. S. Middleton & D. Edwards (Eds.), *Collective remembering: Memory in society*. Beverly Hills, CA: Sage. 169-189.

Papert, S. (1990). Computer Criticism vs. Technocentric Thinking Retrieved September 8, 2001, from http://www.papert.com/articles/ComputerCriticismVsTechnocentric.html

Proctor, T. (1991). Brain, a computer program to aid creative thinking. *Journal of Creative Behavior, 25*, 61.

Riva, G. (1998). From toys to brain: Virtual reality applications in neuroscience. *Virtual Reality, 3*, 259-266.

Riva, G., & Mantovani, G. (2000). The need for a socio-cultural perspective in the implementation of virtual environments. *Virtual Reality, 5*, 32-38.

Rizzo, A. A., & Buckwalter, J. G. (1997). Virtual reality and cognitive assessment and rehabilitation: The state of art. In G. Riva (Ed.), *Virtual reality in neuro-psycho-physiology - Cognitive, clinical and methodological issues in assessment and rehabilitation*. Amsterdam: IOS Press. 123-145.

Sastry, L., & Boyd, D. R. S. (1998). Virtual environments for engineering applications. *Virtual Reality, 3*, 235-244.

Schank, R., & Cleary, C. (1995). Engines for Education, Educational Outrage Retrieved October 4, 2000, from http://engines4ed.org/hyperbook/

Seidel, R. J. and Chatelier, P. R. (1997). *Virtual reality, training's future? Perspectives on virtual reality and related emerging technologies*. New York: Plenum Press.

Simon, H. A. (1991) Bounded rationality and organizational learning, *Organization Science*, 2(1), 125-134.

Skinner, B. F. (1960). Teaching machines. *Science*, 128 (3330), 969-977.

Slater, M. (1999). Measuring presence: A response to the Witmer and Singer Presence questionnaire. *Presence, 8*(5), 560-565.

Sloane, A. (1997). Learning with the Web: Experience of Using the World Wide Web in a Learning Environment. *Computers Education, 28*(4), 207-212.

Steuer, J. S. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication, 42*, 73-93.

Strangman, N., & Hall, T. (2003). Virtual reality/simulations, from http://www.cast.org/publications/ncac/ncac_vr.html

Tampone, K. (2008). Companies, colleges use virtual worlds as training tools. *Central New York Business Journal*, 11.

Thorsen, C. (2006). Current and Future Trends in Digital Role-Play Simulations. In S. Cohen, K. E. Portney, D. Rehberger & C. Thorsen (Eds.), *Virtual Decisions: Digital Stimulations for Teaching Reasoning in the Social Sciences and Humanities*. New Jersey: Lawrence Erlbaum Associates, Inc. 255-271.

Turkle, S. (1995). *Life on the screen: identity in the age of the Internet*. New York: Simon & Schuster.

Tushman, M. L. (1977). Communication across organizational boundaries: Special boundary roles in the innovation process. *Administrative Science Quarterly, 22*, 587-605.

Yee, N., Bailenson, J. N., Urbanek, M., Chang, F., & Merget, D. (2007). The Unbearable Likeness of Being Digital: The Persistence of Nonverbal Social Norms in Online Virtual Environments. *CyberPsychology & Behaviour, 10*(1), 115-121.