ESTABLISHING CREATIVE-FRIENDLY SPACE FOR DESIGN THINKING IN SHARED VIRTUAL REALITY IN TERTIARY DESIGN EDUCATION

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ABSTRACT:

This paper aims at reviewing the major components of establishing a creative-friendly space in shared virtual reality for facilitating students' design thinking in tertiary design education. One of the important ingredients is creating environmental stimulation for creativity enhancement. As Green (1974) states that design education is fundamentally influenced by environment not only the hardware but also the senses of sight, sound, taste and touch. In shared virtual reality, the platform provides a learning community with various learning activities and stimulation. In this paper, various topics will be discussed for providing the underlying principles in establishing creative-friendly virtual learning environment. Emphasis is placed on (1) the environmental factors in design thinking and creativity; (2) issues of socio-cultural environment as a stimulus of creative minds; (3) How an environment serves as stimulus and information provider for design study; (4)

how to create a heuristic shared virtual space for design thinking; and (5) the basic principles of establishing shared virtual environment for facilitating design thinking.

1. ENVIRONMENTAL FACTORS IN DESIGN THINKING AND CREATIVITY

"I believe that the only difference between a muddle-head and a genius is that between extracting wrong characters and right one. In other words, a muddle-headed person is a genius spoiled in the making" ~ James, 1890

William James (1842-1910) is one of the earliest philosophers who pointed out the significance of the *Environment* over genetic inheritance in determining ability. James (1890) challenged what Galton's (1869) belief about the assumption of hereditary genius, which an individual's creative ability is inherited. Nonetheless, James's assumption triggered the further studies (e.g. Jacobs, 1961; 1969; 1984; Vygotsky, 1978; Feldhusen and Treffinger, 1980; Amabile and Gryskiewicz, 1989; Ripple, 1989; Fischer, 1993; Sternberg and Lubart, 1995) in finding the relationships between human creativity and environment. After more than a century, researchers commonly believe that the *Environment* plays an essential role in facilitating individuals' creative thinking processes. However, that doesn't mean all kind of environments can enhance individuals' creative performance. I believe that the deliberately arranging creative activities and creative-friendly environment, wherever in classrooms, halls, game centers or in the virtual reality, is one of the key factors to release individuals' creative potentials.

In view of design study, Green (1974) states that design education is fundamentally influenced by environment not only the hardware, but also the senses of sight, sound, taste and touch. Green explains that those environmental elements, such as films and advertisements, involve human decision making for design solutions are contributing to design education. Actually, design education is giving students chances to make decisions and develop their value judgments (Green, 1974). Green also notes that the traditional values are based on classic cultural traditions of aesthetics, however, this value judgment is no longer necessary in design education since the new value judgment is established relates to the environmental factors of design students.

"Strong sense critical and creative thinkers, however, are committed to using their abilities to seek out the most accurate and fair positions regardless of or in spite of their own particular interests or desires" ~ Richard et. al., 1995

Similarly, Richard et al. (1995) distinguish the weak sense and strong sense of critical and creative thinking. Richard points out that the common weakness of a creative thinker is being too concentrate on their interests and desires within their context. Therefore, constructing knowledge from surrounding, and developing students' personal value judgment towards current issues could be a crucial factor to release students' creative potentials. In other words, environmental factors play a role of stimulating creative thinking.

2. SOCIO-CULTURAL ENVIRONMENT AS A STIMULUS OF CREATIVE MINDS

Arieti (1976) stresses that creative act can not be judged without the references of environmental factors. Arieti uses a term "a desirable enlargement of the human experience" to describe the outcome of creative act. According to Arieti, creative act has TWO intentions, which are (1) producing a novel perspective of seeing our world to the society and culture domain; and (2) extending this existential space for further explorations (Arieti, 1976). Arieti explains that individuals' creative ability in this new space is predominantly controlled by the existing environmental factors. Likewise, Tradif and Sternberg (1988) agreed that individuals' creativity can only be assessed by considering the creative solution with respect to their culture. Lubart (1990) emphasizes how creativity is manifested in different cultures; he states that a cultural environment with rights and freedoms of every individual can facilitate the development of personal creativity. Similarly, Gruber (1998) and Gruber and Davis (1988) introduce an evolving systems approach to creativity. They believe that creativity is influenced by social relationships, historical and institutional factors. McLaren (1993) supports the study of various external validities as a significant factor. Edward (2000) points out that individuals' creativity is highly related to the individuals' prior knowledge and the environment in which they operate. According to the above discussions, I believe that individuals' creativity can be interpreted as a novel association of concepts extracted from surrounding environment while that creative idea is judged by social and cultural factors eventually. Thus, individuals' creativity is significantly depends on the social and cultural stimulations. Vidal (2003) highlights that originality and creativity is linked to the socialization process, and therefore creativity are belonging to the processes of social differentiation as well as how an individual shapes his/her personal identity. This *Personal Identity* is an individual's cognitive and affective system which helps him/her to situate the social role

playing in society (Vidal, 2003). Accordingly, creativity can be nurtured differently by social and economic environment (Florida, 2002).

Because of these influences of environmental stimulations, individuals' creativity can be enhanced or detracted within particular social and cultural contexts (Arieti, 1976). In order words, the availability of cultural means is crucial in developing individuals' creative thinking. Simply imagine that Einstein were not really able to create the theory of *Relativity* if he was grow up in Africa. Furthermore, some substantial explanations can be found in Aireti's (1976) idea, he postulates NINE positive social factors for creating creative society and culture, they are, (1) availability of cultural means; (2) openness to cultural stimuli; (3) stress on becoming and not just on being; (4) free access to cultural media for all citizens without discrimination; (5) freedom, or even retention of moderate discrimination, after severe oppression or absolute exclusion; (6) exposure to different and even contrasting cultural stimuli; (7) tolerance for diverging views; (8) interaction of significant persons; and (9) promotion of incentives and awards. These nine factors outlined a creative learning environment has to be open to diverse cultures with compromise and tolerance, and this exclusive learning space needs to provide easy access to all cultural stimuli, media and persons as well as facilitating interaction among them.

Although individual's creativity is nurtured by diverse personal interests, knowledge, experiences and perspectives (Simonton, 1999), creativity comes from individuals' organizations where the place they generate their knowledge, exploration and discovery. It can be understood as the *communities of practice* (Brown and Duguid, 2000). Florida (2002) agreed that though creative individuals are come from diverse forms, the commonality is that they are all nurtured and cultivated by organizations and environments. In fact, Piaget (1918) pointed out the significance of socio-cultural factors to creativity nearly a century ago, Piaget states that an individual's personality is a social representation of himself which highly affected by his milieu. According to Piaget, this milieu is a process of how an individual transforms his/her ideal cultural representation into personal experience. Vygotsky (1930) also explains that *art* is a significant component of children's life, especially in children play, which contains full of absurdities, nonsense and inversions. Vygotsky believes that art is creative performance of a child which is affected by the social environment. It is very difficult to identify or explain the said relationship in detail, as Vygotsky (1930) admits that there is no any sociological theory can actually explain the originality of ideology since the individual's consciousness is the origin of ideology and that consciousness interprets art. Vygotsky (1930) describes *culture* is a convergence of every individual's emotion by mean of art. And these forms, techniques and ways of making artworks are developed historically

and socially. In addition, Rogers (1954) focuses on studying the relationship between socio-cultural factors and creativity, he underlines that the social environment is stimulating creativity by supporting an individual to pursue his own uniqueness spontaneously. Rogers believes that creativity is encouraged by an individual's exploration of his personal aptitudes and interests.

A significant research called *Evolutionary Theory of Discovery and Innovation*, which conducted by Scott Findlay and Charles Lumsden in 1988 at the University of Toronto, has introduced a concept of *Linking Thesis* which introduced a series of interesting hypotheses regarding the relationships between creativity and other factors, for instance, the linkage with the socio-cultural environment.

"Our system concept is then integrated with current theories of bicultural dynamics, leading to the hypothesis that creative activity is an evolved strategy in which rules of cognitive development act through the joint inheritance of genetic and cultural information" ~ Findlay and Lumsden, 1988

Findly and Lumsden (1988) believe that creative activity comes about because of the result of the establishment of new linkages among neurons in responding to the existing socio-cultural structure and outer simulations. That is what Findly and Lumsden explained "a consequence of a novel sequence of group selection events" (Findlay and Lumsden, 1988). Further exploration of this hypothesis, Findly and Lumsden state that there is a complex *interaction* among FIVE aspects of human existence and each of these aspects is influenced by the others in certain degree so as to release human creative potential. These FIVE aspects are (1) the genotype which is the genetic constitution of a person; (2) the brain development; (3) the cognitive phenotype which is a thinking mode that developed by genetically and environmentally determined manner; (4) the physical environment; and (5) the socio-cultural environment. According to Findly and Lumsden's Linking Thesis (1988), environmental factor plays an indispensable role in releasing individuals' creative potentials by making linkages among cognitive thinking mode, physical and socio-cultural environment. Similarly, Csikszentmihalyi (1990) notes that creative performance of an individual is highly bound to THREE key factors. They are (1) the domain, (2) the person, and (3) the field. Csikszentmihalyi explains that individual's creative thinking process is working by the interaction of these factors. Accordingly, that can be interpreted as a creative-friendly learning environment has to facilitate these linkages by deliberately organizing learning spaces and applying socio-cultural stimulations.

3. ENVIRONMENT SERVES AS STIMULUS AND INFORMATION PROVIDER FOR DESIGN STUDY

In view of design study, Fischer (1993) states that the dual factors of establishing a design environment are (1) offering individuals some mechanisms that help them to contextualize information to strategy or solution; and (2) undertaking design activities with the help of rich information. Further elaboration from Fischer, design environment has to serve as a *stimulus* for individual that provides a multifaceted architecture and suggestion for further development and decision making. In other words, those successful environments in enhancing individual's creativity must be multidimensional, simulative and interactive (Jacobs, 1961; 1969; 1984). Regarding a learning environment, Addison and Burgess (2000) stress that individuals are being motivated easily by a well structured and stimulated learning environment. Addison and Burgess believe that both autonomous learning and getting ownership of ideas are equally important in building learning environment. Certainly, environment does help children to grow up into an intellectual life (Vygotsky, 1978).

In order to establish an environment of rich stimulations for design study, some strategies were adopted to reinforce creative-friendly learning space, namely the climate analysis (e.g. Amabile and Gryskiewicz, 1989), the manipulations of group composition (King and Anderson, 1990), and the role modeling or mentoring (Zuckerman, 1974). One of the remarkable strategies is establish a *Creative Climate* to stimulate individuals' creative performance (Feldhusen and Treffinger, 1980). According to Feldhusen and Treffinger, TEN recommendations have been made to establish a creative climate within any environment, they are (1) the learning space should able to proactively accept any unusual ideas and responses from students; (2) the space should help students realize errors and meet acceptable standards in a supportive atmosphere; (3) the space can aware students' interests and ideas; (4) the space allows sufficient time for students to think and develop their creative ideas; (5) the space is able to establish a climate of mutual respect and acceptance between student-to-student and students-to-teachers; (6) the space realizes that creativity happens in all curricular areas and disciplines; (7) the space facilitates divergent learning activities; (8) the space creates a warm, supportive atmosphere which provides freedom and security in exploratory thinking; (9) the space offers students choices and let them involves in decision-making process; and (10) the space demonstrates the value of involvement by supporting student ideas and solutions to problems and projects. Comparing the above TEN

recommendations to Torrance's idea of creative teaching (Torrance, 1981) which focuses on *motivation, alertness, curiosity, concentration* and *achievement*. Some common understandings could be found in both sides, for instances the items 8 and 9 are focus on establish a warm and supportive atmosphere which help to *motivate* individual to explore their ways of thinking under a free and secure circumstance as well as offer choices for decision making; In items 2 and 6 state that individual has to aware his/her own errors and realize how creativity takes place, that is a sense of *alertness*; the item 3 notes that the space has to aware individuals' interests and ideas in order to develop their *curiosity* towards everything within the environment; In item 4, Feldhusen and Treffinger mentioned about providing sufficient time for creative development in order to enhance individuals' *concentration* during the creative thinking process; last but not least, items 2 and 10 aim at demonstrating the values of involvement by supporting individuals' ideas and help them to realize errors and meet acceptable standards, that is what Torrance has mentioned about the *achievement*. These common understandings indicate that a creative-friendly environment is closely interacted with the creative teaching methods in order to produce creative climate.

Another important component of forming creative climate is *simulation*, Sternberg and Lubart (1995) emphasizes the environmental stimulation for creativity enhancement. Sternberg and Lubart suggest that creativity can be stimulated by THREE different levels, which are the (1) level of sparking creative ideas; (2) level of encouraging follow-up of creative ideas; and (3) level of evaluating and rewarding creative ideas. Based on Sternberg and Lubart's idea, I could say a creative-friendly environment has to provide simulation on provoking individuals' idea explorations and evaluations.

In addition, creativity can be interpreted as a way of suggesting novel solution to problem within a subject domain. Thus, this problem solving skill may require certain knowledge in particular subject domain. According to the prior case studies in that areas (e.g. Gruber, 1981; Gardner, 1983; Gruber and Davis, 1998), a creative individual is equipped with both *Formal* and *Informal* Knowledge. Further elaboration from Csikszentmihalyi (1988), he distinguishes *Formal* Knowledge is acquired from the knowledge of particular domain, while *Informal* Knowledge is obtained by the knowledge of a field, for instance the informal knowledge can be developed from the social system in that domain. In other words, to develop individuals' creativity in some ways is based on enhancing both *Formal* and *Informal* Knowledge in their subject domains and environments. An example can be found in gameLab project by Zimmerman and his colleagues (2003), they developed a game development studio for enhancing creative activities and

significantly constructing a *climate* of design research for designing and developing computer games.

"Any office is a nexus for the exchange of ideas, and at gameLab we encourage staff to share the insights from their informal play research." ~ Zimmerman, 2003

The gameLab equips with a design research library which includes books, games, graphic novels, DVDs, toys, card games and other playful objects. This setting aims to foster design research and creative thinking by encouraging staff to collect and share cultural objects for any formal and informal investigations. In gameLab project, both formal (library) and informal (share playing experience) knowledge have been developed within the creative environment. This successful case in gameLab can be applied into a teaching and learning environment effectively by deliberately arranging learning activities within. As I mentioned in the above paragraphs, a creative-friendly learning environment requires a creative climate which is constructed by some important components such as motivation, encouragement, simulation, openness, alertness and achievement. In fact, Wallach and Kogan (1965) had already pointed out the significant of *development of a game-like atmosphere* for individual during the creativity exercises. This playful environment forms creative climate which allows individuals to be free on exploring, sharing and evaluating their creative thoughts. All in all, a creative-friendly environment should be carefully established by deliberately arranging creative teaching methods and learning activities as well as promoting creative climate. Besides, the environment also ought to provide a knowledge base which involves formal and informal knowledge for individuals. I believe that environment is not only responsible for fostering the exploration of possible solutions, but also providing underlying knowledge for idea analysis and evaluation.

To create a proactive learning environment for releasing individuals' creativity, I believe that *encouragement* is crucial component for that. Champers (1972) investigated the effects of teacher-student relationship, teacher personality and classroom behavior on individuals' creativity in order to study the characteristics of creative behaviors. Champers found out that *encouragement* is the best indicator in student-teacher relationship of developing creativity. Chambers (1972) and Ripple (1989) specified how environment facilitating creative performances of individuals by providing opportunities, or may say encouragement, to individuals based on stimuli and relevant information; individuals are able to make use of these stimulations to develop their creativity by associations. In contrast, individuals' creative abilities could be hindered by circumscribing these associations (Chambers, 1972; Ripple, 1989). Another supporting idea is

from Torrance (1981), he stresses that the purpose of creative teaching is establish a *responsible* environment by teachers' teaching enthusiasm and their openness of appreciating every individual's differences.

In addition, I believe that *learning* differs from *knowing*. Learning is a process of understanding while knowing (creating knowledge) is the development of how an individual interacting with environment (Piaget, 1962). Many researchers (e.g. Goodson, 1992; Starko, 1995; Baer, 1997; Hickey. 1999; Kiely, 1998; Rejskind, 2000) believe that a creative classroom environment, or learning space, can provide a brightly colored, supportive, comfortable and welcoming atmosphere to individuals in order to help them to be cooperative, friendly, excited and interested. An example can be found in the research of Howard Gardner and his associates (Harvard Graduate School, 2004), they are continuously conducting the creative research called "*Project Zero"* from 1972 to 2000 at the Harvard Graduate School of Education. The project aims at understanding and enhancing learning, thinking and creativity in arts. The research team suggests a new approach to help individuals, groups and institutions to develop their creative capacities - designing strategies for creating *culture of thinking* in the classroom. Gardner and his associates introduced the concept of *Smart Schools* which contains guidelines that strongly emphases on developing students' deep understanding, flexible and active use of knowledge. The research team believes that *learning* is a consequence of *thinking* (Harvard Graduate School, 2004). This constructional learning approach allows students to shape their learning personally relevant, and that could eventually establish students' knowledge base (Papert, 1990).

4. CREATING HEURISTIC SHARED VIRTUAL SPACE FOR DESIGN THINKING

Jacobs (1961; 1969; 1984) reminds that a creative community needs an appropriate physical environmental setting as well as some participants who are able to generate ideas and facilitating during the creative process. Human creativity is indeed multifaceted and multidimensional which must be nurtured and cultivated by both individual thinking habits and social stimulations within the community (Florida, 2002). Thus, it is easy to imagine that a sensible and effective communication among participants and a healthy community setting within a *space* would be one of the key factors to establish heuristic shared environment for facilitating design thinking process. In fact, Information and Communication Technology (ICT) is inherently facilities learning and communication among teachers, students and administrators within a learning community

(Bouras, Philopoulos and Tsiatsos, 2001). In addition, Cross (1999) believed that computer technologies are able to support *design process* in the areas of enhancing designers' creativity by interactive system and developing computational machines that expedites design practices. Cross provided a clue that if an interactive system is aiming to foster designers' creativity, then this system must be designed according to the cognitive behavior of designers. According to the prior studies in the said area, some attempts had established a computer support system for empowering the design creation process (e.g. Noguchi, 1998; Maher and Tang, 2003), while some attempts had upgraded the computer technology with advanced performances, researchers believed that this *creative* computer can assist designers' creative thinking processes (e.g. Rogers, 1959; Koestler, 1964; Arieti, 1976; Hofstader, 1979; Boden; 1990). One of a distinguish examples, Fischer et al (1993) who established versions of computational environments which called "*Domain-Oriented Design Environments*" (Fischer, 1992). This computational design environment helps individuals, particularly designers, to understand and explore the creative methods of breakdowns. Fischer et al (1993) expound that the system assists designers to aware of the breakdowns whenever they participated into this environment. Likewise, Edmonds and Candy (1996) who concern the interactive system design for creative users, they adopted a criteria-based modeling to support designers for completing creative tasks in computational environment. Apparently, computer technology has been closely involved in creative and design thinking practices in different levels and domains. Even Cross (1999) admitted that some of those existing design machines and applications are trying to perform designers' professional, in other words, machine that can do what designer does. However, under the blossoming explorations of ICT in design practices, Fischer et al (1993) remind that the difficulties of constructing a computational environment is provide *right* information in a *right* time.

5. ESTABLISHING SHARED VIRTUAL ENVIRONMENT FOR FACILITATING DESIGN THINKING

A common misunderstanding of interactivity in electronic learning platform that means individuals can click buttons to navigate autonomously, Seitzinger (2006) rectifies that an interactivity learning is that individuals can participate with the course elements and learning environment actively as well as arranging their own learning process and materials autonomously. Because of the convergence of new open media tools and constructivist learning recently, these factors help educators to understand the usage of constructivist online learning environments as well as the implementation of this learning mode (Seitzinger, 2006). Youngblut (1998) completed an

extended review on applying virtual reality for educational purposes, he reported that there is only two percent of virtual reality applications are supporting multiple users and almost all them are provide limited types of interaction between participants. In view of the design education which is even worst, this subject area is lack of sufficient online learning materials, engines, and virtual platforms in helping design students to develop their design thinking skills (Lau, 2003). All in all, an effective shared virtual reality consists of using various ICT components to support students' learning processes. ICT plays a very essential role in conducting design thinking to design students in virtual space. In my previous research in using ICT to conduct creative thinking exercise (Lau, 2006a; 2006b), the following implications have been found in reviewing the advantages of using ICT to establish a shared learning virtual platform for facilitating design thinking, they are;

- Flexibility in digital platform: Virtual platform provides a flexible learning environment to students without limitations in time and space;

- Stimulation in digital environment: Virtual platform can wider students' horizon through digital media without any space constraint. Thousands of stimulations in terms of astonishing websites, images, pictures and interactive files stimulating students' design thinking; and

- Motivation in doing design thinking exercises: Younger are inherently being attracted and familiar with the Internet. Students are willing to use computer as their learning partner rather than receiving too much instructions and information from teachers.

In addition, Myerson (2003) states that a creative space is not about creating visually "wacky" or attention-grabbing environments, the space has to help individuals to develop new knowledge within the organization by tailoring the physical environment to fit the requirements. Meanwhile, the creative space has to be able to help individuals to de-stress, open their minds and inspire each other. This underlying principle can also be applied into building a shared learning virtual reality for design education. To establish a virtual learning space for facilitating design thinking for design students, is neither focus on the system nor interface designs of the ubiquitous space; that is actually the building of learning community, creating diverse simulations, providing peers and teacher supports as well as the appropriate design of learning activities.

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