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Structural Model of Simulation – Social Constructionist Perspective

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Abstract: The purpose of this study is to establish a viable structural model of simulation in learning from the social constructionist perspective. The study is based on one of my empirical studies about knowledge construction in learning community and also the researches on simulation from the interdisciplinary fields. The findings indicate that simulation is a process of designing and practicing a model generated from the representational structure of the real world and modifying the model according to the specific contexts. Simulation is useful for gaining analogous knowledge, knowledge that has similar or relevant structures between the simulatee and simulator.

Purpose of the Study

Simulation is the technique of imitating a subject in a suitably analogous situation. It has been applied in the fields of computers, engineering, entertainment, healthcare, education and training, etc. (Smith, 1998). Many researches on simulation used computerized programs to imitate the real objects or to visualize the hypothesized objects that does not exist (for example, Field, 2009; Hartmann, 1996; Smith, 1998). In this study, I will deepen our understanding of simulation from the social constructionist perspective. The purpose of this study is to establish a viable structural model of simulation in learning from the social constructionist perspective.

Theoretical Perspective

Social constructionist perspective of simulation in learning is to make connections between simulators and simulatees through social interaction. For Berger and Luckmann (1967), "the social stock of knowledge as a whole has its own relevance structure" (p.45). "An important element of my knowledge of everyday life is the knowledge of relevance structures of others" (Berger & Luckmann, p.45). Simulation is a process of articulating a model that represents the similar structure in resonance with some phenomenon (Winsberg, 1999). It can imitate the experts' knowledge structure, imitate the real world or system, imitate people's behaviours, imitate the specific fields or imitate the animals' behaviours.

Bases of the Study

The study is based on one of my own empirical studies about knowledge construction in learning community and also the researches on simulation from the interdisciplinary fields. For the empirical study, I interviewed 20 learners from nice learning cells in a local administration community in Shanghai, China. I also collected data through observations and documents, and used the constant comparison method to analyze the empirical data

For the data from the research studies, I searched the researches on simulation from one of the major education database ERIC(at EBSCOhost). The search terms are simulation, and knowledge and simulation. The search runs across about four decades, dating back to 1960s. I identified and analyzed the articles that mention about simulation or simulation and knowledge. I

integrated the findings from the empirical study and the findings from the researches and provided the structural model of simulation and the conditions for applying simulation in practice.

Findings

Based on my empirical study and the studies from the research, I define the simulation as a process of designing, and practicing a model generated from the representational structure of the real world and adapting the model to the specific contexts (Churchill, 2007; Eskrootchi & Oskrochi, 2010; Smith, 1998; Vescoukis, Retalis, & Anagnostopoulos, 2003).

The Empirical Study: Pattern of Simulation

The empirical study of Knowledge construction in Learning Community Conducted by the author indicates that simulation is a process of how people gain knowledge suitably analogous through a process of observation, imitation, and adaptation(Chang, unpublished paper)(see figure 1). In figure 1. The author divided the simulated object into four components: 1, 2, 3, 4. 1, 2, 3 and 4 on the left are the parts of knowledge imitated. 1, 2, 3, and 4 on the right are the parts of knowledge imitated from left package and adapted to the local context. Knowledge is simulated through a process of observation, imitation, and adaptation (arrow in the middle).

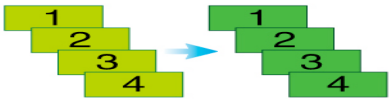

Figure 1: Simulation

The pattern of simulation was represented in several adult learners' learning experiences. For example, Qiong from the Fashion Show program in a local community simulated the catwalk from the walks of others in daily life. Observing the similarities between catwalks and daily life walks in the street, he integrated the beautiful walks he observed on the streets in his catwalk and refined and modified the walks he observed. Qiong also observed the other professional teams' catwalks, identified their differences, and modified some parts of his walks that were not good. Chau, an administrative official in a company, improved his communication and human relationship skills by observing different people's behaviors, the language they used and the actions they made. He also imitated how people react in TV programs and integrated those implicit skills and knowledge in his work.

The examples above reflect the connection of knowledge to people, the reality, the system and the phenomenon that has the similar structures(Farell & Holkner, 2002) and show how knowledge is simulated through a process of observation, imitation and adaption. Simulation connects knowledge that shares the similar structure.

Researches on Structural Model of Simulation

In the simulation process, the initial step is to analyze the structure of the simulated objects and find out the features that learners want to simulate from. The empirical study on knowledge construction provides us a general structure of simulation from the social

construction perspective. Many researchers explored the structure of simulation in a variety of contexts. In this section, I will present five cases that applied simulation for educational purpose. Analysis of the simulation models in five cases is to reveal a general picture of how to conduct a simulation in learning activities.

Smith(1998) described in detailed the process of how to design a simulation, including: (a). Define the problem to be addressed by the model and the appropriate conceptual models; (b) collect input data for operating the model; (c). verify, validate, and accredit the model to ensure the model designed consistent with the real world and could solve the problems identified; (d). design experiments to identify the methods for running the simulation that can generate the desired answers; (e). execute simulation according to the experimental design to answer the problem identified; (f). collect output data; (g). analyze data for the long-term trends; (h). document results of the simulation study or training session; (i). expand model designed in other projects after modification. Smith (1988) provides a skeleton structure of simulation which includes (a) the design of the simulation, in which designers analyze the structures and features that need to be imitated and design the simulation; (b) execute the simulation in learning activity and practice; and (c) modify and apply simulation in other contexts. McCrary and Mazur (2010）discussed how a narrative simulation is designed. The narrative simulation used for an online mentors' training, a case study on a new teacher intern was simulated. The experience from the case study was used as a sample to created a simulated model. This model is a storyline that is broken into several segments, such as the settings and emotions. Each segment includes a dilemma with a question and possible response choices, which gave mentors an opportunity to explore complex situations and reflect their decision making. They address the following steps of how to design a model of simulation:

1. Find out the similar structure and identify the features to be simulated

This includes: defining the problem, collecting data and selecting simulation model. To use simulation to train the mentors, the designers collected data to determine their needs. Data were collected through conversations with experienced mentors, examining the documents such as state teacher standards and mentor training materials in previous training activities, etc. Based on data collected from the needs assessment, the designers selected narrative simulation, which is based on the real world case of mentoring with problem-based questions, the response choices and multiple outcomes .

2. Observe and imitate the simulated objects

The simulation model is launched in a learning activity. In this process, the experienced mentors' decision making process is integrated into several different outcomes to the different narrative paths. Teachers were asked to simulate the experienced mentors and select the responses from those mentor's experiences.

3. Modify the model

After the simulation was used in practice, the authors collected quality review data from the feedbacks of the simulation users, and corrected some errors, clarify some questions and adjust the model for users' convenience.

In a course on political revolutions, Roper（2004）created a simulation through the following procedures:

1. Identify the simulated object and the features to be simulated.

The author decided to use a simulation to address the limitations in the readings. It is a non-technology based social interaction group simulation. In this simulation model, students

role-played either a reformer or a revolutionary in a Latin-American country to understand the complex life in other country. A fictitious country called Barria was created. It is a country similar to many Latin American countries in terms of socio-economic indicators and demographics. Students were randomly assigned to either a revolutionary or reform group to play different roles.

2. Socially imitate and adjust the simulated object

Students were requested to "imitate" the real roles of the reality in a Latin American country, such as priest, student, president, etc. , to write a imitated biography of their character, and to create their profiles. Speranta, a weekly newspaper, was created as a platform where students presented their positions and the actions they took, and the policies and strategies they used. Students as groups produced a position paper to address their strategies of how to achieve their goals. The position papers, some policies or suggestions from the groups, and the editorial questions were integrated into the newspaper, which served as basis for next week's discussion. Groups could adjust their policies based on the effect of their prior policies addressed in newspaper.

3. Give the feedbacks to students and evaluate the results of the simulation

The new edited weekly newspaper provided some information and feedbacks about how effective their policies and strategies were. Students had the opportunities to understand the complex situations and adjust their decisions based on the feedbacks. Throughout the semester, students were required to provide the evaluation of simulation for adjustments.

4. Modify the simulation model for future usage.

The author modified the simulation over the last few years and gradually added or changed several components of the simulation.

Vescoukis, Retalis, and Anagnostopoulos (2003) introduced business simulation activities to provide learners on-the-job training experience. The simulation imitated the real world business environment. They argued that a real world company has its own structure, objectivities and operating scenarios. The virtual enterprise imitated a real world company in these aspects. Vescoukis, Retalis, and Anagnostopoulos (2003) listed five steps of how to run a virtual enterprise simulation activities in a specific educational environment:

1. Define the market characteristics that is relevant to a specific educational environment

There are many aspects of market characteristics. Only those that are relevant to a specific educational environment were defined and imitated.

2. Collect data to define an operational structure

To imitate the defined aspects of market characteristics, designers needed to collect data to define the roles, responsibilities, communication paths, etc.

3. Create virtual enterprise handbooks. The handbooks provided the rules and procedures for the simulation activities.

4. Give feedbacks and assessment, and adjust the simulation activities to ensure that the simulation can approach to the desired level of reality.

5. Create a simulated business environment. It is a network learning infrastructure to support the simulation activities.

Johnson (2004) stated a case of how students used simulation to practice developing a bargaining plan and enacting specific bargaining strategies. To prepare for the bargaining simulation, students needed to (a)collect data and prepare for the simulation of bargaining; (b) modify the bargaining plan according to the behaviors of the other teams; (c) discuss the simulation process and evaluate the effectiveness of the bargaining strategies.

Newman (2007) discussed how to use simulation to improve undergraduate students' skills of writing emails within a realistic and real-time environment. The structure of the simulation is similar to Johnson's (2004), including: (a) collecting data and introducing the background information about the Writeaway Hotels, a fictitious organization, the simulation backgrounds, and the roles within the company; (b) identifying the features of the modeled email principles, practicing email sending in a imitated context; and (c) collecting feedbacks about the effectiveness of the simulated results. Instructor and students discussed and identified the best email in simulation, displayed that email, and analyzed it against the modeled email principles.

Discussions

Simulation represents the reality. However, reality is much more complex than the simulated morel(Smith, 1998). Simulation simplifies the reality and captures some key features of the simulated objects. Data from the author's empirical study and the five cases of the researches on simulation present a general picture of simulation structure. Smith (1998) discussed in detail about how to design and conduct a simulation model. The pattern of simulation generated from author's empirical study analyzed the structure of the simulated object and emphasizes simulating the key or partial features of the simulated objects through a process of observation, imitation and adaption(see figure 1). The simulation discussed in five cases share some similarities with Smith's (1998) simulation model, such as collecting the data and define the similar knowledge structure between the simulated and the simulator, imitating the key features from the simulated object, and modifying the simulation to adjust to the specific context. By comparing the findings from the empirical study and the findings from five cases, I reframe the simulation as a process of analyzing the structure of the simulated objects, defining the key features to be imitated, imitating the identified features, and modifying the features based on learners' needs and specific context (see figure 2).

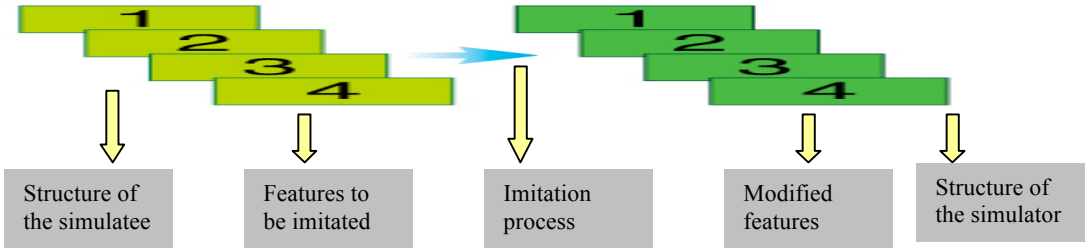

Figure 2: Modified simulation

Simulation imitates the features from the reality that have the similar structures and enable learners to make connections to others through social action(Berger & Luckmann, 1967; Winsberg, 1999). The simulated objects can be analyzed based on its general functions (for example, Xu & Yang, 2010).

The new model of simulation generated from the empirical study of Knowledge Construction in Learning Community and five cases of simulation in different learning contexts emphasizes how people gain knowledge suitably analogous through a process of identifying the features to be simulated, imitating the simulated objects , and adapting the simulated features to learners' knowledge base or to the specific context. Unlike the computerized simulation environment in which people in training react to the simulated system to accurately capture the

real or visualized world-environment (Smith, 1998), social constructionist perspective of simulation emphasizes learners' actively interacting with the simulated objects. It supports learners to actively engage in the simulation process, to capture and imitate the nuanced features of the simulated learning objects, and to make modifications according to learners' needs, rather than passively reacting to the simulated environment.

The simulation is useful for gaining analogous knowledge, knowledge that has similar or relevant structures between the simulatee and the simulator. Learners can simulate the analogous knowledge from people, from daily life, from other animals, or from the cultural and historical heritages(for example, Chen & Howard, 2010; Vescoukis, Retalis, and Anagnostopoulos, 2003). Generally speaking, simulation is a process of observing and analyzing the structure of the simulated objects, identifying the key features to be imitated, imitating it, and adapting it to the specific context.

Implication to the Practice

Based on the empirical study and the researches on simulation, several factors are identified that are important in simulation process: the similar knowledge structure of the simulatee and the simulator, learners' ability to access to knowledge carriers, the knowledge carriers' willingness to share the tacit knowledge safely, and the feedbacks to learners, which is consistent to McDevitt's (2009) study about a appellate simulations in a business law course. To apply the simulation in learning activities, the practitioners need to (a) make sure that the knowledge gap among learners is not huge; and (b) support learners to analyze the structure of the simulated learning objects to know which parts in their knowledge base are missing or weak and need to imitate from. For the individual learners, they need to know (a) the learning resources available to them; (b) the expertise of the people in their social circles; and (c) trust, respect, and love are important factors in knowledge sharing process. The organizations should create a learning environment that rewards knowledge sharing.

Simulation supports learners to pursue the tacit knowledge, exchange the ideas, train their problem solving ability, etc. (for example, Taylor & Chi, 2006; Xu & Yang, 2010). However, practitioners need to acknowledge the limitations of simulation in learning activities. Simulation is imitating the reality or the real system. However, the simulated objects are much more complex in reality. Some features and details could hardly be captured in the simulation model. Simulation is usually the simplified reality. In practice, designers has to omit some details and make some adjustments, which in some cases may cause inaccuracies. Simulation usually provides the general trends of the simulated objects rather than the exact presentation of the reality. Due to lack of available resources to imitate the system or reality, simulation model can only partially represent the reality (Smith,1998).

Significance of the Study

This study provides the complementary ideas to the study of simulation in terms of how to design and conduct a simulation model from the social constructionist perspective. It will benefit the practitioners and learners and offer them a step-by-step guidance about how to apply simulation in their training and learning activities.

References

Berger, P. L. & Luckmann, T. (1967): *The social construction of reality: A treatise in the sociology of knowledge.* Garden City, New York: Anchor Books.

Chen, C.-H., & Howard, B. (2010). Effect of live simulation on middle school students' attitudes and learning toward science. *Educational Technology & Society, 13* (1), 133–139.

Churchill, D. (2007). Towards a useful classification of learning objects. *Educational Technology Research and Development, 55*(5), 479-497.

Eskrootchi, R., & Oskrochi, G. R. (2010). A study of the efficacy of project-based learning integrated with computer-based simulation - STELLA. *Educational Technology & Society, 13* (1), 236–245.

Farell, L. & Holkner, B. (2002, December). *Knowledge is something we do: Knowing and learning in globally network communities.* Paper presented at the Annual Conference of the Australian Association for Research in Education, Brisbane.

Field, D. W. (2009). Simulation of a start-up manufacturing facility for Nanopore arrays. *Journal of Technology Studies, 35*(1), 20-24.

Hamilton, J. P. (2008). long-term, non-computer, communication simulations as course integration activities. *Communication Teacher, 22*(1), 6-9.

Hartmann, S. (1996). The world as a process: Simulations in the natural and social sciences. InR. Hegselmann, U. Müller, & K. Troitzsch (Eds.), *Modelling and simulation in the social sciences from the philosophy of science point of view* (pp. 77-100). Dordrecht, Netherlands: Kluwer.

Johnson, D. I. (2004). Bargaining simulation: applying bargaining plans and strategies. *Communication Teacher, 18*(2), 57-60.

Klopfer, E., & Yoon, S. (2005). Developing games and simulations for today and tomorrow's tech savvy youth. *TechTrends: Linking Research & Practice to Improve Learning, 49*(3), 33-41.

McCrary, N. E., & Mazur, J. M. (2010).Conceptualizing a narrative simulation to promote dialogic reflection: using a multiple outcome design to engage teacher mentors. *Educational Technology Research and Development, 58*(3), 325-342.

McDevitt, W. J. (2009). Active learning through appellate simulation: a simple recipe for a business law course. *Journal of Legal Studies Education, 26*(2), 245-262.

Newman, A. (2007). Real-time computer-mediated communication: email and instant messaging simulation. *Business Communication Quarterly, 70*(4), 466-470.

Roper, S. D. (2004). Teaching students how to be revolutionaries or reformers: A course simulation. *Innovations in Education and Teaching International, 41*(3), 245-253.

Smith(1998). *Simulation article.* Retrieved March 1, 2011, from http://www.modelbenders.com/encyclopedia/encyclopedia.html

Taylor, R. S., & Chi, M. T. H. (2006). Simulation versus text: acquisition of implicit and explicit information. *Journal of Educational Computing Research, 35*(3), 289-313.

Vescoukis, V. C., Retalis, S., & Anagnostopoulos, D. (2003). Network-based business simulation activities in technical professional education. *Interactive Learning Environments, 11*(3), 169-191.

Wills, K. V., & Clerkin, T. A. (2009). Incorporating reflective practice into team simulation projects for improved learning outcomes. *Business Communication Quarterly, 72*(2), 221-

227.Winsberg, E. (1999). Sanctioning models: the epistemology of simulation. *Science in Context*. *12* (2), 275-292.
Woltjer, G. B. (2005). Decisions and macroeconomics: development and implementation of a simulation game. *Journal of Economic Education, 36*(2), 139.
Xu, Y., & Yang, Y. （2010）. Student learning in business simulation: An empirical investigation. *Journal of Education for Business, 85*(4), 223-228.