

# Causal Factors Affecting Learning from Educational Games Based on Jigsaw with the Graphic Organizers Technique

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***Abstract** The purpose of this research were : 1) to study confirmatory factors of instructional, jigsaw, graphic organizers and 2) to study causal factors affecting learning from educational games based on jigsaw with the graphic organizers technique in the learning management and environment for learning of the students in the faculty of education at Bansomdejchaopraya Rajabhat University. Data were gathered with the questionnaire from the 300 students of the faculty of education who were selected by multi-stage sampling and were taking the learning management and environment for learning class (Course code 1001302, D12) during the academic year of 2014. The data were analyzed by mean, standard deviation, exploratory factor analysis, confirmatory factor analysis, and analyzed causal factors affective by LISREL program. The research findings were as follows: 1) The confirmatory factor analysis of learning from educational games comprised three factors: instruction, jigsaw and graphic organizers. The factor of instruction comprised four factors: objective, process, facilitator and measurement and evaluation. The factor of jigsaw comprised four factors: enthusiasm, knowledge sharing, problem solving and motivation. The graphic organizers comprised three factors: information storage, cognitive process and metacognition. 2) The casual factors affecting learning from educational games based on jigsaw with the graphic organizers technique in the learning management and environment for learning of the students in the faculty of education at Bansomdejchaopraya Rajabhat University had two factors that were jigsaw and graphic organizer commitment at 1.59 and .98.*

**Keywords:** Causal factors, Learning, Game, Jigsaw, Graphic organizers

## **Introduction**

The trends of globalization and information technology have led the changes of the world society to the new system called information technology, or knowledge society, or knowledge-based society economy. According to Porntida Wichianpanya (2004) and Rungrueng Limchupatapan (2003), knowledge management is the system that needs propagation and knowledge to be a key vehicle to build growth and wealth, and make jobs in every sector of the society – economic sector, agricultural sector, industrial sector, service sector, and educational sector – including the system that needs to use knowledge and innovation. From the study of learning management based on constructivism theory.(Khamkai Noichompoo. 2011). According to the educational games are games explicitly designed with educational purposes, or which have incidental or secondary educational value. All types of games may be used in an educational environment Game types include board, card, and video games. An educational game is a game designed to teach humans about a specific subject and to teach them a skill. As educators, governments, and parents realize the psychological need and benefits of gaming have on learning, this educational tool has become mainstream. Games are interactive play that teaches us goals, rules, adaptation, problem solving, interaction, all represented as a story. They give us the fundamental needs of learning by providing enjoyment, passionate involvement, structure, motivation, ego gratification, adrenaline, creativity, social interaction and emotion

The researcher found that the jigsaw is game that is designed to help student to learn about certain subjects, expand concepts, reinforce development, understand an historical event or culture, or assist them in learning a skill as they play.

Therefore, the researcher is interested in study confirmatory factors of instruction, jigsaw, graphic organizers and to study casual factors affecting learning from educational games based on jigsaw with the graphic organizers technique in the learning management and environment for learning of the students in the faculty of education at Bansomdejchaopraya Rajabhat University and the effects of the model by using the using the technique of confirmatory factor analysis and causal analysis which are the suitable methods and most often use.

## **Research Question / Research Problem**

Are there any casual factors or causes that affect instruction from games based on jigsaw by integrating with the graphic organizers?

## **Research Objective**

An analysis casual factors affecting instruction from games based on jigsaw integrated with the graphic organizers in the learning management and environment for learning of the students in the faculty of education at Bansomdejchaopraya Rajabhat University

## **Research Methodology**

### **Population**

The 716 students of the faculty of education that enrolled in learning management and environment for learning (Course code: 1001302) in the academic year of 2014.

### **Sampling**

The 300 students of the faculty of education that enrolled in learning management and environment for learning (Course code: 1001302, D12) in the academic year of 2014 selected by determining sample size from a given population table of Krejcie and Morgan (1970) and stratifying with proportion by year of studying. Then selecting by Simple Random Sampling.

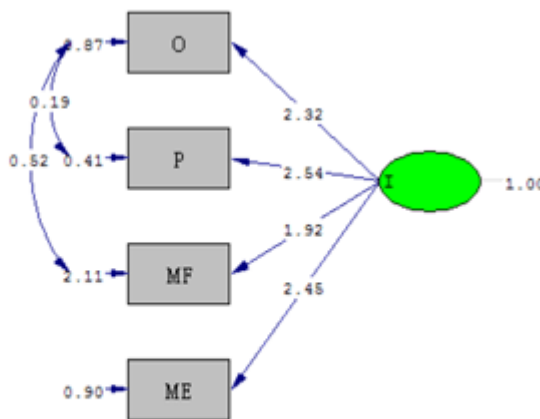
### **Instruments**

The instrument used for gathering data is questionnaire. It investigates the states and problem of learning management in the course of learning management and environment for learning. This questionnaire has the quality of content validity proved by the experts for its content validity and reliability, and the reliability of Cronbach's Alpha Coefficient is .91.

## Results

The results of the confirmatory factor model analysis of instruction found that the model comprised four factors: 1) objective 2) process 3) facilitator 4) measurement and evaluation and consistent with the empirical data which is determined by the chi - square is equal to 0.00;  $p = 1.00000$ , degrees of freedom equal to 0 and the goodness of fit index (GFI) is 1.00. The adjusted goodness of fit index (AGFI) is 1.00. The comparative fit index (CFI) is 1.00. The root mean square error off approximation (RMSEA) is equal to 0.000. These indicate that the model is consistent with the empirical data. When considering the factor loading, it is found that the latent factor of 4-aspect learning management is between 1.92 and 2.54. (Figure 1).

**Figure 1: The confirmatory factor model of instruction**

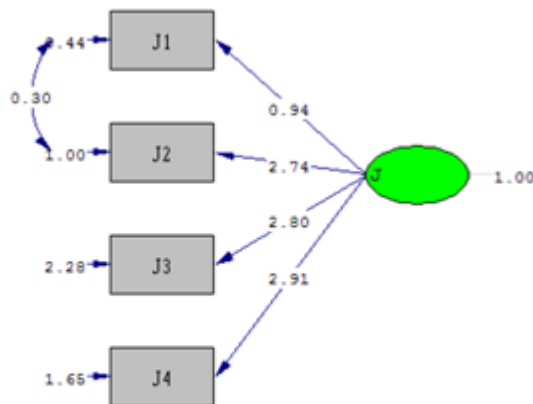


Chi-Square=0.00, df=0, P-value=1.00000, RMSEA=0.000

The results of the confirmatory factor model analysis of jigsaw found that the model comprised four factors: 1) enthusiasm 2) knowledge sharing 3) problem solving 4) motivation and consistent with the empirical data which is determined by the chi - square is equal to 0.09;  $p = 0.76357$ , degrees of freedom equal to 1 and the goodness of fit index (GFI) is 1.00. The adjusted goodness of fit index (AGFI) is 1.00. The comparative fit index (CFI) is

1.00. The root mean square error off approximation (RMSEA) is equal to 0.000. These indicate that the model is consistent with the empirical data. When considering the factor loading, it is found that the latent factor of 4-aspect constructivism theory is between 0.94 and 2.91. (Figure 2).

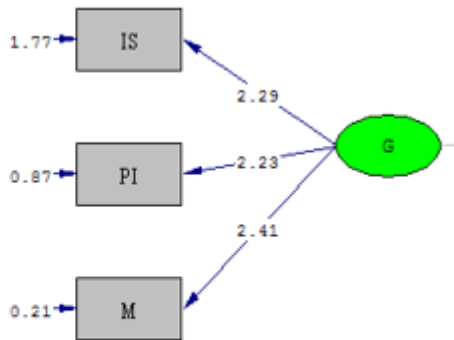
**Figure 2: The confirmatory factor model of jigsaw**



Chi-Square=0.09, df=1, P-value=0.76357, RMSEA=0.000

The results of the confirmatory factor model analysis of the graphic organizers found that the model comprised three factors: 1) information storage 2) cognitive process 3) metacognition and consistent with the empirical data which is determined by the chi - square is equal to 0.00;  $p = 1.00000$ , degrees of freedom equal to 0 and the goodness of fit index (GFI) is 1.00. The adjusted goodness of fit index (AGFI) is 1.00. The comparative fit index (CFI) is 1.00. The root mean square error off approximation (RMSEA) is equal to 0.000. These indicate that the model is consistent with the empirical data. When considering the factor loading, it is found that the latent factor of the 3 aspects of the philosophy of sufficient economy is between 1.92 and 2.54. (Figure 3)

**Figure 3: The confirmatory factor model of graphic organizers**

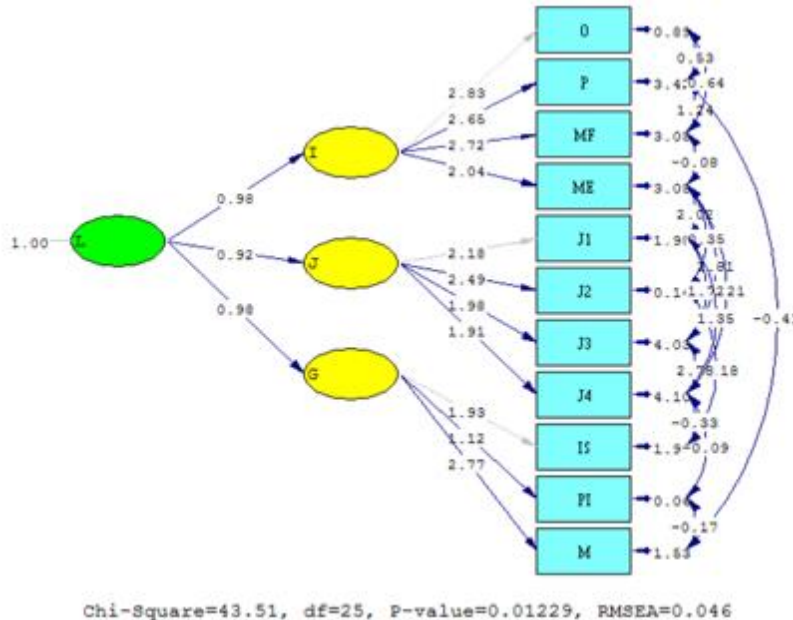


Chi-Square=0.00, df=0, P-value=1.00000, RMSEA=0.000

The results confirmatory factor analysis of learning from educational games based on jigsaw with the graphic organizers technique comprised three factors: 1) instruction 2) jigsaw 3) graphic organizers and consistent with the empirical data which is determined by the chi - square is equal to 0.00;  $p = 1.00000$ , degrees of freedom equal to 0 and the goodness of fit index (GFI) is 1.00. The adjusted goodness of fit index (AGFI) is 1.00. The comparative fit index (CFI) is 1.00. The root mean square error off approximation (RMSEA) is equal to 0.000. These indicate that the model is consistent with the empirical data. When considering the factor loading, it is found that the latent factor of the 3 aspects of the philosophy of sufficient economy is between 1.92 and 2.54. (Figure 4)

**Figure 4: The confirmatory factor model of learning from**

**educational games based on jigsaw with the graphic organizers technique**



The causal factors directly affected to learning from educational games based on jigsaw with the graphic organizers technique in the learning management and environment for learning of the students in the faculty of education at Bansomdejchaopraya Rajabhat University had two factors that were jigsaw and graphic organizers commitment at 1.18 and 1.42. The model is consistent with the empirical data which is determined by the chi - square is equal to 91.14;  $p = 0.00487$ , degrees of freedom equal to 46 and the goodness of fit index (GFI) is 0.98. The adjusted goodness of fit index (AGFI) is 0.99. The comparative fit index (CFI) is 1.00. The root mean square error off approximation (RMSEA) is equal to 0.052. The Regression Coefficient of casual relationship hypothesis model of to learning from educational games based on jigsaw with the graphic organizers technique is equal to 0.96, which indicates that the variables in the model can explain the variance of variables in the learning from educational games model equal to 52 percent.

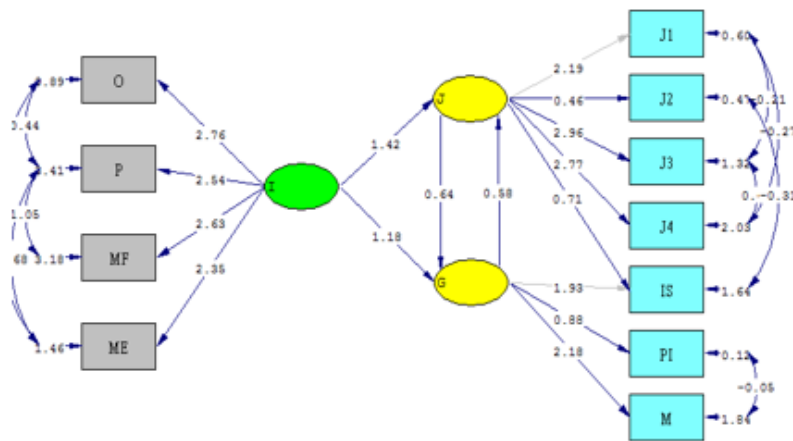
When considering the paths that affects the variables of the casual relationship hypothesis model to learning from educational games based on jigsaw with the graphic organizers technique, it is found that the latent variables of learning from educational games are influenced by all the latent variables.

While considering the paths that directly affect each latent variables, it is found that the latent variables of learning management factors has influenced directly to the two latent variables, which are jigsaw and the graphic organizers equal to 1.18 and 1.42 respectively and statistically significant at .01.

In addition, the latent variables of jigsaw and the graphic organizers are also found that the paths affect directly the variables to each other equal to 0.64 and 0.58 respectively and statistically significant at .01.

The results of the partial correlation analysis between variables and path coefficient of casual factors affecting learning from educational games based on jigsaw with the graphic organizers technique (Figure 5)

**Figure 5: The model of causal factors affecting learning from educational games based on jigsaw with the graphic organizers technique**



Chi-Square=91.14, df=46, P-value=0.00487, RMSEA=0.052



## Discussion

Learning from educational games is the one of instruction technique to achievement development of student is similar to Buranasirijrungrat Kalaya (2012) to study the students' English reading ability of the control group before and after being taught with general activities and that of the experimental group, whose attitudes towards computer games were positive, before and after being taught with the learning integrated with Game-based learning (MMORPG type), and to compare the English reading ability between the two groups after being taught with the activities. It also aimed to compare the students' motivation in English learning before and after being taught with the integrated activities. The data obtained were analyzed by using mean, standard deviation and t-test. The findings revealed that there was more development of the English reading ability of the experimental group than that of the control group, and the motivation in English learning was positively higher after being taught with the integrated activities and learning from educational games based on jigsaw with the graphic organizers technique to make learners to create their own learning process by using their prior experiences that help stimulate learners' cognitive structure as well as integrating the philosophy of sufficient economy in order for sustainable development which is similar to Pajit Saduakkarn (2000) stating that constructivist theory is the theory that is developed from pragmatism by James and Dewey in the early 20th century and the paradigm change of searching for knowledge in philosophy of science by Popper and Feyerabend in the late 20th century from the pioneer of the key psychologists like Piaget, Ausubel and Kelly. Then there were a group of constructivist students like Driver, Bell, Kamil, Noddings, Von Glasersfeld, Henderson, Underhill, and Sumalee Chaicharoen (2008) said that constructivists believe that learning is a process of knowledge construction rather than receiving information. Therefore, constructivists are focused on constructing new knowledge appropriately to a particular person and environment plays an important role in constructing meaning according to the reality. Constructivism is a method that can be applicable to teaching and learning management which is mainly focused on doing in order to construct knowledge that is different in the aspect

of knowledge construction or learning. This is because of the basic principle from the report of Jean Piaget, a Swiss psychologist and educator, and Lev Vygotsky, a Russian psychologist and educator, which can be divided into 2 types: Cognitive Constructivist and Social Constructivist. Cognitive Constructivist is based from the philosophy of perseverance theory that links prior knowledge or experiences to new knowledge with the process that can be proven reasonably.

From the research findings, it is found that learning from educational games based on jigsaw with the graphic organizers technique is linked with each other in the aspect of learning processes of each stage and step. Teachers must think of reasons and principle in integration thoroughly, and they must consider the possible impact that might affect the learners by thinking of sustainable development and lifelong learning with constructing cognitive knowledge.

## References

- Bloom, B.S. (1956). Taxonomy of educational objectives: Affective domain. New York :Mckay.
- Bruner, J. ,Goodnow, J.J. , & Austin, G.A. (1967). A study of thinking. New York : Science Editions.
- ChaicharoenS. (2008). Educational Technology : Principles, Theories to Practice. Khonkaen :Klangnanawittaya.
- Doymus, K. (2007). Effects of a Cooperative Learning Strategy on Teaching and Learning Phases of Matter and One-Component Phase Diagrams. J. Chem. Educ. 84(11), 1857.
- Jordan, D. and Le Metaias, J. (1997). Social skilling through cooperative learning. Educ. Res, 39, 3-21.
- Limchupatapan R.(2003) ). Developing the Entrepreneurs to the Clusters with Information Technology and Communication. NP.
- Noichompoo, K.(2011). The Development of Learning Management Based on Constructivism Theory Focused on the Skills to Problem Solving of Mathematics: Addition, Substraction, Multiplication, and division to Grade 3 Level. Khonkaen University.
- Saduakkarn, P.(2000). Learning How to Manage with Thai

- Wisdom Consistent to Constructivism Theory. Education Revolution. Bangkok: Chulalongkorn University Press.
- Slavin, R. (1996). Research on cooperative learning and achievement: What we know, what we need to know. *Contemp. Educ. Psychol.*, 21, 43-69.
- Thepsittha, S. (2007). Sufficient Economy Regarding the Royal Initiative Approach. Bangkok: Ariyamak Press.
- Towns, M.H. and Grant, E.R. (1997). I believe I will go out of this class actually knowing something: Cooperative learning activities in physical chemistry. *J. Res. Sci. Teach.*, 34(8), 819- 835.
- Webb, N., Troper, J., and Fall, R. (1995). Constructive activity and learning in collaborative small groups. *J. Educ. Psychol.*, 87, 406 – 423.
- Wichianpanya, P. (2004). Knowledge Management : Fundamental and Application. Bangkok :n.p.
- Wiratchai, N. (1998). Linear Structural Relationship (LISREL) : Statistical Analysis for Research on Social Science and Behavioral Science. Bangkok :Chulalongkorn University Press.

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