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Using eight trigrams (BaGua) approach with epistemological practice to vitalize problem-solving processes: A confirmatory analysis of R&D managers

Jon-Chao Hong[a], Ming-Yueh Hwang[b,*], Yu-Ju Chen[a], Mei-Yung Chen[c], Li-Chun Liu[a]

[a] Department of Industrial Education, National Taiwan Normal University, Taiwan
[b] Department of Adult and Continuing Education, National Taiwan Normal University, Taiwan
[c] Department of Mechatronic Technology, National Taiwan Normal University, Taiwan

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ABSTRACT

Eight trigrams (BaGua) is a philosophy that has played an essential role in Chinese life. The purpose of the present study is to extend the theory to organizational problem-solving, so that individuals can engage in creative problem solving and justification to discover the most effective approaches. Questionnaires were returned by 259 research and development managers, and were analyzed using the SEM statistical method. The results indicate that the interaction among each trigram in the model of BaGua was significantly correlated. Most of the hypotheses were supported. The more an individual interacted with others, with data and with devices, the higher the problem sensitivity and evaluation performance. Despite the finding that the Tui trigram was not significantly related to the Ken trigram, all other trigram elements significantly affected each other. This finding is discussed in terms of the confirmatory situation and the conceptualization of epistemology in problem-solving.

1. Introduction

A problem represents a gap between where we are or what we have, and a desired location or outcome. Problem-solving is the thought and behavior that people engage in to obtain the outcome they desire. The outcome could be attaining a certain goal or finding a satisfactory answer to a question (Treffinger, Selby, & Isaksen, 2008). Problem-solving activity can be characterized by novelty, unconventionality, persistence, and difficulty in problem formulation. A problem task can be clearly defined and structured or it can be fuzzy, ill-defined, and ambiguous. The way to obtain the solution or the solution pathway or method can be known, predetermined, and relatively simple, or it can be unknown, complex and non-determined. The former is more a function of memory, expertise and knowledge. The latter requires creative approaches to gain new knowledge (Geary, 2005; Kirton, 2003). Arts, Gijselaers, and Boshuizen (2006) point out that the importance of acquiring 'dynamical' approaches for accurate problem-solving. In other words, if a problem solver has a problem for which insufficient knowledge is available, he or she can develop, select or justify knowledge to apply a conceptual model. Such a conceptual model, for example the BaGua system used in this study, should contain relevant aspects of the problem, the contextual system in which the problem occurs, and the solution.

Relevant aspects of the BaGua system consist of dominant entities and processes in modeling. 'Modeling' refers to the development and/or use of models in order to solve some problem, in other words model-based problem-solving. The

* Corresponding author at: P.O. Box 7-513, Taipei, Taiwan. Tel.: +886 2 2341 7409; fax: +886 2 2394 6832.
E-mail addresses: tcdahong@gmail.com (J.-C. Hong), t06013@ntnu.edu.tw (M.-Y. Hwang), luludapipi@gmail.com (Y.-J. Chen), cmy@ntnu.edu.tw (M.-Y. Chen), sherry.l.c.liu@gmail.com (L.-C. Liu).

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models discussed here can be categorized as epistemological models, as they share the use of epistemology to represent relevant parts of an objective system and to solve the problem at hand. The models may range from dynamic and continuous knowledge application, to justification and creation to solving problem in research. In this sense, the BaGua system aims to mimic research behavior, often by minimizing some predefined measure of differences between the epistemological model and observations.

The development of solutions involves analyzing, refining, or developing promising options. Epistemological model-based problem-solving can be seen as a process consisting of many activities, e.g., problem finding and formulation, data handling, implementation, sensitivity analysis, solution evaluation, justification and calibration. By defining this process in detail, one can provide a shared concept of a problem-solving system. In other words, explicit descriptions of epistemological models and of their combination with the BaGua system are needed. Explicit descriptions of epistemological models and the BaGua system should be examined, and can represent the shared vision of different groups. This study assumes that these explicit descriptions, together with professional and subjective reports, can act as the cornerstones of a framework to improve the use of epistemological models in model-based problem-solving, based on the perspectives of the BaGua system.

Research and development (R&D) managers in industry are the first group to encounter a constant flow of fresh problems among employees (Cummings & Oldham, 1997). R&D managers working on various job fronts inescapably encounter novel, ill-defined profession-related problems. Finding creative solutions to these problems may be the critical factor that could elevate their organization to a higher vantage point, thereby acquiring a competitive advantage over their rivals (Reiter-Palmon & Illies, 2004). The present study, therefore, will focus on building an R&D managers' epistemological problem-solving model, using the BaGua system.

2. Theoretical framework

While the process of exploration and investigation in problem-solving, as a method for challenging and developing one's existing constructs and schemata, has long been posited as an indicator of higher-order thinking (including both divergent and convergent thought processes in knowledge application) (Turvey, 2006). There are three classes include 'Things we know we know,' 'Things we know we don't know,' and 'Things we don't know we don't know.' Of these three types of knowledge, 'Things we don't know we know' could be viewed as potentially the most difficult to figure out or judge, but it would surface during problem solving in the epistemological model.

The search for knowledge should facilitate the exploration of new fields of knowledge, build up expertise in new fields, and create new competencies. New organizational capabilities, or at least the expansion of existing capabilities, are needed (McDermott & O'Connor, 2002). Idea-seeking plays a supportive role, which is particularly important when new approaches build upon existing problem-solving, and new problem-solving crystallizes knowledge. According to Sternberg (1996), one's creativity may be determined by one's intellectual processes, knowledge, intellectual style, personality, motivation, and environmental context. In other words, the more knowledge one possesses, the more creative he/she will be, although there are exceptions to this rule. To better explain this phenomenon, Sternberg and Lubart (1995) emphasized the importance of the intellectual process, which is the key interface between a problem and knowledge.

2.1. Problem-solving processes

Isaksen and Treffinger (1985) created a model for problem-solving, as follows: (1) Mess Finding – identify the problem; (2) Data Finding – collect information, knowledge, facts, feelings, opinions, and thoughts about the problem; (3) Problem Finding – formulate the problem statement; (4) Idea Finding – brainstorm as many ideas or alternatives as possible; (5) Solution Finding – select the best ideas, based on criteria established by evaluating the strengths and weaknesses of each potential solution; and (6) Acceptance Finding – formulate and evaluate a plan to implement the solution. In other words, while problem-solving, the individual creates new ideas, but they are confined within his/her own current knowledge base. If one could not find the right knowledge to identify the causes of a particular problem and raise enough alternatives to solve that particular problem, one would have to search for new ideas or knowledge (Barrick & Spilker, 2003). If the problem could not be solved, then one's brain would function by returning to the knowledge base to look for any suitable knowledge to apply or justify in solving the problem.

2.2. The essences of BaGua system

From the eastern Chinese perspective, the mechanism of searching for ideas may be illustrated from the Chinese *Yi Ching* (the Book of Change) (Sung, 1988). This book is one of the most prominent classics of Chinese culture. *Yi Ching* is defined by the philosophy of divination. It could thus be interpreted as the Philosophy of Divination Made Easy (TenHouten & Wang, 2001). BaGua (eight trigrams) is derived from *I Ching* which represents Yin (broken; negative) and Yan (unbroken; positive) as the source of creativity for problem solving (Pham, Liu, & Dimov, 2006). Pham et al. (2006) articulated that each *Yao* (line) contains *Yin* and *Yan* to form two opposite extremes. The three *Yao* in BaGua correspond to three aspects of each basic solution, thus, $2 \times 2 \times 2 = 8$ array to be BaGua and can be divided further into 24 sub-parameters. Furthermore, based on Baynes (1967) and Flowers' (1998) interpretation, this study elaborated Ch'ien trigram as the opening of problems; Kun trigram represents the effectiveness of ending problem solving; Tui trigram is associated with the pleasure linked with the