www.irmbrjournal.com June 2017
International Review of Management and Business Research Vol. 6 Issue.2

# Discrepancy of Cognitive Ability in Management Decision

**HONG-WEN LIN**
Department of International Trade, Chinese Culture University
No.55, Hwa-Kang Rd., Yang-Ming-Shan, Shrlin Dist., Taipei, 111, Taiwan
Email: lhw3@ulive.pccu.edu.tw
Tel: +886228610511 Ext 35140

**YA-CING JHAN**
Department of Business Administration, National Taiwan University of Science and Technology
No.43, Sec. 4, Keelung Rd., Da'an Dist., Taipei, 106, Taiwan
Email: kelly6824@hotmail.com
Tel: +886227333141 Ext 7227

**YU-LING LIN**
Department of Business Administration, National Chin-Yi University of Technology
No.57, Sec. 2, Zhongshan Rd., Taiping Dist., Taichung, 411, Taiwan
Email: yllin2@ms27.hinet.net / yllin@ncut.edu.tw
Tel: +886423924505 Ext 7784

**SHU-MEI WANG**
Department of Business Administration, National Chin-Yi University of Technology
No.57, Sec. 2, Zhongshan Rd., Taiping Dist., Taichung, 411, Taiwan
Email: s198506@yahoo.com.tw
Tel: +886925198506

## *Abstract*

*In this study, Creative Problem Solving (CPS) has been chosen as the theoretical basis to explore the discrepancies between learners' cognitive ability for management decision-making process as individuals and in groups. The study attempts to shed light on the differences between the problem-solving processes for individual learners and learner groups through means of Protocol Analysis and Think Aloud Protocols. The research discovered that the extent of information content familiarity imposes varying degrees of impact on the decision-making process on individuals and in groups. When learners are unfamiliar with information contents, they are caught in a loop in the midst of a problem-solving process. In contrast, learners with a relatively higher degree of familiarity with information content would be able to solve a given problem in smooth-running procedures. These discoveries reveal the discrepancies between different learners in the problem-solving process, and hopefully may serve as useful reference for educators looking forward to formulate effective teaching guidelines and strategies for classroom instruction.*

***Key Words:*** *Creative Problem Solving, Protocol Analysis, Management Decision, Cognitive Ability, Business Operation Simulation System.*

## Introduction

In general, people do not rely on the processes of scientific thinking to improve upon their decision-making prior to making choices (Young & van Aarde, 2011). As such, resorting to different scientific approaches to

explore the behavior of decision-making (Failing et al., 2007) and cultivating of talents in relevant domains have become an important topic in the field of education. In the past, cognitive psychology has been the method that most studies have adopted to explore the process of decision-making (Leddy, Anderson, & Schulkin, 2013). The essence of decision-making has also been studied through decision-making history (Meder et al., 2013) and various aspects including problem recognition, information search, data analysis & processing, data interpretation & decision-making, and the evaluation of selection decision (Sacchi & Burigo, 2008) in attempts to understand how individuals utilize scientific thinking to resolve different problems (Finkelstein, Whitehead, & Campbell, 2009). However, few studies have chosen to use problem-solving history to determine if discrepancies exist between individuals and groups in their awareness of decision-making management. In this study, problem-solving theory was chosen as the theoretical framework, along with protocol analysis and think aloud protocol to explore subject learners' decision recognition management capacity. This study offers a summary of the discrepancies in the decision recognition management between individuals and groups and the discrepancies in the learning of optimal solutions for learners majoring in different academic disciplines.

## Literature Review

### Problem-solving and Cognitive Ability

Problem solving is a behavior that involves specific goals/needs and the search of different thinking models. Moreover, through different heuristics and rules of thumb, such behavior would lead to specific behaviors that would enable one to solve the problems at hand (Eysenck & Keane, 2000). Relevant studies pointed out that problem-solving behavior emphasizes logical thinking that solves specific problems (Meder et al., 2013), and that the structure of said logic is formulated from a person's previous experience and the mental structure of their prior knowledge in order to choose the best solution. However, the construction of this mental structure involves sophisticated cognitive skills (van Merriënboer, 1997) and requires longer periods of time to achieve a suitable state (Brand-Gruwel et al., 2005). The model of creative problem-solving (CPS) comprises processes including fact-finding, idea finding, method finding, solution finding and adoption (Parnes, 1977). Compared to other problem-solving techniques, this process emphasizes more on the application of divergent thinking and convergent thinking. The learner has to retread their existing knowledge and thinking in order to figure out a feasible solution to resolve the difficult situation at hand (Weisberg, 2006).

### Individual Decision and Group Decision

Under different circumstances or situations, individuals will often resort to similar methods or experiences to solve different problems (Hastie & Dawes, 2009; McCarthy & McCarthy, 2006). However, this might result in the restriction of one's thought processing skills, making the decision less than optimal (Hastie & Dawes, 2009). In contrast, when groups are faced with a decision to make, they would convert the private knowledge of group members into group knowledge shared by all members before making the decision (Kerr & Tindale, 2004). During the process of group decision-making, participants would usually be involved in negotiations or group coordination (McCaslin, 2009). Such social regulative behavior not only helps to facilitate better group performance but also functions as a key factor that affects learners in the process of cooperative learning (Romero & Lambropoulos, 2011). Past studies suggest that organizations should be highly socially bonded and strive to strengthen communication, interaction, sharing of learning experience, and knowledge reorganization to reach consensus, which would then facilitate effective decision-making management (Morita & Kumar, 2007; Sacchi & Burigo, 2008). As such, when a decision-making task involves an argumentative solution, the behavior of group discussion would help to lead to decisions that avoid error through empirical evidence. In other words, group discussion enables groups to enhance their data processing capabilities (Laughlin et al., 2002).

## Methodology

### Experiment Design

The first part of the study involves the use of the Business Operation Simulation System (BOSS), which features team-based, online multiplayer competitive learning. Since BOSS is capable of simulating various economic environments and provide relevant information that helps with decision-making, learners will be able to acquire relevant decision-making management capabilities (such as decision-making thought process, strategy formulation, competitor analysis, management strategy and etc.) in rapidly changing economic models. In addition, given an online multiplayer competitive format, the environment parameters that the BOSS has configured would also affect learners' decision-making behavior and strategic directions. Therefore, the BOSS that primarily simulates economic environments can help the experiment by revealing participants' thought logic in their decision-making process while realistically reflecting the real world decision-making environment that is both sophisticated and ever changing (Lin & Tu, 2012).

Secondly, the subjects were divided into two experimental groups: individual decision-making and group decision-making. In this study, learners who have had prior experience with BOSS have been chosen as the subjects. In individual decision-making experiments, learners were asked to make decisions independently without the interference of group opinions. For group decision-making, subjects were divided into teams for the experiment. Subjects in both groups were given questionnaires with identical content. The questionnaire is separated into two parts, the first part asks the participants to determine the ranking of eight decision-making items (product pricing, marketing budget, maintenance expense budget, planned production quality, equipment investment budget, quantity of material purchased, and stock dividends). The next part asks participants to answer the following questions: (1) How do you determine the point of market entry? (2) How do you establish product pricing? (3) How do you set the budget? For these questions, the learners were asked to think aloud and explain the key information they have referred to for their decision in order to reveal the thought process of learners when they make decisions.

### Sample and Data Collection

In order to explore the learners' decision-making process, the subjects must have the competence to clearly express their own abstract thoughts. For qualitative studies, the subjects' fitness and variety are far more important than mere sample size alone. Therefore, this study chose 41 undergraduates in Taiwan with prior experience using the BOSS through purposive sampling for the research. Among the subjects, 19 were chosen as the samples for individual decision-making and the remaining 22 (separated into 7 groups) were chosen for group decision-making.

For the purposes of this study, protocol analysis was used for data collection. The technique can be effectively applied during the process of problem analysis and decision-making for the learners in order to extract the data of decision-making cognition from subjects' model of internal thinking. Subjects were given a time limit of 30 minutes for their decision-making. The study also obtained consent from the learners to keep track of their mental activities and decision-making history through audio and video recording so that the oral transcripts may be coded and converted into a protocol. Lastly, the data of learners' decision-making process were then simplified and analyzed to extract the desired information.

## Results

### Analysis of the Eight Decision-Making Rankings

As evident from Table 1, the ranking of decisions for individual learners revealed a subjects' opinion that management decisions ought to prioritize *product pricing*, followed by *marketing budget* and *estimating*

*production quantity*. These learners perceive *product pricing* and *estimating production quantity* to be important as these factors enable them to predict income from sales, which in turn offer crucial information on the company's operating status. They also believed *marketing budget* to be essential to product image improvement and improved odds of creating profit. On the other hand, *quantity of material purchased* came after the aforementioned items primarily because the learners felt that operating revenues and costs must be accounted for before the right quantity of material can be determined. Therefore, *quantity of material purchased* fell between third and seventh place for the individual subjects.

Table 1: Individual decision ranking tally (N=19)

| Decision items | Decision ranking | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Product pricing | 4 | 1 | 2 | 0 | 1 | 4 | 5 | 2 |
| Marketing budget | 4 | 5 | 2 | 1 | 3 | 2 | 1 | 1 |
| R&D budget | 1 | 4 | 2 | 7 | 3 | 0 | 2 | 0 |
| Maintenance expense budget | 3 | 4 | 1 | 4 | 4 | 1 | 2 | 0 |
| Planned production quantity | 4 | 3 | 5 | 2 | 3 | 2 | 0 | 0 |
| Equipment investment budget | 2 | 2 | 2 | 2 | 3 | 4 | 3 | 1 |
| Quantity of material purchased | 0 | 0 | 5 | 3 | 2 | 6 | 2 | 1 |
| Stock dividend | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 13 |

From Table 2, we can see that subjects in groups believed the combination of *R&D budget* and *planned production quantity* to be the factors that ought to be prioritized, followed by the combination of *R&D budget*, *planned production quantity* and *equipment investment budget*. In other words, the learners believed the establishment of *R&D budget* and *planned production quantity* to be the crucial tasks for business operation. On a related note, *maintenance expense budget* fell mostly between 4$^{th}$ and 6$^{th}$ place, mainly due to the fact that learners felt that maintenance only comes after the equipment have started running for production. Six groups of learners chose *stock dividend* as the 8$^{th}$ place, as most of them felt that a company may only issue dividends after the business has surplus from profit, and this is consistent with the ranking from individual decisions.

Table 2: Group decision ranking

| Decision items | Decision ranking | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Product pricing | 1 | 0 | 1 | 0 | 0 | 1 | 3 | 1 |
| Marketing budget | 1 | 0 | 4 | 0 | 0 | 0 | 2 | 0 |
| R&D budget | 2 | 2 | 0 | 2 | 1 | 0 | 0 | 0 |
| Maintenance expense budget | 0 | 0 | 0 | 2 | 2 | 2 | 1 | 0 |
| Planned production quantity | 2 | 2 | 0 | 1 | 1 | 1 | 0 | 0 |
| Equipment investment budget | 1 | 2 | 2 | 1 | 1 | 0 | 0 | 0 |
| Quantity of material purchased | 0 | 1 | 0 | 1 | 2 | 2 | 1 | 0 |
| Stock dividend | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 |

**Status of Data Usage**

Results from the study revealed that determination of point of market entry had been tackled from aspects including shipping expenses and product lifecycles. As for the setting of product pricing, pricing versatility, and shipping expenses had been the top priority. Impact of marketing activities had also been a vital indicator and a factor for consideration in the formulation of marketing budget. Most of the subject groups shared the opinion that prior to determining the point of market entry, one must take factors including the costs of shipping for the particular market in question, growth of product lifecycle and consumers' responses to the pricing into consideration in conjunction with other relevant information in order to accurately deduct relevant costs to determine pricing. As for the estimation of marketing budget, participants referred to the market's response toward the marketing activities before finalizing the marketing budget. These findings reveal that given subjects' background in the business, the overall economic data and industry background data had functioned as important references in the process of decision-making.

**Analysis of Individual and Group Decisions**

This study found that familiarity with data content to be a factor that had affected subjects' decision-making process (as shown in Fig. 1). When the subjects were less familiar with the contents of specific given data, they would first discover the problem before getting to the facts. If they happened to have limited understanding of the questions asked, they would confirm the question once more and adhere to specific rules and logic before proposing their ideas and searching for a solution. That would be Path 1. However, when the subjects had more understanding of the experimental data, they would discover the problem before finding the facts, followed by proposing their ideas directly in search of a solution. That would be Path 2. In contrast with the problem-solving history that Osborn (1953) and Parnes (1977) had proposed, regardless of subjects' familiarity with the data, they had always found the problem first before their discovery of the facts, rather than getting at the facts prior to identifying the problem.

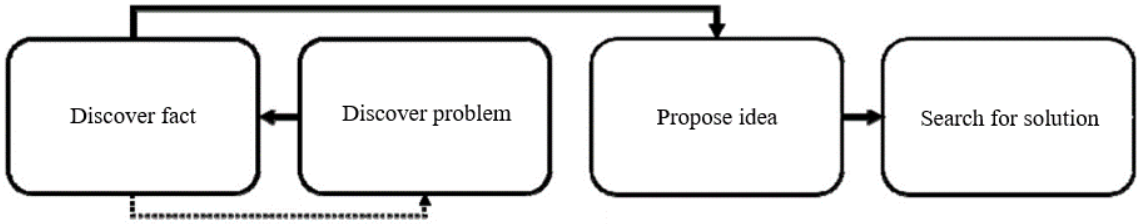


Fig 1. Flow of individual decision-making process

According to past studies, the extent of information availability and enthusiastic participation from group member discussions were affected by the amount of information possessed by individual members. Therefore, the more information that individual members have, the more likely they would be able to reach consensus in an effective decision-making process (Bonito, 2001). That said, the study had set out to explore if individual subjects' familiarity with a given data set would also affect the group's decision-making process when given the same amount of information. The study found that when the subjects were less informed on experimental data, they would engage in a loop of individual decision – share information – integrate information and only come to a decision after reaching consensus (as shown in Fig. 2). However, when the subjects were more familiar with the experimental data, they would engage in a shorter loop of individual decision – share information before integrating the information for decision-making. In short, this finding is consistent with the argument that groups of subjects would follow the sequence of information processing as a group before decision-making as presented in past studies (Kerr & Tindale, 2004).

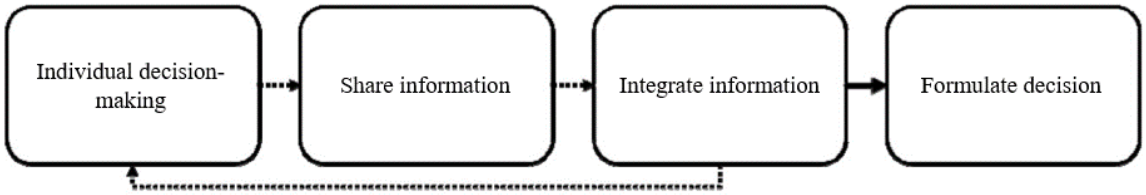


Fig 2. Flow of group decision-making process

## Conclusions and Implications

### Conclusions

In the exploration of subjects' individual and group decision-making cognition through the analysis of their decision ranking, the study found that for subjects in both groups, product pricing, marketing budget, and planned production quantity had been priority factors for consideration. Concerning the decision for stock dividends, most of the subjects believed that a business must first have surplus from profit before it can issue dividends. Therefore, they would first determine factors such as income and expenses before deciding if they would issue stock dividends. Individual subjects and group subjects showed discrepancies as individual subjects would first compare expenses and income before purchasing materials, while group subjects would calculate all the relevant costs before determining product pricing. The study also found that for all subjects, their familiarity and sensitivity towards the experimental information have changed their paths of thinking. For individual participants, when they were unfamiliar with the given data, they would go through a loop of thinking about the problem and discovering facts and would choose data that are relatively scattered. In contrast, subjects who were familiar with the data would avoid the loop, discover the problem and facts before proposing their ideas, and offer more professional information. As for subjects in groups, when they were unfamiliar with the data, they would go through a loop of information sharing and integration in order to search for the information they needed. When they were familiar with the data, they would go to the loop of individual decision and information sharing before integrating their information for the formulation of decision.

### Implications for Education

Findings of this study show that the process of decision-making for individual and group subjects is in fact susceptible to change depending on their familiarity with the given data. From the teacher's perspective, students demonstrate varying degrees of awareness for decision-making management. As such, the task of achieving the anticipated learning results for all students in a limited number of lessons might be somewhat difficult. According to Hsu (2004) study, students can only acquire limited problem-solving skills and knowledge by studying textbooks, while O'Neil et al. (2005) believed that digital educational games could not only help students to prepare for lessons in advance and test their learning results at the end of lessons but also facilitate awareness and affective learning.

In addition, Adobor and Daneshfar (2006) pointed out that the closer simulation games are to real-life situations, the easier it would be for students to understand the connection between decisions and consequences. Therefore, the study suggests that for courses that feature complicated contents that may be hard to understand for students, teachers could use digital simulation games to assist students in the learning process. Educational simulation games not only help to boost students' motivation and interests in learning but also enable students to associate relevant social and economic factors in the real world through realistic scenarios, thereby making them an ideal tool for pre-lesson preparation and post-lesson review.

## References

Adobor, H., & Daneshfar, A. (2006). Management simulations: Determining their effectiveness. *Journal of Management Development, 25*(2), 151-168.

Bonito, J. A. (2001). An information-processing approach to participation in small group. *Communication Research, 28*(3), 275-303.

Brand-Gruwel, S., Wopereis, I. G. J. H., & Vermetten, Y. (2005). Information problem solving by experts and novices: Analysis of a complex cognitive skill. *Computers in Human Behavior, 21*(3), 487-508.

Denzin, N. K., & Lincoln, Y. S. (2012). *The landscape of qualitative research* (4th Eds.). Thousand Oaks, CA: Sage.

Eysenck, M. W., & Keane, M. T. (2000). Cognitive psychology: A student's handbook (4th Eds.), Chapter 18. Philadelphia: Psychology Press.

Failing, L., Gregory, R., & Harstone, M. (2007). Integrating science and local knowledge in environmental risk management: A decision-focused approach. *Ecological Economics, 64*(1), 47-60.

Hastie, R., & Dawes, R. M. (2009). *Rational choice in an uncertain world* (2nd Eds.). Thousand Oaks, CA: Sage Publications

Hsu, S. (2004). Using case discussion on the web to develop student teacher problem solving skills. *Teaching and Teacher Education, 20*(7), 681-692.

Kerr, N. L., & Tindale, R. S. (2004). Group performance and decision making. *Annual Review of Psychology, 55*, 623-655.

Laughlin, P. R., Bonner, B. L., & Miner, A. G. (2002). Groups perform better than the best individuals on letters-to-numbers problems. *Organizational Behavior & Human Decision Processes, 88*(2), 605-620.

Leddy, M, A., Anderson, B, L., & Schulkin, J. (2013). Cognitive-behavioral therapy and decision science. *New Ideas in Psychology, 31*(3), 173-183.

Lin, Y. L., & Tu, Y. Z. (2012). The values of college students in business simulation game: A means-end chain approach. *Computers & Education, 58*(4), 1160-1170.

McCarthy, P. R., & McCarthy H. M. (2006). When case studies are not enough: integrating experiential learning into business curricula. *Journal of Education for Business, 81*(4), 201-204.

McCaslin, M. (2009). Co-regulation of student motivation and emergent identity. *Educational Psychologist, 44*(2), 137-146.

Meder, B., Le Lec, F., & Osman, M. (2013). Decision making in uncertain times: what can cognitive and decision sciences say about or learn from economic crises? *Trends in Cognitive Sciences, 17*(6), 257-260.

Morita, D., & Kumar, K. (2007). Managed socialization: How smart companies leverage global knowledge. *Knowledge and Process Management, 14*(3), 148-157.

O'Neil, H. F., Wainess, R., & Baker, E. L. (2005). Classification of learning outcomes: Evidence from the computer games literature. *The Curriculum Journal, 16*(4), 455-474.

Osborn, A. F. (1953). *Applied imagination.* New York, NY: Scribner's.

Parnes, S. J. (1977). Guiding creative action. *Gifted Child Quarterly, 21*, 460-476.

Romero, M., & Lambropoulos, N. (2011). Internal and external regulation to support knowledge construction and convergence in computer supported collaborative learning (CSCL). *Electronic Journal of Research in Educational Psychology, 9*(1), 309-330.

Sacchi, S., & Burigo, M. (2008). Strategies in the information search process: The interaction between task structure, knowledge and source. *Journal of General Psychology, 135*(3), 252-270.

Van Merriënboer, J. J. G. (1997). *Training complex cognitive skills: A four-component instructional design model for technical training*. New Jersey, NJ: Educational Technology Publications.

Weisberg, R. W. (2006). *Creativity: Understanding innovation on problem solving, science, invention, and the arts*. Hoboken, NJ: Wiley.

Young, K., & van Aarde, R. J. (2011). Science and elephant management decisions in South Africa. *Biological Conservation, 144*, 876-885.