# AN INVESTIGATION OF THE COGNITIVE PROCESSES IN SOLVING OPERATIONAL RESEARCH PROBLEMS AMONG SELECTED BUSINESS DEGREE UNDERGRADUATES IN MALAYSIA

CHENG CHUEN SHEILA

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# AN INVESTIGATION OF THE COGNITIVE PROCESSES IN SOLVING OPERATIONAL RESEARCH PROBLEMS AMONG SELECTED BUSINESS DEGREE UNDERGRADUATES IN MALAYSIA

**CHENG CHUEN SHEILA**

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## ABSTRACT

Many studies and reports indicated that Malaysian graduates did not possess the required problem solving skills to meet the societal and industrial demand with the increase in complexity of problems nowadays. The crux of Operational Research is to equip students with problem solving skills. It also helps people to make better and informed decisions. Solving OR problems hinges on principles of cognitive psychology, but there is a dearth of research on cognitive processes in the domain of OR. This study explored the cognitive processes and pathways used by Malaysian undergraduate business degree students (UBD) in solving well-structured (WS) and ill-structured (IS) OR problems. The similaritioures and differences in these problem solving processes between the successful and unsuccessful problem solvers were identified.

Forty-two UBD students from six tertiary institutions were selected for the case study. In-depth observations and interviews were conducted. The problem solving sessions using the 'think aloud' approach were audio- and video-recorded. For both OR problems, the cognitive processes were determined from behaviour and performance exhibited by participants while they were delineating the concepts, proposition and strategies in their solution paths. All written responses and transcripts of video-recordings and interviews in the problem solving sessions were transcribed, analysed and classified into episodes of strategies for the interpretations of the cognitive processes.

The findings from this study reveal that the performance on the well-structured problem was different from, and independent of, the ill-structured problems. For the well-structured problem, the cognitive processes of participants did not exhibit

a straightforward linear pattern, while no non-linear pattern of cognitive processes was found in the cases of the ill-structured problem.

This study also found similarities and differences in cognitive processes between successful and unsuccessful solvers. For the well-structured problem, successful solvers could recall, retrieve and relate the relevant concepts to the problem. For the unsuccessful solvers, they could not fully comprehend the problem although they indicated that they had learnt the relevant concepts and knowledge. For the ill-structured problem, both successful and unsuccessful solvers could recall, retrieve and relate concepts, knowledge and experiences relevant to the problem. The difference between the successful and unsuccessful solvers was the varying degrees in understanding and analysing the problem. Successful solvers spent more time in solving both the well- and ill-structured problems than the unsuccessful solvers. It was also found that pathways to solving well- and ill-structured problems influenced the individual's decision-making outcomes. When the problem did not conform to certain patterns, participants had a freer hand to use their own preferred method(s) to solve (whether successful or otherwise) the problem and made the decision accordingly.

Emanating from these findings, a (6+1)-Rs problem solving heuristic model has been proposed to ameliorate the cognitive processes of students in solving OR problems and the quality of decision making. The findings suggest significant implications for the development of effective OR pedagogy and improvement in the design of instructional materials.

## APPROVAL PAGE

I certify that I have supervised /read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in quality and scope, as a thesis for the fulfilment of the requirements for the degree of Doctor of Philosophy.

.....
Prof. Dr. Siow Heng Loke
Asia e University
Supervisor

.....
Prof. Dr. Miles Barker
Universiti of Waikato, New Zealand
External Examiner 1

.....
Prof. Dr. Beh Kian Lim.
Universiti Teknologi MARA
External Examiner 2

.....
Prof. Dr. Leonard Yong
Adjunt Professor, Asia e University
Internal Examiner

.....
Prof. Dr. John Arul Phillips
Asia e University
Chairman, Examination Committee

This thesis was submitted to Asia e University and is accepted as fulfilment of the requirements for the degree of Doctor of Philosophy.

.....
Prof. Dr. John Arul Phillips
Dean, School of Education
& Cognitive Science

.....
Prof. Dr. Siow Heng Loke
Dean, School of Graduate Studies

## DECLARATION

I hereby declare that this thesis is submitted in fulfillment of the PhD degree is my own work and that all contributions from any other persons or sources are properly and duly cited. I further declare that the material has not been submitted either in whole or in part, for a degree at this or any other university. In making this declaration, I understand and acknowledge any breaches in this declaration constitute academic misconduct, which may result in my expulsion from the programme and/or exclusion from the award of the degree.

Name: Cheng Chuen Sheila

Signature of Candidate: 

Date: 9 June, 2014.

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# CHAPTER 1

# INTRODUCTION

*"Learning is what you do when you don't know what to do... learning power is 'all in the mind' ".*

*(Guy Claxton,2001)*

## 1.1 Introduction

"If we are to question ourselves on what is the most interesting and important thing humans do with their thinking skills, the answer usually is 'They solve problems'" (Sinnott,1989, p. 1). The ability to solve problems is an essential skill in life.

To understand how to solve problems effectively is critical not only in improving people's life, but also helps in an organisation's sustainability and competitiveness, especially in the rapidly changing global environment. Many researchers (Burton, 2013; Chong, Wang, & Chiew, 2010; DeYong, Flanders, & Peterson, 2008; Hammouri, 2003; Lee, Teo, & Bergin, 2009) acknowledged that decision makers are required to possess different problem solving skills to approach and solve different types of problems.

In Malaysia, problem solving is regarded as an important skill in the development of human capital and upgrading of mental and intellectual capacity of a nation. It is thus an important skill to be acquired by its decision makers who are the pillars of the society if Malaysia is to become a developed country (Ninth Malaysia Plan, 2006).

In the international education system (OECD, 2004), problem solving is also regarded as one of the educational objectives. Jonassen (1997) commented that most educators regarded problem solving as the most meaningful and important way of learning and thinking. It was believed that the transfer of problem solving skills