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A STUDY OF THE COGNITIVE PROCESSING MODELS USED IN THE APPRAISAL SYSTEM: THE MALAYSIAN PUBLIC SERVICE

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ABSTRACT

The purpose of the paper is to present the results of semi-structured interviews undertaken with expert raters (School Principals) within the Malaysian Education System. These interviews have been conducted using a cognitive mapping protocol. The resultant causal cognitive maps are explored for what they have to tell us about the Cognitive Processing Models (CPM) applied in appraisal decision-making. From the research findings, it is clear that raters recognized the CPM steps in their performance appraisal (PA) practice. The study also identifies the differences between individual expert raters in terms of concepts and complexity in the decision making process. Finally, the study discusses the implications of the research for the CPM and appraisal decision-making process.

INTRODUCTION

The performance appraisal system is important as a management tool for confirming the effectiveness and efficiency of employees in the workplace (Armstrong and Baron, 1998). As a result employees become strategic assets for organizations and can determine the survival of an organization (Drucker, 1994). This paper discusses research into the performance appraisal system in the Malaysian Public Service (MPS) by looking at the CPM of the raters. It offers understanding and explanation of the role of CPM as a new perspective on the decision-making process. In the MPS, performance decisions are of great interest to employees because they can affect their monthly salaries. They can also be seen as influencing the job satisfaction and motivation of workers. The first section of this paper looks at the appraisal process as practiced elsewhere in general and specifically in the MPS. It is followed by a discussion of the CPM. After that, the research questions and research design in this study are described. Finally, research findings are detailed and this paper ends by discussing conclusions and drawing implications for the CPM and appraisal decision-making process.

THE APPRAISAL PROCESS

PA can be defined as a periodic evaluation of the output of an individual measured against certain expectations (Yong, 1998). PA is the process of observing and evaluating a staff member's performance in relation to pre-set standards (Lewis and Panting, 1985). Classical approaches to PA have treated it as a measurement process, whilst more contemporary approaches to appraisal are more concerned with information processing within the PA decision-making process. In this context, Dennis (1994) stressed the importance of looking at PA as a participative process (coaching and counselling) rather than a judgmental review. The PA system in the MPS is a process of evaluating employees, always begining early in the year, and ending sometime in December. The system consists of several steps, which can be considered as a continuous, yet periodic process.

COGNITIVE PROCESSING MODELS (CPM)

Cognitive processing broadly includes almost any activity involving the mental manipulation or storage of information (Murphy and Cleveland, 1995). Models of PA have assumed that appraisal largely concentrates on cognitive processing activities (DeNisi, Cafferty and Meglino 1984; Feldman, 1981; Landy and Far, 1980, 1983; DeNisi and William, 1988; Ilgen and Feldman, 1983). These models explicitly treat the rater as an active seeker of information, and are often referred to as social information processing models because raters are processing information about people rather than objects (DeNisi and William, 1988). How a rater searches for information will determine what behaviour the rater observes. If important information is not observed, incorrect evaluations of ratees may be made. Several conceptualisations of the cognitive processes involved in PA have been proposed (e.g. Beck De, Osullivan and Boh Le, 1995; DeNisi *et al*., 1984; Feldman, 1981; Landy and Farr, 1980, 1983, Murphy and Cleveland, 1995, Wofford and Goodwin, 1982, 1990). They are 'observation', 'categorization', 'storage', 'retrieval', 'integration' and 'decision' as shown in Figure 1.

The first step in the CPM is the 'observation' of ratees by raters. 'Observation' is defined as carefully observing behaviour for performance evaluation, so that accurate information is stored in memory (Murphy and Cleveland, 1995). The purpose of 'observation' can have a direct impact on the accuracy of behaviour ratings. The second step is 'categorization', which means information is simplified by categorising it into dimensions that represent the complexity of observed behaviour in a relatively simple form. 'Categorization' depends on the similarity between a target and each of the categories that are available to the rater. The 'storage' step refers to the process by which sensory information is retained in the memory. This process involves both short-term working memory and long-term memory.

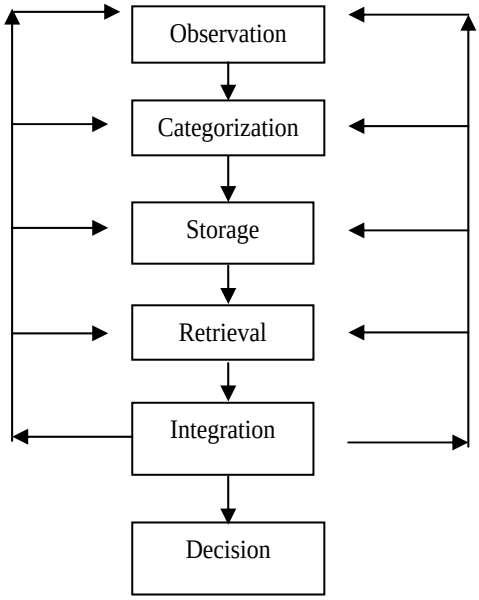

Figure 1. Cognitive processing model in performance appraisal

The fourth step, i.e. 'retrieval' incorporates the process by which stored information is recovered. 'Retrieval' procedures involve recall and recognition. Recall represents a relatively unstructured effort to retrieve information. Recognition represents an attempt to determine whether a stimulus that is present in working memory matches anything stored in long-term memory. 'Integration' of different pieces of information happens through encoding, storage and retrieval. 'Integration' of information about present performance with information about previous and subsequent performances can lead to either assimilation or contrast effects. The final step 'decision' can be influenced by the rater's judgement and should integrate all the stages of the model as described. It is at this stage that all the factors previously identified are most likely to influence the effectiveness of an appraisal.

RESEARCH OBJECTIVES

This study aims to identify a CPM of the raters in the MPS' PA system. To achieve this aim, the cognitive maps of the expert raters are explored. Experts are defined as those raters with experience of five years or more who have been trained in the PA process. In particular, this study seeks to answer the following research questions:

- What are the expert raters' cognitive maps in the PA system in the MPS?

- What are the differences between CPM in the MPS and the CPM in the theoretical framework?

DESIGN AND METHODOLOGY

A qualitative approach has been used to gain understanding of the expert raters' CPM used in PA in the MPS. It is meaningful because qualitative research is situational or contextual, and aims at discovering meaning, giving explanations (Morvaridi, 1998) and describing the situation, phenomenon, problem or event (Kumar, 1998).

In this study, in-depth semi-structured interviews were undertaken to construct causal cognitive maps of raters and took place between 6th October 2000 and 30th November 2000. A cognitive map is a graphical representation of an individual's understanding of a particular issue, domain or problem (Langfield-Smith, 1992), which if elicited properly potentially allows for deeper and more integrative understanding and insights for the researcher. These were then subsequently explored for evidence of the CPM.

One-to-one interviews were undertaken between the researcher and respondent on the appraisal decision process. All the individual participants were assured of anonymity. The interviews began with the researcher asking the participants to describe what they thought were the key elements or concepts of the issue under discussion. These were recorded without prejudice, by the interviewer on Post-It notes, using the individual's own terminology. Individuals were allowed to speak with minimal interruption until they indicated that they had generated enough concepts to describe their understanding. Participants were then asked to identify those concepts they thought were related and to describe the nature of this relationship. This allowed the interviewer to define causal links between the concepts, which describe the line of influence that exists between them. In practice it was done by transferring Post-It notes to sheets of paper. Participants were given 'core' or 'seed' concepts as starting points for their models. It was made clear to participants that they were free to discard any concept that did not add to or fit the image they were building. During the construction process, participants frequently identified additional concepts. Finally, to complete the interviews, participants were asked to look again at their concepts and to further describe and explain them.

Interviews were conducted at the Kota Setar Education District Office, Kedah, Malaysia and on average lasted from 45 minutes to an hour and a half. The outcome of the interview consisted of a 'raw' cognitive map, made up of a Post-It Note collage built by the respondent and aided by the interviewer. Interviews were also recorded on tape with the permission of the respondent. The tape was reviewed by the researcher to ensure that it concurred with the image and information obtained.

Following the interviews, the 'raw' cognitive maps were redrawn on computer using a specialist cognitive mapping software tool, called *Decision Explorer* (Version 3.0.6; 1997) provided by Banxia Software Limited. This was adopted because of its flexibility, accessibility and wide use (Ackermann, Eden and Cropper, 1990; 1996; Eden, 1992). The images obtained were returned to the respondent for comment and validation, and any changes by the respondent were included in the final version of the cognitive map. For this research, the output from *Decision Explorer* was posted to the respondent and a specific date was given to the respondent to make any changes . If there were no changes within that period of time, it was assumed that respondent accepted his cognitive map. These maps were subsequently explored by the researcher for evidence of the CPM, as described in Figure 1.

RESPONDENT PROFILE

Of the 11 respondents involved in the semi-structured interview, 44.5% were males and 55.5% were females. With regard to the ethnic origin, 72.7% were Malays, 18.2% Chinese and 9.1% Indians. In terms of age, 63.3% were below 45 years while 45.6% were between 45–55 years old. In terms of educational level, only 18.2% of respondents completed their masters degree and the rest had a bachelor's degree. In terms of current post, 27.3% were school principals, 54.6% were Deputy Principals and 18.2% were Senior Teachers. As for their length of time in the public service, 45.5% served between 16–20 years while the remaining between 21–25 years. The respondents were also asked to indicate their roles in the implementation part of the New Remuneration System. The survey showed that, 27.3% of the respondents were First Assessor Officers while 72.7% were Second Assessor Officers.

ANALYSIS

This section discusses the output of the cognitive maps of the raters. A map consists of individual causal cognitive map representation of their understanding on CPM. An example of the causal cognitive maps representing the expert raters towards CPM in the decision-making process are presented in Appendix 1. They are numbered 'E1' to 'E11' to distinguish between respondents. Concepts identified by each individual are numbered in the order they were espoused, with each individual model's numbering beginning with a multiple of 100, corresponding with the order in which the models were obtained.

The links and relationship between the concepts are shown by the arrows between them, with causality of these relationships expressed by the direction of the arrows. For example, an arrow from 'X' to 'Y' denotes that 'X' leads to, influences or affects 'Y', or 'Y' is dependent upon or follows 'X'. A double-headed arrow denotes co-dependence, where influence is shared or works both ways. The action of the influence in relationship is also

expressed. The negative influence is shown by the inclusion of a minus sign (–) next to the arrow while a positive influence is shown by the absence of such a sign.

Cognitive Map Descriptive Statistics

Table 1 shows the expert raters' cognitive-map concepts. The table shows that the total concepts explored by the expert raters were 586 and the mean value is 53.4. The highest individual concepts is 69 (E11) while the lowest is 39 (E9).

TABLE 1
ANALYSIS OF EXPERT RATERS' CONCEPTS BY CPM STEPS

Rater steps	Obse.	Cate.	Stor.	Retr.	Inte.	Deci.	Total
E1	12	4	6	8	12	7	49
E2	11	6	7	7	11	15	57
E3	15	1	1	1	20	16	54
E4	10	7	7	4	7	12	47
E5	13	5	5	5	19	11	58
E6	14	4	4	4	12	7	45
E7	24	6	6	10	11	4	61
E8	10	8	8	12	10	6	54
E9	7	3	3	5	8	6	39
E10	9	8	8	7	12	9	53
E11	22	4	8	8	11	16	69
Total	147	56	70	71	133	109	586
Mean	13.4	5.1	6.4	6.5	12.1	9.9	53.4

Key: Obse. = observation, Cate. = categorization, Stor. = storage, Retr. = retrieval, Inte. = integration, Deci. = decision

This table gives a clear picture of the emphasis of expert raters towards the CPM in PA decision. The first step of CPM is 'observation', and the highest concepts score for the expert raters group is 24 (E7). The lowest score is 7 (E9). Seven respondents (63.6%) have scores below the mean value (13.4). For 'categorization', the highest concepts score is 8 (E8, E10), and the lowest is 1 (E3). 45.5% of the expert raters' obtained scores above the mean (5.1). For 'storage', the total concepts are 70, and the mean value 6.4. The highest score is 10 (E9) and the lowest score is 1 (E3). More than half of the respondents (54.5%) have scores above the mean. The total cognitive concepts for 'retrieval' are 71, and the mean is 6.5. The highest score is 12 (E8) while the lowest is 1 (E3). 45.4% have a 'retrieval' concept below the mean. The total concepts for 'integration' are 133, with a mean value 12.1. The highest score is 20 (E3). 81.8% have concepts below the mean value. The final step in CPM is 'decision'. The total number of concepts for all the raters is 109, while the mean value was 9.9. Among the respondents, E3 and E11 have the highest score on concepts, namely 16. The analysis above shows that step 1 ('observation'), step 5 ('integration') and step 6 ('decision') of the CPM have a large number (147, 133 and 109)

of the cognitive concepts mentioned by expert raters. In general, it means the three steps were the most recognized and important for the raters amongst the other concepts.

The concept links which show the map links for expert raters in Table 2 also show the same pattern: 'observation' has 167 concepts-links, 'integration', 167 links 'decision', 133 links. Other concepts show the moderate score ('categorization – 55, 'storage' – 70, 'retrieval' – 72). The total number of map links for expert raters was 664, while the mean value is 60.4. Rater E3 has the most map-link concepts (89 links), while the lowest number of links (39 links) comes from rater E9. Analysis by map links shows that E11 has the highest score for 'observation' (27 links); E4 for 'categorization' (14 links); E7 and E9 for 'storage' (11 links); E7, and E8 for 'retrieval' (11 links); E3 for 'integration' (39 links); and E3 for 'decision' (27 links). The data output of the map links above shows that 45.5% of respondents have map links below average, while 54.5% are above average. This shows that, 54.5% of respondents have complex map links while performing their tasks in the decision-making process for PA purposes.

TABLE 2
EXPERT RATERS' MAP LINKS

Rater steps	Obse. link	Cate. link	Stor. link	Retr. link	Inte. link	Deci. link	Total
E1	15	3	5	7	13	9	52
E2	10	5	6	7	10	14	52
E3	23	0	0	0	39	27	89
E4	13	14	5	3	8	23	66
E5	13	4	1	4	19	10	51
E6	14	4	10	9	4	11	52
E7	24	5	11	11	16	3	70
E8	10	7	5	11	15	7	55
E9	9	2	11	4	7	6	39
E10	9	7	8	8	24	8	64
E11	27	4	8	8	12	15	74
Total	167	55	70	72	167	133	664
Mean	15.2	5.0	6.4	6.5	15.2	12.1	60.4

Key: Obse. = observation, Cate. = categorization, Stor. = storage, Retr. = retrieval, Inte. = integration, Deci. = decision

Table 3 shows each model in terms of the number of concepts and links it contains including measures of complexity (B), and density (y). The mathematical basis for these measures are discussed in Appendix 2. Complexity (B) gives the mean number of links per concept in each map, and the higher the B-score the more complex the map (Johnson, Gregory, and Smith 1986; Eden, Ackermann, and Cropper 1992). Density (y) compares

the actual number of links present in a map with the theoretical maximum number possible for the number of concepts the map contains. The closer y approaches one, the more the map approaches optimal connectivity (Daniels, Markoczy and DeCernatory, 1994). Table 3 below highlights the variety obtained in the context of expert raters' individual models; they incorporate between 39 (E9) and 69 (E11) concepts, and between 39 (E9) to 89 (E3) maps links. In terms of complexity, individual models range from a low of 0.91 (E2) links per concept, to a high of 1.56 (E3). The individual models of density (Y) range from 0.016 (E2) to 0.033 (E4).

TABLE 3
EXPERT RATERS' MENTAL MODELS SUMMARY

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
Concepts	49	57	54	45	55	51	62	52	39	54	69
Links	52	52	89	65	51	50	70	55	39	66	74
Beta	1.06	0.91	1.56	1.44	0.92	0.98	1.12	1.06	1.00	1.22	1.07
Y	0.022	0.016	0.031	0.033	0.017	0.019	0.018	0.021	0.026	0.023	0.016

DISCUSSION

Discussion is organized around sub-topics reflecting the research objectives and questions. The intention is to simplify the discussion and to contribute to a better understanding of the research findings.

What are the individual cognitive maps of expert raters towards CPM in PA decision?

Cognitive maps of the raters can be seen and understood from two aspects: individual cognitive maps and group cognitive maps. Individual cognitive maps, as shown in Table 1 and Appendix 1 explain the information processing process in the PA decision. It shows all the steps followed and involved in the process, and is based on causal concepts relationship. Every individual cognitive map is different in terms of the concepts themselves, concepts for each step, the total concepts themselves and the concepts links. As a result, every individual has a personal cognitive map with its own complexity.

Based on that argument, the data shows that among expert raters, E11 has the highest cognitive concepts towards CPM in decision making, while E8's scores are the lowest. E3 has the highest scores for link concepts, while E8 has the lowest score. From the discussion above it is clear that the raters' cognitive maps can be explored and understood through the use of selective techniques in the data collection phase.

What are the expert raters' cognitive maps in the PA system in the MPS?

The expert cognitive maps can be seen in Table 1. It is clear that expert raters while making a PA decision follow all the steps in the CPM. Rater E11 has a higher number of total concepts compared with other respondents. The lowest total goes to respondent E8. The total concepts show how many concepts were discussed or practiced by the respondent. Indirectly, a respondent with the highest total is considered as a rater who gives a wide coverage to the task and is more complex in processing information.

From that table, it is clear that expert raters are keener and have a clearer understanding when performing their jobs. Everybody, without denial, realized, recognised, and was aware of the six steps in the CPM. The only difference was the emphasis in each of the CPM steps. For the expert raters, the sequence of emphasis was led by 'observation' (147 concepts), followed by 'integration' (133 concepts), 'decision' (109 concepts), 'storage' (71 concepts), 'retrieval' (71 concepts), and ending with 'categorization' (56 concepts). Thus, the data shows that three steps in CPM (observation, integration and decision) were more familiar to the raters compared with the other concepts (categorization, storage and retrieval). This finding supports the literature review that states that the above three steps were more complex and hard to understand.

In terms of concept links, the results show that 'integration' and 'observation' have the highest score (167 concepts), followed by 'decision', 'storage', 'retrieval' and 'categorization'. The results also show that expert raters take a lot of consideration when integrating and observing the information before arriving at 'decisions'.

What are the differences between CPM in the theoretical framework and CPM in the MPS?

The CPM model was based on literature review. This section will discuss how the CPM model can be applied to the Malaysian Public Service. All the respondents recognized and practiced the six steps in the CPM. Table 4 shows a summary of the CPM steps and the raters' recognition of each step.

In short, the research findings show that the six steps in the CPM are practiced and recognized by the raters in the Malaysian Public Service PA decision-making. The important point to highlight is that every step has its own weighting, and raters are welcome to emphasise any point they consider important. It is clear that the research findings have met the research objectives in this study, namely to test the CPM suggested by other scholars and researchers. The answer is that the raters have followed the CPM as suggested by the literature review.

TABLE 4
EXPERT RATERS' PRACTICE ON CPM STEPS

CPM Steps	Percentage (%)
Observation	100
Categorization	100
Storage	100
Retrieval	100
Integration	100
Decision	100

RESEARCH IMPLICATIONS

This paper discusses the practice of PA and identifies a role for research, which, in particular, focuses upon the influence of CPM employed by raters. In general from the research findings it is clear that the raters in the MPS uses the CPM in PA decision which parallels the CPM offered by scholars. The research findings show that raters have different types of cognitive maps. Raters concentrated more on 'observation', 'integration' and 'decision'. The findings show that the other steps need to be emphasised as well and considered to make the decision making process more systematic, effective and reliable. It would be better if training can be conducted for the raters involved with the system. It is hoped that by systematic and continuous training, raters can perform better in the appraisal decision-making process. Research by Al-Atoibi (1999) supports this fact saying that training can enhance raters' ability and accuracy of rating.

One of the important research findings indicates that rater experience is very important in order to fulfill their obligation as raters. Experience is a very important criterion for a good rater. Skills and knowledge for good raters can be obtained by training. Perhaps training programmes can be arranged by the Public Service Department, for all existing and would-be raters. It is hoped that such training would produce good raters. The Public Service Department, Malaysia also should be more stringent in the appointment of new raters. New raters should fulfill all criteria before being adjudged expert raters. This group of raters can be called novice raters. Perhaps a comparative study should be conducted for these two types of raters and the output compared.

PROBLEMS AND LIMITATIONS

Although the research has generated important and interesting findings, there are limitations and problems in this study, which need to be acknowledged and addressed. There are several problems, which arise during the use of cognitive mapping techniques. Face-to-face, semi-structured interviews call for a lot of skills to conduct. The researcher must be very careful with the words and terms. Although there is a guideline for the

questions to be asked, sometimes it is hard to control the session. This is because the issue discussed is very sensitive. Respondents also try to avoid giving detailed information, as the topic of discussion may be very sensitive and they were also not ready for open discussions. To prevent these problems, the researcher asked permission from the respondent to tape the discussion. More than 50% of the respondents were not happy with this. As an alternative to this the researcher used post-noted techniques to record the interview details.

Other limitations were the narrow scope of the issues identified (the CPM), the time sensitivity of the models, and the changes in the cognitive maps studied. These problems limit the applicability of the results to real situations. Finally a descriptive analysis adopted in this study has its own limitations, which may also limit the findings of the study.

SUMMARY AND CONCLUSION

In this paper, the emphasis has been on the steps involved in cognitive processing models by the raters in the PA decision-making process. The analysis of this paper indicates that there were six steps followed by raters when performing their job: 'observation', 'categorization', 'storage', 'retrieval', 'integration', and 'decision'. Furthermore, the descriptive analysis carried out in this chapter highlights the fact that cognitive processing models do exist in the Malaysian Public Service PA system. The outcomes from the semi-structured causal interviews undertaken among the raters in the Malaysian Public Service were presented. As a result, cognitive maps representing novice and expert raters in cognitive processing models have been explored.

The paper started with a discussion on the aims of the semi-structured interview and was followed by a discussion of the respondents' background. Cognitive maps of the raters were then shown in detail.

This paper offers a new perspective to understanding performance rating by looking at the cognitive processing models of the raters. It is hoped that important facts and steps that are involved in the decision-making process can be explored. As a result, the research should contribute to a better understanding of the PA process undertaken by raters. By explaining the cognitive processing models of expert raters the research offers some insight to policy makers on how performance rating can be impressed.

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APPENDIX 2

Mental Model Characterisation and Analysis: Measures Used

Map Measures

Two measures derived from mathematical graph theory (Harary, 1969) are identified:

1. 'Complexity'

   Complexity (B Index) identifies the mean number of links serving each concept and differentiates simple maps (low B) from complex (high B) (Johnson, Gregory and Smith 1986), according to the formula:

   $$B = I / C$$

   Where: I = the total number of links in a map; and c = the total number of concepts in that map.

2. 'Density'

   Map density (y Index) represents the total number of link in a causal map divided by the theoretical maximum number of links, which is defined as the maximum possible number of links between a given number of concepts (Klein and Cooper 1982). Y is calculated according to the equation:

   $$Y = I/C(C–1)$$

   Where: I = the total numbers of links in a map; and c = the total number of concepts in that map. This provides a score ranging from 0 to 1, and as y approaches one, the map's density increase and the more it approaches optimal connectivity.