

Studying the effect of mental sets in solving anagram

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Abstract

Introduction: Mental sets are clues which are already coded and stored in memory, and retrieved when needed. The present study investigated the role of mental sets in solving anagram problems.

Methods: The design of this study is an experimental with repeated measurement design. The participants were 20 MA students and graduates chosen through voluntary sampling. Each of them were required to undertake four different varieties of measurement by anagram cards; names (people/country), sets (with/without) as the experimental instrument. Research data were analyzed through repeated measurements ANOVA test.

Results: There was significant discrepancy between names of people and names of countries with and without set ($p < 0.05$). This was while, there was no significant difference between names of people and names of countries with set and names of people and names of countries without set.

Conclusion: The presence of mental sets and clues facilitates the solving of anagrams. This readiness and clues should be presented in the coding stage in order for them to be remembered in the retrieval stage.

Keywords: Mental Sets, Clue, Problem Solving, Anagram

Introduction

Problem solving is the analysis and transfer of data for a particular purpose. This goal may be accessible or needed to gain insight directly and so, solutions may be focused on a specific domain of extensive knowledge [1]. Problem solvers have to overcome barriers between a given initial state and a goal state [2]. Thereby, they explore and integrate information to discover rules that can be applied to solve the problem [3]. While interacting with the task, problem solvers build a problem representation and derive a problem solution [4]. Therefore, problem solving is a self-directed cognitive-behavioral process in which a person attempts to identify effective or adaptor solutions for specific problems encountered in everyday living [5]. This cognitive behavioral process makes available a variety of potentially effective solutions for a particular problem, and also increases the probability of selecting the most effective solution from among the various alternatives. Problem solving is conceived as a conscious, rational, effortful, and purposeful activity (ibid).

Findings in educational psychology show that expert problem solvers master a large body of easily accessible domain-specific knowledge [6]. Mastering and applying problem solving is essentially critical for successful performance [7].

One of the variations of problems is "anagram". Anagrams are vague and unclear words represented to participants (e.g. M-d-r-s-e) and they have to solve it [8].

The mental set is the ability that the problem solver brings to the learning situation and this data provides facilities for him.

So, mental set is a cue or clue that helps participants in problem solving [9]. *Thimpson & Medigan* [10] believe anagram solving by mental sets to be related to the retrieval stage of working memory. In the retrieval stage, the participant converts a cue to code, and then compares it to saved materials in short-term memory and ultimately the participant is hopefully able to solve the problem [11]. *Cushen & Wiley* [12] ascertained that the increased representation in the retrieval stage has caused memory recovery and increased function of problem solving.

Ash et al. [13] showed that the representation of clear cues help people in solving problems creatively. *Ellis, Glaholt & Reingold* [14] found that a barrier in solving of anagram problems causes a decrease in participant functions. *Cushen & Wiley* [12] demonstrated that representation of implicit cues facilitates the visual-insightful problem solving in participants.

Even though cuing effects can be observed with both endogenous and exogenous cues, recent findings point to the idea that endogenous attention and exogenous attention produce qualitatively different effects on information processing [15].

Interesting examples of dissociation on the speed of information processing has been stated in literature [16], illusory perception [17], conscious perception [18], and conflict resolution [19]. *Alaghebandha & Yazdi* [9] have shown that solving verbal problems accompanied with mental sets happens faster than solving them without mental sets. Also, *Korami-Noori et al.* [20] have found that representation of cue facilitates recall in dyslexic children. Overall, problem solving is important in the functioning of subjects. The presence of a cue would increase the speed of recall in retrieving data [19]. So, if no selective attention is paid to the learning of material in coding the data, or the cues have decreased, or there is an obstacle in the storage and retrieval of data, it would lead to failure of the problem solving function [12, 13].

This topic is important in learning and increases the problem solving ability. The presentation of cues is important for learning and problem solving, because they cause an increase of strategies of problem solving in students and improve their performance [12, 15]. Taking former studies into consideration, the aim of this study is to investigate the effect of mental sets in solving anagram problems.

Methods

This experimental research enjoyed a repeated measurement design. The participants of the study were chosen from postgraduate students and PhD graduates

attending the Tehran National Library. Twenty participants were chosen by available sampling. Among this sample 8 were male and 12 were female. Each participant was required to undertake four different varieties of measurement by anagram cards. i.e. names of people with set; names of people without set; names of country with set; and names of country without set. Anagram cards were prepared by the researcher. They consisted of 20 cards in 5×6 cm size. On each of the 10 cards, scrambled letters of names of people (female & male) were written, and on the other 10 cards the scrambled letters of names of countries were written down. All of the words consisted of 5 letters. At the back of anagram cards related to proper names letters A₁ to A₁₀ were written, and at the back of anagram cards related to the name of countries letters B₁ to B₁₀ were written. Each group of cards (name and country) was divided to two. So there were four groups of cards each consisting of 5 cards, named "AA, BB, AB, BA". "AA" referred to the proper names with set; "BB" referred to the name of country without set; "AB" related to proper names without set, and "BA" related to the name of country with set. The reliability and internal consistency of the cards for the time spent in solving anagrams calculated by Spearman-Brown correlation coefficient (0.77).

The research was carried out with each of the participants and there was a resting time between each stage. Reaction time was registered for each group of cards (AA, BB, AB, BB) for every individual participant. The maximum responding time was calculated to be 240 seconds. Using the split-half method, the reliability of the time required for solving anagram cards was calculated as 0.77.

Each participant undertook four different kinds of measurement by anagram cards including "proper name with/without set" and "country name with/without set"

Results

Based on the time each participant solved the scrambled word in each of the four groups of the experiment, the descriptive statistics is depicted below.

As it can be seen in table 1, the mean (M) and standard deviation (SD) for "proper name with set" are 216.8 and 225.84 respectively. The (M) and SD for "country name without set" are 257.15 and 276.92 respectively. The mean and SD for "proper name without set" are 316.45 and 324.64 and the mean and SD for "country name with set" are 122.25 and 149.23. As it is clear from the above table the response time in each group was significantly less with set compared to without set.

Table 1. Descriptive statistics of four research variables for each of the participants

Variables	Mean	Standard deviation (SD)	Standard error of mean	N
Proper name with set	216.8	225.84	50.52	20
Country name without set	257.15	276.92	61.95	20
Proper name without set	316.45	324.64	72.62	20
Country name with set	122.25	149.23	33.36	20

Table 2. The results of ANOVA with repeated measurement and Tukey's follow-up test on the differences among the four groups

Change sources	Sum of squares	df	Mean of squares	F	Sig	Difference in mean of groups	Tukey's follow-up test	sig
Between subjects	116137.59	19	6112.50	*17.78	0.05	99.65	*3.79(1) & (3)	0.05
Within subjects	826332.30	60	13772.20			134.9	*5.14(4) & (2)	
Trial reaction	399505.39	3	133168.46			117.28	*4.46(1,4)&(3,2)	
Residual(tre)	426826.91	57	7488.19			94.55	3.60(1) & (4)	
Total	942469.89	79				59.3	2.25(2) & (3)	

As it can be observed from table 2, the results of ANOVA with repeated measurements show that there are significant differences between the four groups of proper names and country names with and without set at $\alpha = 0.05$. Therefore, a Tukey test was run to find out exactly where the difference lay. Given the results of Tukey's follow-up test, this difference was between the proper names with and without set and names of country with and without set integrally ($P < 0.05$). It should be pointed out that no significant difference was found between proper names and country names with set, and also proper names and country names without set.

Discussion

As indicated in the literature by *Alaghebandha & Yazdi* [9] the mental set is the learning readiness that the problem solver brings with him/her-self to the problem situation. *Thimpson & Medigan* [10] believed that solving anagrams by mental sets relates to the retrieval stage of working memory.

The present study indicated that mental sets have an effect on solving anagrams. The solving of anagrams accompanied by the presentation of mental sets occurs faster than without sets, and decreases reactive time. This can have positive effects on enhancing learning of specific materials for learners.

In addition, this study showed that responding time of the country names (with and without set) is less than the responding time of proper names (with and without set). The reason could probably be that learning tasks consisted of high and low frequency words which had a determinative role in learning and coding operations. *Bowden* (1997 as cited in *Pressley and Hilden, 2006*) showed that high frequency words were recalled much faster than low frequency words. These findings are consistent with the findings of *Lupianez et al.* [21]; *Lupianez et al.* [22] and *Korami-Noori et al* [20].

Another finding of the study indicated that the time for solving anagram of names (proper, country) with mental sets was much shorter than solving anagrams without mental sets. In line with this findings of this study is the result of research findings of *Funes, Lupianez, & Milliken* [19] and *Botta, Fabiano, & Lupianez* [15] which stresses the effectiveness of mental sets in solving more difficult anagram problems. More difficult anagram problems (a combination of proper and country names) act as creativity problems and require hard work on the part of the learner. In such difficult tasks the speed of processing information decreases and the anagram solver engages

in conflict resolution [19]. In such circumstances presenting cues could increase the speed of information processing and provides the best situation for decision making for the anagram solver. These findings are in line with the findings of *Ash et al.*[13]; *Botta and Lupinez* [15] and *Funes et al.*[19].

Another research finding showed that a significant difference was found between proper names and country names with set. *Korami-Noori & Nilson* [20] referred to the negative effect of cueing. They believed that although the cues were presented in the coding stage, not only the presentation of cues didn't aid in data recall in the retrieval stage, but they also negatively affected recall and weakened it. Several studies have shown that the presentation of part of words list or just part of the used categories as compared with the time when no cue was presented didn't help subjects to recall the material better [8]. Therefore just as retrievable cues could facilitate the recall of information, they could also have an inhibiting effect, and instead of playing a facilitative role have a debilitating role.

Another research result was that there wasn't any significant difference between means of names of people and countries without set. The participant in the explicit retrieval (recall with the help of cue), consciously recalls the learning material, but in the implicit retrieval, She/he can retrieve information without consciously being aware of it. In such circumstances, according to *Eyessenck & Keane* [23], neither the presence nor the absence of sets are determinative factors in way of information processing, but rather the psychological activity of the learner is a determining factor.

Overall, the representation of set and clue is useful in teaching and problem solving, since the aim of presenting them is helping the learner to learn, decreasing amnesia and losing data in each of the three stages of memory, i.e. coding, storage, and retrieval [23]. Like any other research, there were some limitations during this study. The most important one was the limited number of researches carried out in Iran. Therefore the researcher had to take advantage of researches published outside the country. Furthermore, there was no way to control intervening variables which might affect the generalizability of the research. Another limitation was the lack of knowledge of the participants regarding "problem solving", "mental sets", and the effect of these mental sets on learning and that this lack of knowledge led to non-cooperation of some of the participants in the process of research.

We recommend further future studies to be conducted

with anagram cards in familiar and unfamiliar situations and a research could measure the number of trials instead of reaction time. Also, researchers could increase the number of scrambled letters on anagram cards to make it more difficult for the learners.

Conclusion

Mental sets are clues that provide a position for the information learning in storage phase, until it's remembering is facilitated with external signs in the retrieval phase. Therefore, their presentation can be used in the instructional level and people's education.

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