EFFECTS OF LEVELS OF PROCESSING AND DISCIPLINARY DIFFERENCES IN RECALL MEMORY

[1]Mefoh, P.C., [1]Chukwuorji, J. C., & [1]Nwonyi, S.K.
[1]Department of Psychology,
University of Nigeria, Nsukka,
Enugu state, Nigeria.

Abstract

This study re-examined the hypothesis that deep processing results in higher performance in recall tasks and investigated whether disciplinary differences exists in recall memory. Undergraduate students (N=128; Males = 64, Females = 64) of 4 faculties in University of Nigeria, Nsukka were given a memory prose and their performance on recall task was tested. ANOVA results showed that there was no significant difference in the performance scores of students in the various academic disciplines on the memory test, however the effect size for disciplinary differences was .06, indicating that 6% of the variance in recall was explained by differences in academic discipline. Participants in deep processing condition had superior performance on recall than those in shallow processing condition, $F(1,120) = 37.17$, $p < .001$. The effect size of .24 indicated that about 24% of the variance in recall was explained on account of levels of processing. The interaction effect of levels of processing and academic discipline on recall memory was not significant. Findings were discussed on the basis of levels of processing framework and the generic nature of common university courses.

Key Words: Deep processing, Disciplinary differences, Recall, Shallow processing.

Memory is a cognitive function that allows for information processing, storage and retrieval/recall (Ruchkin, Grafrnan, Cameron & Berndt, 2003; Postle, 2006; Rudner, Karlsson, Gunnarsson & Rönnberg, 2013). It is vital for daily functioning; and the levels of processing framework has become increasingly regarded as one of the most well-established information processing approaches for the past 42 years. In their seminal work, the proponents of the levels of processing approach (also referred to as depth of processing) (Craik & Lockhart, 1972), suggests that during memory encoding, different types of processing leads to different levels of memory retention and performance. Deep processing involving the semantic content of the to-be-remembered information is associated with higher levels of recall than shallow processing involving only the surface characteristics of the stimulus such as orthography and phonology (Rudner, et al., 20l3). In other words, "memory traces can be seen as records of analyses carried out for the purposes of perception and comprehension of which deep processing results in more durable traces" (Nyberg, 2002, p. 345).

The depth of processing effect on recall memory has been demonstrated in several studies showing that tasks requiring semantic processing result in greater recall ability (e.g., Rose, 2010; Boatwright-Horowitz, Langley & Gunnip, 2009; Barton, 2010; Loaiza, McCabe, Youngblood, Rose & Myerson, 2011; Rose & Craik, 2012; Mefoh, 2006; Giraldo, 20l3; Wagner, Schacter, Rotte, Koutstaal, Maril, Dale, et al., 1998). In a computer-based experiment, Torun and Altun (2012) investigated recall performances during reading a context-free story

Correspondence: sampsonnwonyi@yahoo.com

from a computer screen. An immediate recall test was used to determine students' performance on free recall, title recognition and location memory with an online memory performance determination and measurement instrument. It was found that deeply processed elements were remembered better and the strength of the encoded memory trace depended on the mental processes involved in the different tasks. On the contrary, Rose, Myerson, Roediger and Hale (2010) developed a complex working memory span task manipulated levels of processing at encoding but they did not find a significant benefit of deep processing on recall memory. Such contrary findings were also reported by Loiaiza and Camos (2013) and Rose (2013). Most of the previous studies (e.g., Mefoh, 2006) studied levels of processing among only students in homogenous areas of study, but recent research efforts (e.g., Sarnavi, Javdan & Rahbar, 2013), are geared towards investigating depth of processing effect on recall memory of students studying different academic disciplines. The present research is therefore in line with the current wave of research.

Disciplinary differences in academic pursuits (labelled academic discipline in this study), is a level of context which is beyond task variations (see Vanderstoep, Pintrich & Fagerlin, 1996; Prosser &Trigwell, 1999). It has been observed to have substantial significance on motivational orientations and engagement in higher education (Blumenfeld, 1992; Becher, 1994; Healey, 2000; Lueddeke, 2003; Kemp & Jones, 2007; Kandiko & Matos, 2012). In particular, Vanderstoep, Pintrich & Fagerlin (1996) reported that the components of knowledge, motivation and self--regulation do distinguish high from low achievers in social and natural sciences, but not in humanities. To the knowledge of the researchers in the present study, there is no previous research on effect of academic discipline on recall memory.

Research on the functional educational relevance of disciplinary differences in learning has not been developed to examine whether such disciplinary differences affect performance on recall memory tasks; or whether academic discipline interact with levels of processing to recall memory. The present study extends the investigations of the levels of processing framework by not only examining the effect of levels of processing on recall memory among students in a broad range of disciplines, but also the differences in performance on recall memory tasks on account of the disciplinary differences. The study will also investigate the interaction effect of depth of processing and academic discipline on recall memory. **It** was hypothesised as follows:

HI There will be significant effect of levels of processing on recall with deep processing resulting in higher performance on recall memory tasks.

H2 There will be a significant difference in performance on recall memory tasks of students in different academic disciplines.

Method

Participants

One hundred and twenty eight undergraduate students of University of Nigeria, Nsukka (UNN) in 300 levels participated in this study. They consisted of 64 males and 64 females, drawn from four randomly selected faculties, amongst the 9 faculties of university of Nigeria Nsukka campus. The faculties were Art, Biological sciences, Engineering and Social sciences, following Donald's (1990, 1994) lead in order to examine differences across a diverse spectrum of disciplines. There were 32 participants (16 males and 16 females) from each faculty. Age range was from 15-32 years (Mean age = 21.57).

Instrument

The stimulus material for the study was a prose passage of 267 words (Wright, 2007), which was chosen by 6 students out of 10 students that were randomly selected from the Department of English and Literary studies, University of Nigeria, Nsukka. The students were asked to judge 6 selected prose passages on the basis of "which is most interesting". The face/content validity of the prose passages was ascertained through expert judgment by the first author and two other researchers

in Department of Psychology, University of Nigeria, Nsukka. Pilot testing of the instrument yielded an internal consistency reliability coefficient (Cronbach's alpha) of .81, which showed that the instrument has adequate reliability.

Procedure

At the beginning of the experimental session, participants were informed about the nature of the experiment and informed consent was obtained. They were informed that anyone who wishes to withdraw at any point in the course of the experiment has the right to do so. Participants were randomly divided into two groups with the restriction that there is equal number of males and females in each group. Levels of processing were manipulated by varying the instructions that was given to the deep processing and shallow processing conditions. Participants assigned to the deep processing condition received the following instructions:

You are welcome to this experiment. When you settle down; you would be given a prose passage to read. Your task is *to identify the theme of the passage.*

Those who were assigned to the shallow processing condition were instructed in these words:

You are welcome to this experiment. When you settle down; you would be given a prose passage to read. Your task is *to identify the number of times these words Negroes, I, police man, and black woman appeared in the passage.*

Participants in one group were unaware of the instructions given to the other group. The two groups were also unaware that a memory test would follow later. Each group studied the stimulus materials separately in the same class room. The study time was 5 (five) minutes to discourage rehearsal. After studying the stimulus material, five (5) minutes retention interval elapsed before the administration of the memory test. Participants were instructed to write their answers on the spaces provided besides each item. The dependent variable was the total correct answer out of the nine (9) items on the memory test. Each correct answer was scored 1, while an incorrect answer was scored 0 (zero).

Design/Statistics

A 2 (Levels of processing: deep, shallow) X 4 (Art, Biological sciences, Engineering, and Social sciences) factorial design was employed. Analysis of variance (ANOVA) was employed to test the hypothesis.

Results

Table 1: Mean and Standard Deviations of academic discipline and levels of processing (LOP)

Variable	Levels	Mean	SD	N
Academic Discipline	Arts	4.44	2.12	32
	Biological Sciences	5.53	2.08	32
	Engineering	4.66	2.18	32
	Social Sciences	5.28	2.07	32
Levels of Processing	Deep	5.98	1.59	64
	Shallow	3.97	2.15	64

Table 1 showed that participants from faculty of Biological Sciences had higher recall memory mean score (M = 5.53, SD = 2.08), followed by Social Sciences (M = 5.28, SD = 2.07), Engineering (M = 4.66, SD = 2.18) and Arts having the lowest recall memory mean score (M = 4.44, SD = 2.12). Also, participants in the deep processing group had a higher recall memory mean score (M = 5.98, SD = 1.59) than those in the shallow processing group

(M = 3.97, SD = 2.15).

Table 2: ANOVA summary table showing the effects of academic discipline and levels of processing (LOP) on recall memory.

Source	SS	DF	Mean Square	F	D2
Academic Discipline (A)	25.40	3	8.47	2.42 NS	.06
Levels of Processing (B)	130.01	1	130.01	37.17*	.24
AXB	3.84	3	1.28	.37 NS	.01
Error	419.69	120	3.50		
Corrected total	578.93	127			

Keys: NS = Not significant; *p > .05; **p > .001

Table 2 showed that there was no significant difference in the mean performance scores of students in the various academic disciplines on the memory test, F (3,120) = 2.42, p > .05. However, the effect size for disciplinary differences was .06, indicating that 6% of the variance in recall was explained by differences in academic discipline. There was no significant effect of academic discipline on recall. Result indicated a significant effect of levels of processing on recall, F (1,120) = 37.l7, P > .001. Participants in deep processing condition had superior performance on recall than those in shallow processing condition. The effect size of .24 indicated that about 24% of the variance in recall was explained on account of levels of processing. The interaction effect of levels of processing and academic discipline on recall memory was not significant, F (3, 120) = .37, NS. Only 1% of the variance in recall was explained on account of the interaction of levels of processing and academic discipline.

Discussion

Effects of levels of processing and academic discipline on recall memory were investigated by the researchers. The result of the findings showed that levels of processing had a significant main effect on recall memory. Thus the first hypothesis which stated that there will be significant effect of levels of processing on recall with deep processing resulting in higher performance on recall memory tasks was supported. Consistent with the Craik and Lockhart's (1972) levels of processing framework, memory tasks that require participants to consider the semantic features of the material needed a deeper processing and resulted in greater recall. The present finding is also consistent with previous empirical research findings (e.g., Rose, 2010; Boatwright, Langley & Gunnip, 2009; Barton, 2010; Loiaiza, et aI., 2011; Rose & NCraik, 2012; Mefoh, 2006; Giraldo, 2013; Wagner, et al., 1998; Kanegi, N. D; 2012; Samavi, et al., 2013) showing that deep processing leads to superior performance on recall because semantic processing involves thinking about the memory task in a conceptual way and there is increased levels of stimulus elaboration.

The finding is contrary to some other studies (Rose, Myerson, Roediger & Hale, 2010; Loiaiza & Camos, 2013; Rose, 2013) indicating a lack significant difference between participants in deep processing conditions and those in shallow processing conditions on recall. Generally, it can be argued that for accurate recall, deep processing of information is more effective than attempting to consciously store information on a shallow level and this seems particularly important to students in their exams, class tests, interviews, screening exercise and other assessments. Students who study extensively with utmost effort and are able to analyse the information contained in the course material will likely score better grades than those whose do not study in the same manner. It has been suggested that contextual modifications in teaching, task requirements and assessment processes can increase college students' use of deep processing approaches in learning (Gordon &Debus, 2002; Mefoh, 2006).

Findings showed that academic discipline had no significant effect on recall memory. This finding is contrary to the second hypothesis which stated that there will be a significant difference in performance on recall memory tasks of students in different academic disciplines. This implies that course of study does not determine how effective people may recall. The present day Nigerian university system has become structured in such a way that students offer courses that are not specific to their discipline. The stimulus material used for the study is a prose passage and the study of English is a compulsory course for all students in the university, irrespective of their study area. Examining the results of the interaction, there was no interaction effect of levels of processing and academic discipline on recall. The findings of the present study is relevant to students in an academic environment where there is an age-long need to improve students' performance and enhance the applications of conceptual knowledge in finding solutions to real-world problems.

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