INTERNATIONAL BACCALAUREATE EXAMINATION YEAR 2008

PSYCHOLOGY: HIGHER LEVEL

INTERNAL ASSESSMENT

TITLE: An experiment to determine the effect of different processing tasks on recall.

Word Count: 1980

Abstract

The aim of this experiment was to determine whether different levels of processing information altered the accuracy and amount of information that can be recalled. The research hypothesis states that the participants who perform the deep-processing task (semantic) will have significantly more accurate recall and remember more words than those who perform the shallow-processing task (superficial).

The method used was an experiment with a design of independent measures. The independent variable was the task that participants performed and the dependent variable was the number of words they recalled. The participants were separated into two conditions, A and B with different processing tasks. They were then presented with a list of 20 words and given 3 minutes to process them. At the conclusion of this time they were unexpectedly asked to perform a recall test.

All 12 participants were aged between 16 and 17 and were taken from an opportunity sample of Year 10 and 11 classes at C C G S .

The results supported the research hypothesis, which indicates that different processing tasks have a significant impact on the accuracy and extent of recall. These results support the Levels of Processing model proposed by Craik and Lockhart (1972).

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INTRODUCTION:

When learning takes place, it can occur through many different processes. Inevitably, some of what is learnt is later forgotten, which leads to the question of what can be done to improve memory, and if memory is linked to a particular learning process. This study of memory is related to cognitive psychology, which studies human mental processes. The aim of this experiment is to determine whether different levels of processing information can alter the accuracy and amount of information that can be recalled.

Craik and Lockhart (1972) proposed the Levels of Processing (LOP) theory and conducted an experiment to show that information could be processed in a number of different ways, and the durability and strength of a memory trace was a direct function of the depth of processing involved. The aim of their experiment was to systematically study retention following different orientation tasks within the incidental learning condition. Several groups of participants were presented with the same list of 20 words and told to process them using one of three different tasks. These tasks moved progressively from shallow to deep processing and were to count the vowels in each word, to write a definition for each word, or to personalise each word. The groups were then all given a surprise recall test. The independent variable that Craik and Lockhart used was the task that the participant performed with the list and the dependent variable was the amount and accuracy of the words recalled. Craik and Lockhart found that the deep processing group remembered the most words and the superficial group remembered the least. From this they concluded that retention depended on how the central processor was used during learning and that a deeper level of processing could produce better retention. This is most relevant to my experiment as I will be generally replicating this study, but with only 2 conditions.

Hyde and Jenkins (1973) conducted a similar experiment, but employed different orientation tasks. These tasks moved progressively from deep to shallow processing and required the participants to rate the word for pleasantness, estimate the frequency with which each word is used in the English language, detect the occurrence of the letters "e" and "g" in the list words, decide whether the list words fitted sentence frames, or decide the part of speech (noun, verb, etc.) appropriate to each word. Hyde and Jenkins found that the first two tasks, involving semantic processing of the word, resulted in a higher recall rate than the other three, which did not involve semantic processing. This supported the Levels of Processing theory because it showed that the nature of the processing, i.e. semantic/deep, had a direct impact on the strength and accuracy of a memory. Thus the work of Hyde and Jenkins (1973) also relates to my experiment because it shows that even though different words and orientation tasks were used the deeper processing still produced more accurate recall. This is important because I will be using a different word list to Craik and Lockhart (1972).

Eysenck (2001) further experimented with this theory and argued that long-term memory is affected by the distinctiveness of processing. He tested this theory by using nouns having irregular grapheme-phoneme correspondence (i.e. words not pronounced in line with pronunciation rules, such as "comb" with a silent "b"). Participants performed shallow processing tasks of pronouncing the words as if they did have regular grapheme-

phoneme correspondence, which produced distinctive and unique memory traces. Eysenck found that this distinctiveness enabled participants in this condition to remember almost as many words as the two semantic conditions. Thus his findings show the importance of distinctiveness. This is relevant to my experiment as it means that the word lists will need to be alternated in relation to word order, to counterbalance any effects that distinctive words may have.

Research Hypothesis – H_1
The participants who perform deeper processing tasks (semantic) will have significantly more accurate recall than those who perform shallow processing tasks (superficial)

Null Hypothesis – H_0
There will not be a significant increase in the amount of information that can be recalled with the deeper processing task.

This is a one tailed (directional) hypothesis.

METHOD:
Design:
The design of this experiment was independent measures. This was used in order to reduce demand characteristics. The independent variable was whether the participants counted the vowels in each word or wrote a definition for each word. The dependent variable was the number of words they recalled. The word lists were alternated in relation to word order, as counterbalancing was necessary to reduce the effect of primacy and recency on recall and ensure that distinctiveness did not confound the results. Consent was attained from each participant and they were given the right to withdraw themselves and their results from the experiment at any time. The participants were not told they would be required to do a recall test in the instructions and this deception was justified because it was necessary to reduce the demand characteristics of memorising the words. At the conclusion of the study participants were fully debriefed, offered a copy of the results if they wished to see them and given the opportunity to withdraw.

Participants:
The target population of this study was the Year 10 and 11 history classes at C C G S . The participants were mostly Caucasian students, aged between 16 and 17. They generally came from middle to upper class families. A participant sample was taken of 12 students. This sample was an opportunity sample because it was the most convenient method in the space of time we had been allocated. The participants were randomly allocated to each condition.

Materials:
Consent Form (Appendix 1)
Set of instructions for each condition. To be given verbally. (Appendix 2-3)
List of 20 words (Appendix 4-5- taken from the Toronto Word Pool)
Debriefing sheet (Appendix 6)
Answer sheet (Appendix 7)

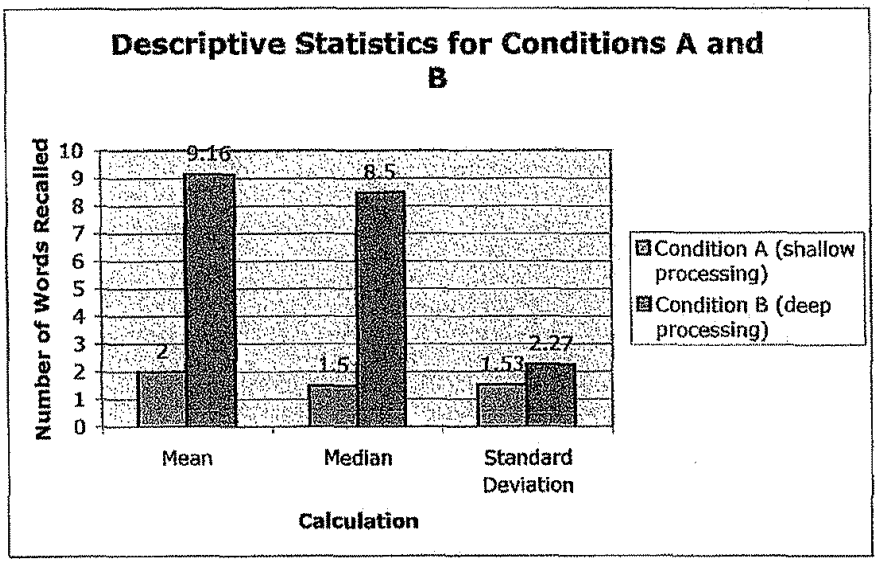
Procedure:
Preparing the room:
Close the blinds and arrange the desks so that they are separate with one chair at each.
Place one word list and one answer sheet face down on each of the desks.

Experiment:

1. In the prepared room handout the consent forms (Appendix 1). Give the participants the opportunity to withdraw.
2. From the opportunity sample group, randomly select 2 groups by drawing the numbers 1 or 2 out of a hat.
3. Take Condition A (deep processing group) into the prepared room and sit them randomly at any desk with a piece of upside down paper on it.
4. Follow instruction sheet 1 (Appendix 2) and give the participants the opportunity to withdraw.
5. Collect the results.
6. Present the group with the debriefing sheet and answer any questions. Give them the opportunity to withdraw.
7. Allow Condition A to leave but ask them to join the rest of the sample again.
8. Reset the room and repeat steps 3-6, following instruction sheet 2 (Appendix 3).
9. Allow Condition B to leave.

RESULTS:
Figure 1 is a column graph showing the mean, median and standard deviation for the participants in both conditions. It can be seen from Figure 1 that the mean number of words recalled in condition A was 2 words and the mean number of words recalled in condition B was 9.16 words. This means that on average the participants who participated in deep processing recalled four times as many words as those who performed shallow processing tasks. The standard deviation for condition A was 1.53 and for condition B it was 2.27. This means that there was a greater dispersal in condition B than in condition A.

Figure 1: Descriptive Statistics for Conditions A and B



To test the significance of the results, a Mann Whitney U test was used because it was an independent measures design and was a non-parametric test. It was one-tailed because a direction for the results was predicted. The number of participants was 12 and the critical value at 0.01% is 3. Therefore, as U=0, U < 3 is true and thus the results were highly significant (Appendix 9). The probability of getting these results by chance or random error was less than 0.01%. This means that the null hypothesis can be rejected and the research hypothesis accepted.

DISCUSSION:

The aim of this experiment was to determine if different processing tasks can alter the accuracy and extent of information that can be recalled. From the results it can be seen that the research hypothesis was supported and the number of words recalled for each condition was significantly different, as shown by the Mann Whitney U test of statistical difference.

These results support the work on Levels of Processing (LOP) done by Craik and Lockhart (1972). This was expected as the procedure used in this experiment was largely based on their systematic study. The results further supported the work of Hyde and Jenkins (1973) who employed different processing, or orientation tasks but still found that deeper semantic processing had a direct impact on the strength of memory. The work of Eyesenck (2001) enabled me to ensure that distinctiveness did not have an effect on the amount of words recalled as I alternated the word order within the conditions. This counter balancing provided an added control to ensure that the type of task performed was the only variable.

The use of an experiment itself has different strengths and limitations. As this was a laboratory experiment I was allowed strict control over extraneous variables, such as disturbances from outside, by closing the blinds and preparing the room in advance. This control increased the accurate measurement of variables and thus the results will be more objective than other methods. By manipulating an independent variable I was able to indicate that the task performed caused the different levels of recall. This also provides a greater ability to replicate the study. By using independent measures I was able to ensure that order effects, such as learning, fatigue or boredom, did not influence a second condition since the participant only participates in one condition. Furthermore, demand characteristics were less prominent because the participants were unaware that they would be required to sit a memory test.

My experiment was limited in that the strict control of variables may have produced unnatural behaviours, which lack ecological validity. The design also had limitations in that more participants were required because each is used only once. This was a problem for the experiment because we were limited to no more than 20 participants in total and the opportunity sample only consisted of 12. The use of an opportunity sample also means that the sample may not directly represent the target population, reducing the validity of my results. Ideally using random sampling could control this; however it was not appropriate for the time we were allocated.

In the future it would be interesting to investigate Eyesenck's theory of distinctiveness in more depth, and see if it could be tied to the Levels of Processing model. This would require having four conditions, 1) Deep processing with non-distinct processes, 2) Shallow processing with non-distinct processes; 3) Deep processing with distinct processes; 4) Shallow processing with distinct processes.

The Levels of Processing model can be applied throughout society, mainly in relation to education. Students could semantically process information and this would enable them to have more accurate recall of the content. This would be useful in particular for younger children when they are learning the meaning of words and things associated with them. If the words can come to have a personal meaning and they can write their own, unique definition of each word then, according to this research, they will be more likely to remember it later in life.

In conclusion, the research hypothesis was supported, which indicates that different processing tasks have a significant impact on the accuracy and extent of recall. These results support the Levels of Processing model proposed by Craik and Lockhart (1972).

Reference List:

Craik, F.I.M. & Lockhart, R.S. (1972) Levels of processing: A framework for memory research. Journal of Verbal Learning and Verbal Behaviour. Vol. 11, pp.671-684

Eysenck, W. (2001) Principles of Cognitive Psychology Second Edition, East Sussex, UK, Psychology Press

Hyde, T. & Jenkins, J. (1973) Recall for Words as a Function of Semantic, Graphic, and Syntactic Orienting Tasks. Journal of Verbal Learning and Verbal Behaviour, Vol. 12, pp.471-480

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Appendix 1:

CONSENT FORM

Levels of Processing Study

I have been asked to participate in a research project to be conducted by S G under the supervision of the IBO. I give my consent for any results obtained from me to be used in an analysis of the study.

Furthermore, I understand that:

1. The study will be carried out as described on the information sheet, a copy of which I have read and understood.
2. My consent to participate is voluntary
3. I may withdraw from the experiment at any time without penalty and I do not have to provide any reason for my withdrawal
4. My personal information will remain confidential and my results will remain anonymous.
5. I will be fully debriefed about the study upon completion.

Please print your name, signature and the date in the spaces provided:

Full Name: _____

Signature: _____

Date: _____

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Appendix 2:

VERBAL INSTRUCTION SHEET 1:

1. Please come in and take a seat at any of the tables.
2. If at any point in this experiment you wish to withdraw yourself or your results please let me know.
3. When you turn over the first piece of paper, you will be given three minutes to complete the following task.
4. You will be required to count the number of vowels in each word and write your answer beside the word.
5. If you finish early, please remain seated and silent.
6. You may now turn over the first page only.
7. (Time three minutes)
8. Please put your pens down and place your answers upside down on the edge of the table.
9. You now have a one-minute break before you will be required to complete another task. Please remain silent.
10. (Time one minute)
11. Now turn over the second piece of paper and recall as many of the words as you can.
12. (Time three minutes)
13. Please put your pens down.
14. If you wish to withdraw your results, please do so now.
15. Otherwise, thankyou very much for your co-operation in this experiment, it is very much appreciated.
16. You can now go back to the room but please don't talk about what you have done because it will ruin the results for the experiment.
17. After all the groups have completed their tasks I will debrief everyone on the aim and implications of this study.
18. Thankyou very much for your time.

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Appendix 3:

VERBAL INSTRUCTION SHEET 2:

1. Please come in and take a seat at any of the tables.
2. If at any point in this experiment you wish to withdraw yourself or your results please let me know.
3. When you turn over the first piece of paper, you will be given three minutes to complete the following task.
4. You will be required to write a definition for each word. Please write your answer beside the word.
5. If you finish early, please remain seated and silent.
6. You may now turn over the first page only.
7. (Time three minutes)
8. Please put your pens down and place your answers upside down on the edge of the table.
9. You now have a one-minute break before you will be required to complete another task. Please remain silent.
10. (Time one minute)
11. Now turn over the second piece of paper and recall as many of the words as you can.
12. (Time three minutes)
13. Please put your pens down.
14. If you wish to withdraw your results, please do so now.
15. Otherwise, thankyou very much for your co-operation in this experiment, it is very much appreciated.
16. You can now go back to the room but please don't talk about what you have done because it will ruin the results for the experiment.
17. After all the groups have completed their tasks I will debrief everyone on the aim and implications of this study.
18. Thankyou very much for your time.

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Appendix 4:

WORD LIST 1:

CLOTHING

POWDER

BEAUTY

TICKET

NOVEL

SUCCESS

CONFLICT

SILENCE

WATER

VALLEY

CANDY

CIRCUIT

LANGUAGE

SUSPECT

SPIRIT

NEPHEW

BITTER

FORGET

MERELY

ATTACH

10

Appendix 5:

WORD LIST 2:

CANDY

CIRCUIT

LANGUAGE

SUSPECT

SPIRIT

NEPHEW

BITTER

FORGET

MERELY

ATTACH

CLOTHING

POWDER

BEAUTY

TICKET

NOVEL

SUCCESS

CONFLICT

SILENCE

WATER

VALLEY

11

Appendix 6:

DEBRIEFING SHEET

Thankyou very much for your participation in this study. I appreciate your help and thankyou for your time. Below is a description of the research rationale.

The aims and implications of the study

This research was based around the concept of Levels of Processing. This theory provides a model for memory in which different processing tasks will provide different amounts of recall. The theory states that those participants who participate in deeper processing tasks, i.e. writing definitions for the words, will remember the word list more accurately than those who participate in shallow processing tasks, i.e. counting the number of vowels in each word.

This can be explained by the reasoning that deeper processing creates stronger links for memories in the brain and thus it is easier to recall those memories, even if this processing wasn't intentional.

The aim of this study was to provide evidence to support the theory that deeper processing provides for more accurate recall.

Rights to Withdraw Data

You have now been fully informed as to the purpose of this experiment and can understand how your results will be used. If you have any reason against the inclusion of your data in the final analysis of the results, you may ask for your results to be withdrawn at this point.

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Appendix 7:

ANSWER SHEET:

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Appendix 8:

Number Of Words Recalled

Condition A	
Participant	Number Of Words Recalled
1	4
2	2
3	4
4	0
5	1
6	1

Condition B	
Participant	Number Of Words Recalled
7	9
8	7
9	9
10	14
11	8
12	8

$$Mean_A = \frac{4+2+4+1+1+0}{6}$$
$$= \frac{12}{6}$$
$$= 2$$

$$Mean_B = \frac{9+7+9+14+8+8}{6}$$
$$= \frac{55}{6}$$
$$= 9.16 \text{ (3.s.f.)}$$

$Median_A = 0, 1, 1, 2, 4, 4$
$$= \frac{1+2}{2}$$
$$= 1.5$$

$Median_B = 7, 8, 8, 9, 9, 14$
$$= \frac{8+9}{2}$$
$$= 8.5$$

$Mode_A = 1$ and 4

$Mode_B = 8$ and 9

$Range_A = 4 - 0$
$= 4$

$Range_B = 14 - 7$
$= 7$

Standard Deviation = 1.53 (3.s.f)

Score (x)	$x - \bar{x}$	$(x - \bar{x})$
0	-2	4
1	-1	1
1	-1	1
2	0	0
4	2	4
4	2	4
12		**14**

Standard Deviation = 2.27 (3.s.f)

Score (x)	$x - \bar{x}$	$(x - \bar{x})$
7	-2.16	4.6656
8	-1.16	1.3456
8	-1.16	1.3456
9	-0.16	0.0256
9	-0.16	0.0256
14	4.84	23.4256
55		**30.8336**

$$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n}}$$
$$s = \sqrt{\frac{14}{6}}$$
$s = 1.53$ (3.s.f)

$$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n}}$$
$$s = \sqrt{\frac{30.8336}{6}}$$
$s = 2.27$ (3.s.f)

Appendix 9:

Mann Whitney U Test

Condition 1	Score	Rank
	4	5.50
	2	4.00
	4	5.50
	0	1.00
	1	2.50
	1	2.50
		$R_A = 21$
Condition 2		
	9	10.5
	7	7.00
	9	10.5
	14	12.0
	8	8.50
	8	8.50
		$R_B = 57$

$$U_A = NaNb + \frac{Na(Na+1)}{2} - R_A$$
$$= 6 \times 6 + \frac{6(6+1)}{2} - 21$$
$$= 36 + 21 - 21$$
$$= 36$$
$$U_B = NaNb + \frac{Nb(Nb+1)}{2} - R_B$$
$$= 6 \times 6 + \frac{6(6+1)}{2} - 57$$
$$= 36 + 21 - 57$$
$$= 0$$

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