

# Investigation on Schema Theory Through Examining Information Processing

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## ABSTRACT

This study is to investigate the relationship between relevant information and activation of schema. The participants in this study all come from the school of the author. In order to follow the ethical guideline of keeping the participants anonymous, the author did not mention the name of the school. The author replicated the study of Bransford and Johnson [3], which was used to test out the schema theory in 1972. The result in this study was that relevant information can activate schema which assist information processing. The author used the same tools as the original study but the result is opposite that exposing relevant information to participants does not have a positive correlation with better efficiency of information processing. However, the limitation of the research method needs to be considered in order to examine the validity of the result.

**Keywords:** *schema theory, relevant information, information processing*

## 1. INTRODUCTION

Past experiences and past information are stored in memory as schema. Schema is like a cognitive mental template that functions as a framework for our information processing. Schema can be influenced by our personal background, culture, past experience, and upbringing. The Schema theory states that how the human process and interpret new knowledge will be influenced by our schema. Schema is also in charge of assisting recalling, organizing information, storing knowledge, and increasing the efficiency of processing knowledge [2]. The study replicated Bransford and Johnson (1972) [3] with the aim to investigate if the activation of schema can help to assist memory recall. The method was using an independent research design. Participants were separated into three groups and were read a passage. Group A was told about the context of the passage which is about doing the laundry after reading and before rating level of comprehension. Group B was told about the context of the passage before reading. Group C was not told about the context throughout the experiment. The participants were asked to rate their comprehension level of the passage and asked to recall information about the passage. The participants of this experiment are 52 males and females who were enrolled in human learning at the State University of New York. The result shows that the compression rating and the

recall score of the group given the context before has a higher score than the rest two groups who had the context given after or weren't given. This is because the schema must be activated to allow the prior knowledge stored to help with comprehension and recall. This study is relevant to schema theory because it demonstrated the ability of schema theory to increase the efficiency of processing knowledge.

The aim of this research is to determine whether relevant information that activates schema impact information processing. This study provides support for the schema theory and explains our information processing and recall system. The result of this study can help to explain the reason for us making mistakes in our recalling information and why humans can quickly recall information. It also reveals why stereotypes exist which might be due to the way humans distort information in order to fix it into a previously existing schema. It was predicted that the titled group (told about the passage is about doing laundry before reading the passage) will rate a higher comprehension level compared to the untitled group (not told about the passage is about doing laundry). Telling the participants, the passage is about laundry before reading the passage or not telling the participants that the passage is about laundry throughout the study. The increased efficiency of information processing can be measured by the comprehension level of the passage. It was rated on a scale from 1 to 7. 1 is very difficult to

comprehend and 7 is really easy to comprehend. It was predicted that knowing the passage is about reading (activated schema) will have no impact on the comprehension level rating (information processing efficiency), so there should be no significant difference between the rating of the titled and untitled group.

## **2. EXPLORATION**

### **2.1. Research design**

This study used an independent group design. The participants were separated into two groups: titled and untitled group. The titled group is the ones that were exposed to the background context of the passage and has 9 people. The untitled group is the ones that were not given the background context of the passage and has 9 people. Furthermore, independent group design also controls the order effect because they were exposed to only one condition which is either titled or untitled. This decreases the chance of them feeling fatigued and boredom.

### **2.2. Sampling method**

This study utilized a convenience sample that is not a representative sample. The reason to choose this sample is that it is simple and time-saving. The participants that were available to us are the grade 10 Individual Society class from an international school in Hong Kong. This study was done during a special time (COVID), so there are still students who do online study (with some in different time zones). This made the sample size smaller than expected. There were 18 students in the lesson with a mixture of males and females between the age of 15-16. All student participants completed the study in class and 3 of them did it online synchronously. The participants have different ethnicities because they come from an international school. Because the study took place in a small school, the sample size is relatively small. Participants under the age of 16 had to get have been given parental consent. Because there were accidentally 11 in the untitled group and 7 in the titled group, the data is very uneven. Therefore, two teachers were added in the untitled group to make the sample more even. In the end, there were 11 participants for the untitled group and 9 participants in the titled group.

### **2.3. Procedure**

At the beginning of the study, the participants that were above the age of 16 were asked to sign an informed consent form. Participants that were under the age of 16 provided an informed consent form their guardians. The participants were noted that their participation in this study is voluntary and they can withdraw at any time if they feel uncomfortable. They were asked to prepare a pen. Next, they were randomly separated into groups by picking the names randomly. The names that were not

called were asked to leave the group and maintain social distancing. Participants that stayed in the room were the untitled group who were not told that the passage is about laundry. After one of the experimenters read out the passage, a survey titled level of comprehension was given to them. The participants were asked to flip over the survey and maintain silence after they've completed the survey. After their survey was collected, the group that was outside was asked to move inside. The group inside was asked to move outside which is the titled group. The passage was read and they were told that this passage is about doing laundry. They were given a survey titled comprehension level. After the survey was completed and collected, the group was invited inside to conduct a debrief. The participants were told about the purpose of the theory of this experiment. Their result will be kept anonymous.

### **2.4. Controlled variables**

Participants were all exposed to the same passage which is about doing laundry. The only difference was the titled group knows the passage is about laundry but the untitled group does not know. By giving all participants the same passage, it makes sure the participants are all activating the same schema which is laundry.

The participants were not allowed to discuss with each other before the study was finished. This prevents participants from influencing others rating and reduce the chance of participants developing demand characteristics.

The scale of the comprehension level was the same for both groups. They are both ratings on the scale from 1 to 7. This makes comparing results in two groups easier and clearer.

The participants were not told whether they were in the titled group or the untitled group. They are also not psychology students. This reduces the probability of the participants developing demand character.

### **2.5. Choice of material**

The same passage about laundry as the original study was used. This is because it comes from the study that was replicated. There were no modifications to the material that it was used word for word. Our group created our own version of scale by using Google Survey and the range of the scale is the same as the study of Bransford and Johnson which is a 1 to 7 scale. This allows us to easily compare our final result to that of the original experiment.

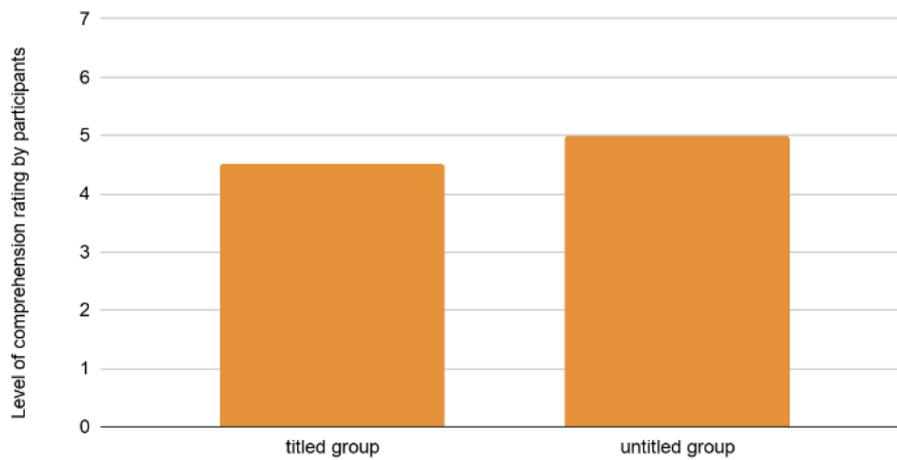
### 3. ANALYSIS

#### 3.1. Descriptive statistics:

The measure of the central tendency of this set of data is median because the data collected was on a scale from

**Table 1.** The measure of central tendency and measures of dispersion of the titled and untitled group

	Titled group	Untitled group
<b>Median</b>	4	5
<b>Range</b>	3	5



**Figure 1.** Comparison of the test results of two groups

The untitled group has a bigger central tendency which is a 5 compared to the 4 of the titled group. (5 is relatively harder to comprehend and 4 is relatively easier to comprehend) The untitled group also has a wider data dispersion which is seen from the range of 5 compared to 3 of the titled group. This means that the group that knows the passage is about laundry (titled group) before hearing the passage have better comprehension about the passage compared with the group that did not know the passage is about laundry before hearing the passage. The comprehension level for the group that doesn't know the passage is about laundry is more varied.

#### 3.2. Inferential statistics:

The author Mann-Whitney U-test was chosen for the inferential statistics because the condition of this data meets the requirements of the Mann-Whitney U test according to Angles of Psychology research by Julia [1]. According to the book, reasons for using Mann-Whitney U test for this study are: this study collected ordinal data for a dependent variable which was on a scale from 1 to 7; independent groups research design was used and the

1 to 7. The intervals between data are not known and equal. The data were also put into rank order. For the measurement of dispersion, the range was used because the data for both groups does not include any outlier [4].

research was looking for the effect of an independent variable (knowing or knowing the passage is about laundry before hearing the passage) on a dependent variable (level of comprehension). The calculated observed value is 47.5 and the critical value is 27. The critical value is 27 because the p-value is 0.5 and the study has a one-tailed hypothesis. Because the critical value is smaller than the observed value the result is not significant so the experimental hypothesis is rejected and the null hypothesis is rejected, meaning knowing the context of passage does not activate schema and enhances comprehension level. This study does not support schema theory.

### 4. EVALUATION

In descriptive statistics, the untitled group has a median of 5 and a range of 5. The titled group has a median of 4 and a range of 3. The descriptive statistics suggest that the titled group who knew the passage is about laundry before hearing the passage has better comprehension but a more varied comprehension level. The untitled group has a lower comprehension level but

a less varied comprehension level. Therefore, the descriptive statistics support the schema theory that people that know the passage is about doing laundry before hearing the passage has an activity schema that will enhance their comprehension level.

However, the inferential statistics were not significant which cannot support the schema theory. The inferential statistics have a smaller critical value of 27 compared to the observed value which densities the experimental hypothesis and accepts the null hypothesis. It suggests that knowing what the passage is about before hearing it cannot activate the schema and cannot aid comprehension. The descriptive statistics result is different from the original study, as the original study found the central tendency of the group given the topic before has a higher comprehension level than the group that did not receive the topic of the passage, suggesting schema was activated in the titled group and it could enhance comprehension. In order to understand why the result cannot support the schema theory, it is necessary to evaluate the strength and limitations of this study.

One potential strength of this study is the independent research design. This research design separates the participants into two groups, and each group of participants was only exposed to one type of condition. This reduces the potential of participants developing demand characteristics. In this specific study, the participants were separated into the titled or untitled group. The titled group was told that the passage is about doing the laundry, and the untitled group was not told that the passage is about laundry. This prevents the participants from figuring out the aim of this study is to test the effect of pre-existing knowledge and comprehension level which can make them be overly helpful and behave the way they think is expected. It also avoids participants from feeling fatigued or boredom which can influence their comprehension level and decrease the internal validity of the study. Therefore, by using independent research design can boost internal validity.

A limitation of this study is the participant variability resulted from using independent research design. Participants in each group have different characteristics that might influence the result which is an extraneous variable that cannot be controlled. Specifically, in this study, participants come from many different ethnicities and nationalities which means their comprehension level in English is very varied which can seriously affect the result of the study. Some participants also did the research online, but the internet stability can also affect the clarity of reading which can affect comprehension level again. Furthermore, laundry is a topic that is very related to life experience, if some students do not have much understanding about laundry, it will significantly affect their schema or comprehension level. Therefore, independent group design has a significant disadvantage

of unable to control the different characteristics of participants which can decrease internal validity. A modification to increase the internal validity is to use repeated measure design where participants are allocated to two groups according to their characteristics and the researches will match their characteristics to make sure two groups have similar participants. This can make sure the participant in two groups has similar schema and comprehension skills in English that will make sure the effect on comprehension level is due to schema theory.

Another strength of this study is the use of convenience sampling. This study used available participants who are one class of students from grade 10. It saves a lot of time and money from recruiting participants. The small sample size also makes the participants relatively easy to control and separate into groups. However, convenience sampling is not an opportunity sampling that has all the characteristics of the interested population. It creates a sampling bias and decreases the external validity which makes the result harder to generalize to a wider population. A modification of this limitation can be trying to use a probability sample which enhances the result's ability to generalize.

Another limitation is the research topic which is the comprehension level of the passage about doing laundry. Participant variability will directly impact their comprehension level and the result of the study. Because different students might have different levels of English comprehension and different understanding of doing laundry. Furthermore, different people have a different understanding of the numbers on the scale. This might make the result not representative enough. However, these limitations cannot be reduced by making modifications because it belongs to the research topic itself.

One strength of this study is the procedure. First, many variables are controlled, such as reading the same passage for both groups. This makes sure the difference in comprehension level is due to activated schema or nonactivated schema but not the difference of the passage. The participants were also not allowed to talk to each other during the experiment which reduced their ability to develop demand characteristics and increase internal validity. The context of the passage which is doing laundry was given to the titled group before the experimenter started to read them. This makes sure that schema can be activated. There were also informed consent and full debrief before and after the experiment to make sure the participants were fully aware of the experiment.

There are also some potential limitations to the procedure. First, the participants were given a 1 to 7 scale. However, it cannot be certain that everyone has the same perception about levels of numbers which might influence the rating and reduce the internal validity. For

example, some participants might think 0 is understanding nothing, but others might think 0 is understanding just a little bit. Some participants might also be generally more confident which drives them to rate higher. The limitations can be improved by adding some text explanation under each number such as 0 represent understand nothing and 7 means understand totally everything. Moreover, some participants participate online which makes them not entirely under control because they could potentially text each other about their answers. They also interrupted the random allocation of participants because online students must be in the same group. To eliminate this limitation, the result of online participants can be excluded. Another limitation is the laundry passage. Some participants might have very little understanding of laundry which can affect their schema and comprehension level. The internal validity can be increased by reading multiple passages with different topics that make sure participants could have activated the schema. However, reading too many passages can develop demand characteristics, so the number of passages need to be carefully considered.

## 5. CONCLUSION

The result of this study does not support the schema theory. The result supports the null hypothesis that knowing the passage is about reading (activated schema) will have no impact on the comprehension level rating (information processing efficiency). This study replicated the study of Bransford and Johnson, but the result of the original study supports the schema theory. However, the result for every study on Schema theory needed to be considered carefully because of the nature limitation of Schema theory. Schema theory is a cognitive theory which is not falsifiable and not observable which makes researchers bias a severe problem. Therefore, the result of this study cannot fully suggest that the activation of schema cannot aid comprehension.

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