Retroactive Thinking Interference of Grade VI Students: A Study on the Topics of PISA Literacy Lessons

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Abstract. Retroactive thinking interference is a failure in retrieving old information because it is covered by new information, often called disremembering. Disremembering happens when a lesson transferred to long-term memory fails to be recalled because it interferes with other similar concepts. This phenomenon causes learning problems for students. This study is qualitative research that focuses on describing retroactive thinking interference in grade VI of elementary school students. The subjects of the study were 37 students in SDN 26 Ampenan. Students’ work and transcripts of short interviews conducted after completing the pretest and posttest were collected. The results show that most subjects cannot answer the questions correctly, some did not even answer the questions. This is related to students disremembering the lessons due to retroactive thinking interference. This thinking interference occurs because of the difficulty in recalling information that has long been buried by new information. The interference of retroactive thinking can also be characterized by the exchange of information between the two concepts already taught.

Keywords: Retroactive thinking interference, PISA, forgotten, long-term memory

1. Introduction
Program Internationale for Student Assessment (PISA) is an evaluation aimed at measuring the ability and knowledge of students at the age of 15 years (Middle School) [1]. The subjects measured in PISA are scientific literacy, mathematical literacy, and language literacy. The latest PISA results in 2015, Indonesia ranked 63 out of 72 countries. Indonesian students are dominated by students who are at level 5 (low), very few students who make it to level 1 (very good).

In Indonesia, scientific literacy, mathematical literacy, and language literacy are projected into science, mathematics, Indonesian and English subjects. According to Tan, Choo, Kang, & Liem [2] These subjects are compulsory subjects that must be taken by students and are the basic abilities that students must have in order to live in society. According to Binkley et al. [3], these basic abilities can be developed starting from the elementary school level.

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It is important to pay attention to basic abilities. According to [5] these basic abilities can be developed starting from the elementary school level. Moreover, [6] explained that elementary education is the best time (golden time) to shape children’s mindset. It is necessary to study the abilities and knowledge of sciences, mathematics, and languages in elementary schools.

2. Literature Review
At the elementary school level, a problem that is often experienced by students is "forgetting". According to [7] many elementary school students forget the lessons that have been taught before. Because of this, the teachers find it difficult in providing further materials for students in the class. More specifically, [8] explains that grade 6 students tend to forget the material that has been taught. Symptoms of forgetfulness can be explained into three theories: 1) decay theory, 2) interference theory, and 3) cue dependent theory.

Disremembering occurs when retrieval of memory is processed by (encoding) and transferred to long-term memory [7]. Lessons or concepts are often forgotten by students are those that have similarities with other concepts taught in the same topic [10]. This error in recalling information is called thinking interference. Thinking interference is a condition where our brain experiences an error or failure to retrieve information from memory storage [11]. There are two types of thinking interference:

a) retroactive thinking interference is a failure to remember old information because it was overwhelmed by new information (Moskowitz in [5]).

b) proactive thinking interference is a failure to remember new information due to obstruction of old information in memory [11].

To minimize interference, memory can be improved by making organized and structured learning. Based on previous studies, thinking interference that often occurs in students is retroactive thinking interference. Therefore, this study focuses on a description related to students’ retroactive thinking interference.

3. Method
This research is qualitative research with a qualitative-descriptive approach. The qualitative-descriptive approach is a research procedure that produces qualitative data, speech, notes and human behavior that can be observed [12]. This type of research was chosen because researchers want to describe how the retroactive interference process occurs in students. The research will be conducted at SD 26 Ampenan located at Jl. Bung Karno No.112, Pagutan Bar., Kec. Mataram, City of Mataram, West Nusa Tenggara. Subjects were selected using a purposive sampling technique. The subjects of this study were 37 students in grade VI of Ampenan 26 elementary school.

The data collected in this study are students’ work and transcripts of short interviews conducted to students after completing their work. This study began with a pretest to 37 grade VI students in SDN 26 Ampenan, Mataram. After the subjects complete their works, the researcher analyzed the results of the subjects’ work for each subject topic. The subjects then asked to solve a new set of questions (posttest) using the Think Aloud method. The test question instruments that were used by researchers are as follows:

Pretest
1. Complete the following fraction operation!
   a. \( \frac{2}{18} + \frac{3}{3} - \frac{5}{6} = \cdots \)
   b. \( \frac{2}{2} \times 1\frac{3}{4} + \frac{2}{5} = \cdots \)

2. Why are leeches or mosquitoes that suck human blood often referred to as parasites and not predators?

3. Make a deductive paragraph that contains 3-5 sentences of your choice!

Posttest
1. Yuli has a 1/3 meter band, Siska has a 4/10 meter band. What is the difference between their bands?

2. Is the symbiotic relationship between sharks and remoras the same as the symbiosis relationship between starlings and buffalos?

3. Pay attention to the following paragraph!
Budi has the highest math grade in the class. He also often gets good grades in other subjects. Budi represented his school to take part in regency quiz competitions. Budi is a smart kid.

Determine the type of the paragraph, whether it is deductive or inductive. Explain your reasoning.

4. Results and Discussion
Based on the results of the analysis of the subject's work, most subjects cannot answer the questions correctly. Students could not recall the material on the test questions. The main reason is the tested material was taught in grade IV. The following are the results of the subject's work on each subject topic:

![Figure 1](image_url)

**Figure 1.** Students’ results in Science (IPA), Math (Matematika), and Bahasa Indonesia (BI)

Figure 1 shows that many subjects are experiencing retroactive thinking interference. They are now in grade VI and have forgotten the materials taught in grade IV. There were 9 subjects who can answer the science question correctly, while the remaining 28 were wrong. For mathematics and Indonesian questions, the results are equal. Seven subjects answered correctly, while 30 subjects answered incorrectly. In general, it can be inferred that the subjects in grade VI have retroactive thinking interference, because they have difficulties in solving problems in the materials that have been taught previously.

Researchers chose 2 subjects on the topic of science, 2 subjects on the topic of mathematics, and 1 subject on the topic of Indonesian language lessons. These subjects were chosen because they were considered to represent the results of the work of the other subjects on each subject topic. These subjects were given new posttest questions and will work on the problems using the Think Aloud method so that researchers can get a picture of retroactive thinking related to the subject.

4.1 Subject P1 Result
The results of the work of subject P1 on the science topic show the answer
"No, because the symbiosis of sharks and remora fishes is a symbiosis of commercialization while the symbiosis between buffalo and starlings is a symbiosis of mutualism".

The answer to subject P1 is correct according to the answer key. The symbiotic relationship between sharks and remora fish is a symbiosis of commercialization that is not the same as starlings and buffaloes that have a mutualism symbiotic relationship. Because the answer to subject P1 is correct, thinking interference did not occur. This symbiotic topic has been transferred to P1 students' long-term memory so disremembering can be avoided.

4.2 Subject P2 Result
The results of P2's work on the subject of Sciences show the answer:
"Remora fishes are always close to sharks, so they are not eaten by other fish, starlings always eat buffalo lice so that the buffalo does not get the itch".

The answer to subject P2 does not clearly answer the question. In this case, P2 is assumed to assume the relationship between remora fish and shark is the same as the relationship between starlings and buffaloes because the answers explain the advantages of each species.

4.3 Subject M1 Result
The subject failed to solve some part of the problem. However, the initial steps taken by M1 are correct, which is to equate the denominator to carry out a reduction operation. This shows that M1 did not fail to recall information regarding the rules of addition and subtraction of fraction operations. In addition, M1 also managed to understand the problem, when subjects were asked to find differences, M1 conducted a reduction operation to find the difference between the bands owned by Yuli and Siska. This can be seen from the answer M1 in part (10-13) / 30. Therefore, M1 can be said to be able to understand the sentence given well. This is contrary to the opinion [13] which states that students often have difficulty in understanding the questions given in sentence form.

Figure 2. M1 Result

Unfortunately, M1 failed to do the calculation correctly. The result of 10-13 = 2 was wrong, the result where it should be (10-13) / 30 = 3/30. This operation error is quite interesting because the subject M1 is already at the class VI level. According to [11] this simple operation error is because students do not re-check in the calculation phase.

The next error is the failure of M1 in the logic of the problem given, this can be seen from the end result M1 is -1/15. This failure results in an incompatible answer M1 with the purpose of the problem. The purpose of the problem is to find the difference in the length of the tape, but the final answer from M1 is a negative number. Even though the difference in the length of the ribbon should not be negative. The failure of M1 is because the subject cannot concretize the problem and is still trapped in an abstract mathematical concept [14].

4.4 Subject M2 Result

The M2 subject also failed to solve the problem given. The results of M2's work showed that retroactive thinking interference was experienced by the subject. This can be seen from the section (10 + 12) / 30 even though the question is the difference between the Yuli and Siska tapes. But M2 represents the different sentences in the problem with the addition operation (+), whereas the difference should be represented by the subtraction operation (-). This misrepresentation is due to the lack of understanding of the subject of the sentence problem [15].

Figure 3. M2 Result

The retroactive thinking interference experienced by M2 is a failure to recall memories related to the concept of difference. Most likely this failure occurs because M2 memory related to the concept of difference has been difficult to call because it has been covered by new concepts being studied now [10]. In addition, this failure can occur due to the possibility of exchanging information between the word "difference" which should be represented by a subtraction operation with the word "and" which should be represented by the addition operation.

4.5 Subject B1 Result

The work result of B1 is correct, where the given paragraph is an inductive paragraph. Subject B1 also managed to show the main sentence in the given paragraph, this is seen in the yellow circled section below.
Figure 5 also shows that subject B1 did not experience the interference of retroactive thinking because it can recall the concepts of inductive and deductive paragraphs that were taught in class IV. However, subject B1 does not provide a reason to explain why B1 chose the inductive paragraph answer to answer the problem. This is consistent with the results of the study [16] that students tend to have difficulty giving written reasons for the ideas he has.

5. Conclusion

Based on the results of the study several points can be summarized as follows: (a) Most students experience failure in solving the given problem. This can be seen from only 7 children who answered correctly on the topic of Mathematics and the Indonesian language and only 9 children who answered correctly on the topic of science lessons. (b) Most mistakes made are due to retroactive thinking interference. This thinking interference occurs because of difficulties in recalling information that has long been buried. Retroactive thinking interference can also be characterized by the exchange of information between the two concepts already taught that occur on subjects P2, M1, M2 and B1. (c) Action is needed to improve the ability of students to complete test questions tested on PISA so that students are ready to face PISA 2021.

Here are some suggestions for further research: (a) For further research interview methods can be added so that data mining can work better and can describe the process of retroactive thinking that is experienced by students. (b) Conduct research related to proactive thinking interference to strengthen the theory of thinking interference experienced by students when solving problems. (c) Teachers as educators should familiarize students with solving questions on the topic of PISA lessons.

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