The influence of the peripheral memory activation on the learning process

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Abstract
The aim of this paper is to investigate the influence of activation of the peripheral memory on the L2 learning process. To this purpose, an experiment was carried out with three different groups of students learning French as a foreign language. Students were exposed to the same teaching material, which, however, was presented to each group with a different teaching technique. Three different teaching techniques were used: In the first one, the unknown vocabulary was just translated in the native language without any other comments; the second technique required conversions, combinations and adaptations of already known concepts from other disciplines or general knowledge; the third technique both involved the simple translation of the unknown vocabulary and the conversion, combinations and adaptations of already known concepts.

An evaluation test was carried out aiming to compare the learning results and examine the effectiveness of each technique on students' learning process. The results of these tests confirmed the superiority of the third technique over the other two.

Keywords: teaching techniques, learning process, foreign language teaching, related knowledge activation

1. Introduction
The improvement of students' learning process has always been the most important requirement of any teaching method and procedure. Ongoing research is focusing on the identification of factors (Shayer and Adey 1981) that influence
and are interrelated with the learning process (Keil 1974), independently of the content and the course that is taught. Activation of peripheral memory is such a factor. One may consider that this factor can be influenced if one applies different techniques in the presentation of the teaching material.

A study into the methodology adopted by teachers of various courses in the Greek school indicated that the methodologies adopted for the teaching of these courses vary widely; such methodologies do not always take into consideration the conceptual similarities that might exist between courses. For example, when mathematics is taught, references are not made to the similarity between the concept of the mathematical function and that of the conditional speech in a language course, and vice versa. Also, no references are made to the fact that the symbol $F$, which is used to denote a function in mathematics, is derived from the French word ‘fonction’ which has, among other meanings, the meaning of verbal hypothesis. This procedure, based on conceptual change (Carey and Spelke 1994), activates the part of the memory that is called peripheral memory. The activation of peripheral memory influences directly memorization and consequently the overall learning process. There is, therefore, a significant motive to structure the presentation technique of our teaching material in a way that activates the peripheral memory.

In order to test the effectiveness that the activation of the peripheral memory has on the learning process, an experiment was designed and conducted. Three groups of students were taught the same course with the same teaching material but with different presentation techniques. The first group of students received no related annotations, that is further explanations, the second one was exposed to related annotations verbally e.g. conversions, combinations and adaptations of already known concepts from other disciplines or general knowledge, and the third one was given related annotations with feedback.

In this paper I aim to present the results of this experiment and draw conclusions with relation to the influence of the activation of the peripheral memory on the learning process. In section 2, the teaching techniques that could be employed for activating the peripheral memory are briefly explained; in section 3, the application of these techniques on the experimental groups of students is described. In section 4, the structure of the teaching material is outlined and the selected testing procedure is explained. Finally, in section 5 the results of the tests and of their statistical processing are given. The conclusions based on the above results are included in section 6.
2. Teaching techniques

The teaching material was the French language syllabus recommended by the Ministry of Education for the first grade of the Greek Lyceum. The vocabulary of this material was presented to the three groups of students with one of the following techniques:
1. The plain translation technique (with no annotations)
2. The referenced technique (with annotations)
3. The referenced technique with feedback (with annotations and feedback)

The first technique consists of three phases (see Figure 1).

![Flow of the current practice](image)

*Figure 1. Flow of the current practice*

The first phase is exclusively restricted to the presentation of concepts related to the specific discipline e.g. the meaning of the concept of ‘function’ in mathematics, of conditional speech in a language course, the translation of L2 words into the corresponding words of the native language, and so on. No reference is made to knowledge that may have been previously acquired from other courses, taught in previous years, or to general experiential knowledge one gains from everyday life.

In the second phase students’ attention is distracted for a period of time by
some other activity, e.g. in a language course grammar may be discussed. The purpose of such an activity is to remove the concepts presented at the first phase from the working memory (Baddeley 2002).

In the last phase students are requested to recall the knowledge presented during the first phase by answering written questions.

The second technique consists of the same three phases as the first one, but the presentation of the teaching material makes use of references, conversions, combinations and adaptations of already known concepts and knowledge which are stored in the memory of each individual (see Figure 2).

![Flow chart of the referential technique](image)

*Figure 2. Flow chart of the referential technique*

As an example relevant to the teaching of L2 vocabulary, the teacher may consider asking learners to find whether a particular vocabulary item s/he has taught reminds them of another similar or translationally equivalent word in their native language.

The third approach is an imitation of the cybernetics model presented by the diagram of Figure 3.
As is shown in the diagram, initially the learner is exposed to the new knowledge as in the first technique. Then, s/he is required to demonstrate understanding of the given knowledge by replying to questions. The purpose of this activity is to stimulate and attract students’ attention to the new information. Next, references, combination and adaptation of the new knowledge to similar information that is stored in the peripheral memory are provided, as in the second technique. In the end, students are requested to recall the newly taught information by answering again written questions.
3. Experiment

3.1 Participants

First-year students of the Lyceum Saint Athanasios in the prefecture of Thessaloniki, Greece took part in this experiment three consecutive times over a period of an academic year. They had all been taught French for the past three years in a Greek state High School. The elapsed period between the experiments was three months. The students were divided into three classes of 27 students each. From these classes three experimental groups were created, each group consisting of 12 students 16 years old. Students’ average grade in all school subjects ranged between 14 and 17 (in a scale of 0 to 20). The criterion for the selection of the specific school was students’ social class. More particularly, the students of this school came from either agricultural or municipal areas, that is, they covered a wide range of social classes. The selected students were not aware that they participated in an experiment and the teaching of each selected group followed one of the three techniques described above. All students took the same test but only the answers of the selected students were taken into consideration and processed. By doing so, we tried to minimize possible changes that might have occurred in students’ behavior and consequently possible effects on the test results.

3.2 Teaching procedure

The teaching procedure was carried out as follows. The first experimental group was exposed to the first teaching technique. A text was given to students and its content was explained without making any references to previously acquired knowledge. In specific, new vocabulary items that were included in the text were explained by translating them into students’ native language without any additional comments. For example, for the words *l’étoffe* and *la couverture* only their Greek translation was given. The presentation of the material lasted 15 minutes. Then, for 20 minutes students’ attention was distracted from what had been just taught, by presenting to them material irrelevant to the given text and to the explanations of the vocabulary items included in the text. In particular, grammatical rules of the French language were presented and explained. This distraction aimed at removing the newly acquired information from students’ working memory. At the last stage of this teaching procedure students were given a test which required them to recall those vocabulary items of the text that were stored in their memory and write them down in French.

A different teaching procedure was applied to the second experimental
group. First, the same text was presented to the students of this group. This time, however, the explanation of the words was not restricted to their simple translation into Greek; students were asked to recall and find either words that are translationally equivalent in their native language or vocabulary items that remind them of the meaning of the words in question. For example, for the word *l' etoffe* (‘tissue’), not only the Greek translation was given, but also the particular word was related to the equivalent Greek word for material (‘ορόφα’. Similarly, for the word *couverture*, its relation to the action of covering something was mentioned. The same has been done with the words *fabriquer* ‘to manufacture something’, and *fabrique* ‘a manufacturing plant’. The next steps of this procedure were the same as those of the first. That is, the next 15 minutes were allocated to teaching irrelevant material to the given text and to the explanations of the new words. The last 10 minutes were spent on testing in writing students’ ability to recall the explained words by making reference to their translations in Greek.

The application of the third teaching technique to the third experimental group involved first the presentation of the text and the simple translation of the new words into students’ native language (15 minutes); this was followed by testing students’ ability to recall the newly taught words (10 minutes). Subsequently, students were presented with the same additional information and explanations given to the second group of students (15 minutes). Finally, a test was given to students asking them to recall and write down the new words in French (10 minutes).

Fifteen days later, all the students who took part in the experiment were asked to recall and write down the same words they had been taught according to the above described techniques. The results of all tests collected were processed as explained in section 5.

4. Testing procedure

In literature (Holloway 1984) three procedures for evaluating students’ performance are described. The first one, called ‘Restitution’, requires students to repeat verbally, re-write or repeat the action that they have learned without any requirement of adding an expression of their own or producing an inferred action from what they have been taught. The second procedure, called ‘Discrimination’, calls the student to identify, find and present the requested knowledge from data that are given to him/her and are related to characteristics and properties of the requested knowledge. The third procedure, called ‘Realization’, requires students to produce one or more verbal or written expressions
that can be inferred from the presented knowledge, and not to repeat the same knowledge in the same way that was presented to them.

From the above three procedures the first one (i.e. Restitution) was selected as the evaluation method in our experiment because we aimed to minimize the influence of parameters other than that of the peripheral memory. Such parameters are first, the increased probability that the discrimination approach has in obtaining the right answer as a matter of students' luck, and secondly, the subjectivity in the evaluation of the answers, a characteristic inherent in the realization approach. The words that the students were required to remember and write in French are the following:

1. participer
2. l' étoffe
3. la grâce
4. des instruments
5. l' auditorium
6. fabriquer
7. coller
8. la couverture
9. des importateurs
10. des manifestations

5. Results

Students' results of the test they took at the end of the presentation are shown in Figure 4.

![Figure 4. Testing results taken at the end of the presentation](image)

As one can easily see, only 27.46% of the students who were presented the new words with the current practice gave the right answers; the equivalent
percentage for the second technique was 44.97% and the percentage for the third technique was 63.29%.

The results obtained when we repeated the test two weeks later are shown in Figure 5. According to these results, 25.81% of the students who attended the presentation with the current practice gave right answers. In the second group the percentage of right answers was 34.81% and in the third one 50.81%.

![Graph showing correct answers percentage after 2 weeks](image)

*Figure 5. Testing results taken after two weeks*

The graphs in Figure 6 present the percentage of correct answers in the test which was given on the day of the presentation and the percentage of correct answers given when the test was repeated two weeks later. What becomes apparent is that the third technique results to the highest percentage of knowledge retention.

![Graph showing percentage of correctly answered questions in both tests](image)

*Figure 6. Percentage of correctly answered questions in both tests*
This is also confirmed by the statistical processing of these data, performed with the $x^2$ test for independent samples which has given $x^2 = 26.84072$ for $P = .005$.

6. Conclusions

In the experiment described in this work an attempt was made to test the superiority of the teaching technique in which the concepts to be taught are presented with reference to similar or relevant concepts learned in other disciplines and knowledge of everyday life. The test results obtained from the three groups show that the percentage of retained knowledge is quite high when the teaching technique adopted includes references and feedback. Therefore, the use of references, conversions and combinations to information already known to the students activates their memory and a higher percentage of the information given at a certain time is transferred from the working memory to the long term memory.

References


