Influence Of Harmonic Mind Maps (HMM) In The Understanding Of Scientific Texts

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Abstract: The research sought to determine the influence of Harmonic Mind Maps (HMM) in the understanding of scientific texts in students of the second grade of secondary education of a school in Peru. For this, a sample of 44 participants was formed and a control group and an experimental group were determined. Reading comprehension was assessed with the first test given to them was the Raven Test, then the Kolb Test and the instrument for understanding scientific information (pre-test). And the results obtained were that, in effect, the influence of HMM is significant in reading comprehension.

Index Terms: Graphic organizers of information; Mental maps; Reading comprehension; scientific texts; didactic strategy; textual comprehension; inferential understanding; criterial understanding.

1. INTRODUCTION

The educational reality shows that one of the most acute problems facing our country is the lack of understanding people have when they read. In this sense it is essential to look for alternatives in teaching that bring us in some way to that complex process that is reading comprehension. Recent research affects the proposal that every teacher has the commitment to train their students intellectually and therefore has the obligation to provide them with strategies and techniques to improve their understanding and autonomous learning, whatever the subject they teach. In this context, the motivation to work in the field of understanding new scientific information and to prove the effectiveness of the mental map in improving the levels of reading comprehension in students arises. Currently there is a scenario of changes and transformations where information and knowledge are reproduced unstoppable, which has led to a real revolution in communication, and a profound change in personal and social behavior. By virtue of globalization, these changes in information is an unstoppable phenomenon for better or worse, since the increase in sources and the amount and speed of transmission of information implies society in general and education in particular, to rethink what citizens should learn and how they will learn, since there is an excess of information and less and less time is available to address it. Presenting then the era of knowledge and information as a challenge for education, therefore, the teaching system requires an interactive model among its actors; teachers, students and the object of knowledge, defined from its essential character "information processors." [1] Today it is necessary for the teacher to assume the need to teach students to document themselves, to analyze collected data, to synthesize the relevant aspects, to communicate their own conclusions clearly and precisely from the new information “... the Information age can be defined as creation of knowledge from information”[2], using tools and learning resources that facilitate their personal autonomy, capable of facing the constant social and technology in which humanity lives, that is to say that “teach to learn” should be the main objective of the educational system. On the other hand, reading is one of the most important lessons learned throughout life, because it largely depends on other lessons acquired formally or informally, at school or outside it. The close relationship that exists between reading and the rest of the school subjects; it can be assumed that school failure in any area may be due to the student's inability to understand and interpret a text: not knowing how to read [3]. Thus, reading, in one of the activities that has given more problems to teachers of all levels and modalities, given that not all students are able to understand and understand the meaning of what they read and, consequently, to be interested for reading. Studies on information comprehension, in students of secondary and higher level, have resulted in statements such as that in the country, there is a high level of "functional illiteracy" that is, the person reads but with poor understanding. Therefore, it is imperative to learn to read and understand what is read until you reach the reading competence that is “understanding, employment and reflection from written texts in order to achieve your own goals, develop knowledge and personal potential, and participate in society”[4].

2 THEORETICAL FRAMEWORK

2.1 Conventional mind map

Defines it as a simple and revolutionary method of analysis that allows maximum use of all the capacities of the mind. It is a manifestation of creative thinking [5], argues that the mind map is a tool that allows the memorization, organization and representation of information in order to facilitate learning processes, administration and organizational planning as well as decision making [6]. What makes the Mind Map different from other information ordering techniques is that it allows ideas to be represented harmoniously using the cognitive functions of the two cerebral hemispheres. Points out that building mental maps is more important than reading them, so they are personal and personalized [7]. McCarthy states that the mind map is a method that distills the essence of what is known and organizes it visually [2]. According to Ontoria (2003), it is the graphic representation of an integral and global learning process that facilitates information, diversification and integration of concepts or thoughts to analyze and synthesize them in a growing and organized structure, elaborated with images, colors, words and symbols [8]. For Sambrano [9], the mind map is a way to generate, record, organize and associate ideas as processed by the human brain, to capture
them on paper. On the other hand Soto [10] argues that, it is a very important knowledge organizer because it seeks to generate, register, organize and associate ideas as processed by the human brain, as an organizational technique uses verbal and graphic code. Likewise, Campos [11] reaffirms what Buzan said, “that the mind map is an expression of radiant thinking and, therefore, a natural function of the human mind whose fundamental characteristic is that the mind map makes use of both cerebral hemispheres.” (p.59). From all of the above it is concluded that, mind maps, promote meaningful learning, assuming a person-centered learning, in which the awareness of the process of creating cognitive structures and, at the same time, of affective processes is manifested social. They also allow us to take advantage of the potential of intelligence through; a radial symmetry, verbal and iconic language, multiple associations, etc. not only to understand, but also to understand the ideas, concepts, theories and situations, which human beings face and need daily. On the other hand, they are in tune with a holistic conception of education and learning, which Novak [12] defines with these three ideas:

- Focused on the student and not the teacher.
- That attends to the development of skills and does not conform only to the memoristic repetition of the information by the student.
- That seeks the harmonious development of all the dimensions of the person, not only the intellectuals. Its use in the negotiation of meanings improves social skills and develops attitudes consistent with teamwork, in accordance with the values of a democratic society.

Characteristics of the mind map

Regarding the characteristics of mental maps, he states that the mental map has four essential characteristics [5]:

1. The subject of attention crystallizes in a central image.
2. The main themes of the matter radiate from the central image in a branched form.
3. Branches comprise an image or a keyword printed on an associated line. Minor points are represented as branches attached to higher level branches.
4. The branches form a connected nodal structure.

2.2 Harmonic Mind Map

The Harmonic Mind Map (MMA) is a variant of the conventional, which starts from a questioning of a hidden feature: the motley. And it also raises a new characteristic: the harmonic. In such a way that the proposed schemes are more intelligible both for the one who produced it and for the one who intends to understand and use:

“The MMH replaces the hidden characteristic of “the motley” with “the harmonic.” This new characteristic understood from the architecture and aesthetics as the use of symmetrical forms that cause pleasant sensations in the viewer since he feels before something that, being harmonic, is beautiful. The association of harmony and beauty dates back to the classical and Renaissance era: “the Greeks examined the matter in connection with the works of art; hence the artists and thinkers of the Renaissance considered that symmetry and harmony were the essential elements of beauty” [13]. This feature makes the schemes not only more understandable, but lasting over time, in the sense that their own readability is both for the time of making the Map in the short term, as the fact that their harmony of form and the symmetry of its design makes certain self-sufficiency in form make its interpretation more fluid” [14].

3 METHODOLOGY

The research was framed within the quantitative approach and a non-experimental design, of the quasi-experimental type. According to the hypotheses formulated and the objectives set, is framed within the type of applied research because, the effectiveness of the global text comprehension strategy (mind map) will be tested at the level of understanding of scientific information; at the same time it is located within the level of confrontation of causal hypotheses because hypotheses are outlined that allow us to explain tentatively if there is an increase in the levels of understanding of the students and in what levels. The present work is located in the group of experimental studies, specifically within quasi-experimental studies.

3.1 Population

The population is made up of the students of the second year of secondary education of the Program of alternative basic education of young people and adults (PEBAJA), who attend the state educational institution "Latin American Union" located in the COVIMA Urbanization of the district of La Molina, in the province and department of Lima and belongs to UGEL Nº 06 of the district of Vitarte. The population of interest was made up of 73 students, but some were excluded because they did not have the requirements required by this research. Verbigracia, very low intellectual levels and work reasons that prevented him from arriving early. The population of the present investigation present the following characteristics: They are economically low, with ages ranging from 14 to 22 years and female by 60%; most come from provinces and work in the morning; y their ability to understand is low, presumably, that they lack reading habits.

<p>| TABLE 1 |
| Sample of the Students of the Second Year of Secondary Education According to Intellectual Level |</p>
<table>
<thead>
<tr>
<th>Group</th>
<th>Intellectual Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal superior to</td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>Superior</td>
<td>Normal</td>
</tr>
<tr>
<td>Control</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>%</td>
<td>27</td>
<td>73</td>
</tr>
</tbody>
</table>

Normal intellectual level superior to superior: conformed by subjects whose percentage is equal to or greater than 75. Normal intellectual level lower than normal: made up of subjects with a percentile of 25 - 50 or more. The subjects of both groups (control and experimental) were evaluated. The first test given to them was the Raven Test, then the Kolb Test and the instrument for understanding scientific information (pre-test).

4 RESULTS

The increase in the level of total comprehension in the students is achieved after a period of time as it is a complex and multifactorial process. But not all students are given in the same way. Well, one of the factors that influences this process is the application of Harmonic Mind Maps (HMM) as a global
strategy of the text.

**TABLE 2**

**READING COMPREHENSION BY TEST: PRETEST AND POSTTEST OF THE EXPERIMENTAL AND CONTROL GROUPS**

<table>
<thead>
<tr>
<th>Group</th>
<th>Test</th>
<th>n</th>
<th>$\bar{X}$</th>
<th>Md</th>
<th>s</th>
<th>% of achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>22</td>
<td>8.68</td>
<td>9.00</td>
<td>2.37</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>22</td>
<td>13.64</td>
<td>13.64</td>
<td>2.36</td>
<td>62</td>
</tr>
<tr>
<td>Control</td>
<td>Pre</td>
<td>22</td>
<td>8.77</td>
<td>9.00</td>
<td>2.37</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>22</td>
<td>9.36</td>
<td>9.00</td>
<td>2.26</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Maximum possible score</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 2, both groups have the same number of subjects. Regarding the arithmetic averages, it is observed that, in the pre-test, it favors the control group (8.77). In relation to the maximum possible score in the pre-test, scores close to 40\% of achievement were obtained, that is, they have a very low level of total understanding. In the post-test the two groups increased their arithmetic averages, but that of the experimental group is higher. Percentage, the Control group rises 3 points (43\%), while the experimental group increased its score by 23 points (62\%) which shows that the level of total understanding improved. The median values, in all cases, are very close to their respective arithmetic averages, indicating a tendency towards normality in said distributions. The standard deviations of the pre and post-test clearly show similar scores between the groups. In addition, the numerical value is very small, indicating homogeneous distributions.

![Fig. 1](image)  
Fig. 1. Arithmetic means obtained from the results of the pre and post-test in total understanding, of the Experimental and Control groups.

According to figure 1, an increase of both groups is observed in the post-test. To know if this difference is significant or not, the student’s “t” test was applied for independent means, which yields the following results.

**TABLE 3**

**TEST “t” TO DETERMINE SIGNIFICANT DIFFERENCES BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS IN TOTAL UNDERSTANDING IN THE PRE AND POST – TEST**

<table>
<thead>
<tr>
<th>Test</th>
<th>Group</th>
<th>t</th>
<th>t $\alpha$, gl</th>
<th>Criterion</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>Experimental</td>
<td>8.68</td>
<td>0.12</td>
<td>“Sit $t &gt; t_{\alpha, gl}$”</td>
<td>We fail to reject Ho</td>
</tr>
<tr>
<td>Control</td>
<td>8.77</td>
<td>2.021</td>
<td>“Sit $t &gt; t_{\alpha, gl}$”</td>
<td>We fail to reject Ho</td>
<td></td>
</tr>
<tr>
<td>Post</td>
<td>Experimental</td>
<td>13.64</td>
<td></td>
<td>“Sit $t &gt; t_{\alpha, gl}$”</td>
<td>We reject Ho</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>9.36</td>
<td></td>
<td>“Sit $t &gt; t_{\alpha, gl}$”</td>
<td>We reject Ho</td>
</tr>
</tbody>
</table>

Table 3 provides two types of information, in the pre-test it fails to reject Ho, which concludes that there is no significant difference in the total understanding between the control and experimental groups. This indicates that both groups of students started from the same level of total understanding, without observing advantages in favor of either. Meanwhile, in the post-test, Ho is rejected because the value of empirical “t” (tc) is greater than the theoretical “t” (ta, gl). Therefore, there are significant differences between the levels of total understanding of the two groups, in favor of the experimental group.

5 DISCUSSION

Undoubtedly, it is up to the teacher to provide the student with different strategies to fully understand the text, so that they can read comprehensively. Studies show that certain school failures in any area often come from the student’s inability to understand and interpret a text. It is therefore necessary a special planning of the educational task, in order to ensure that students not only read frequently but do it well, providing them with strategies that help them understand what they read and thus raise their levels of understanding. Those students who received the help of the mental map as a strategy of global understanding of the text increase their level of understanding of information, this increase differs in relation to the group of students who worked in a traditional way. Presumably, students who received help from mind maps, as a comprehensive text comprehension strategy, will improve their level of overall understanding. It is known that, at the secondary level, it is up to them to reaffirm the reading skills that students develop from the previous levels and therefore it is at this level that it is up to them to prepare students regarding the management of techniques and strategies for a better understanding of information: “If students are to acquire reading comprehension strategies, they have to be taught” [15]. The present research work was proposed to know the effect of the mental map, as a strategy of global understanding of the text, in a group of students who worked with the help of this strategy in counterpart to the group of students who worked in a traditional way. In total understanding. The results obtained will be discussed globally, making the distinction between the two groups to be evaluated (experimental and control). In the pre-test, the control group obtained an advantage over the experimental group. In order to determine whether or not there was significance in these differences, the Student’s “t” test was applied for independent means and it was observed that there was no significant difference, making it clear that both groups of students started from the same level of total understanding. However, in the post-test, the experimental group raised its score with respect to the control
group. The Student's t-test was applied for independent means and it was observed that there was a significant difference. These results can be explained as follows: although it is true that the control group started with a small advantage over the experimental group (see arithmetic averages), the levels of total understanding of the group of students under study (44) of the second Secondary school years were really very low in the pre-test, that is, before working with the help of the mind map as a comprehensive text comprehension strategy, to improve overall understanding. Low levels that are expressed in figures (see percentage of achievement) and at the same time explain not only the well-known extracurricular factors or causes (economic, cultural, psychological-social, structural, historical, etc.) but also significantly, multiple strictly pedagogical-didactic factors. In the first place, most students are not taught methodically or systematically to read comprehensively during the development of their classes (as comprehensive reading needs to be taught), which is deduced, that teachers did not receive instruction on Reading comprehension when they were students, not even their teachers or parents guided them or suggested to read well and permanently. Reading is understanding, and that understanding is first and foremost a process of constructing meanings about the text we intend to understand ...it also requires having resources - relevant prior knowledge, confidence in one's own possibilities as a reader, availability of necessary help, etc. [16]. Referring to the research conducted on reading comprehension strategies in science texts, says that: “There are at least five effective strategies to help students... in reading scientific texts, one of them being the use of graphic organizers that allows students to organize what they are reading” [10]. The ability to understand a text implies the need to use, among others, elaboration and organization strategies to intensify the understanding and recall of what is read, as well as to detect and compensate for possible errors or misunderstandings. As an elaboration strategy, mind maps integrate and connect new information (cognitive networks) in such a way that, the reader uses knowledge structures internalized and stored in his memory, as an organizational strategy he combines all personal and new ideas. To achieve a new structure and as a metacognitive strategy, it allows monitoring progress in reading comprehension. Taking into account the mind map (graphic organizer) as a strategy of global understanding of the text, it is observed that its influence is positive in the total understanding, as indicated by the data presented in the post-test (see percentage of achievement). In this way, the important role of the mind map in increasing total understanding is observed.

6 CONCLUSION
The use of Harmonic Mind Maps (HMM) significantly improves the levels of reading comprehension of scientific texts in secondary school students, in their literal, inferential, and criterial or profound dimensions of students in the experimental group. Similarly, the mind map positively influences the levels of understanding of new information in scientific texts, regardless of the learning styles of the students, coinciding with the position of Buzan [5] who states that the mind map “multiplies the intellectual power of the brain.”

REFERENCES