

## A PROPOSAL FOR THE USE OF HEURISTIC TECHNIQUES AND CONCEPT MAPS IN IC-IPN

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**Abstract.** The present work proposes the use of heuristic techniques developed by Novak and Gowin. This is done starting from the didactic experience in the classroom for computing engineering (IC) at Instituto Politecnico Nacional (IPN) by the implementation of concept maps and Gowin's V in the solution of design problems and algorithms design and computational analysis. This has been done trying to achieve a meaningful learning that should render a better understanding by the students. Gowin's V and concept maps were proposed by Novak and Gowin as heuristic and metacognitive tools. The main reason behind this work is the evidence of success of the use of Gowin's V and concept maps in research done at the University of Cornell, Brazil, Argentina and Spain, in physics, chemistry, and environment sciences. A second reason can be found in the difficulties that the students face in some topics of computer programming, as in algorithm design.

### 1 Introduction

The problem of the low grades of the college students has a worldwide realm, and it has in Latin America, and particularly Mexico, provoked a very deep concern. At IPN researchers and professors have devoted special attention to this problem, and as a consequence of these studies several decisions have been taken. Among them we may find the attempt to change the traditional teaching scheme and implant a new one based upon a constructivist teaching model. The students belonging to engineering computing do not know techniques that could help them in their learning process. This fact has been detected through polls applied at the beginning of the term. These polls have shown us that 88 percent of the students have no idea of metacognitive techniques. The present proposal intends to reduce the number of flunking students in topics of programming whose foundations is algorithm design, but also to increase the level of comprehension. The idea could also imply a meaningful improvement in which the budget is used, an additional point in favor of this model. Clearly, the reduction of flunking students entails a way to avoid the loss of human resources.

### 2 Theoretical framework

Any theory is founded upon postulates and assumptions, pur case is no exception. The postulates are the same behind Ausubel-Novak-Gowin constructivism theory, see, Ausubel: Educational Psychology, a Cognitive View (1968). The main idea to be underlined in the model is the idea of meaningful learning, which is to be confronted against the memoristic one. The student must relate his/her previous knowledge with the new one. I expose the application of the Gowin's V and the Concept maps in the algorithm design's teaching, to improve the Computing Engineer carrier's at ESIME-CU as a part of the Universities' modernization. This will be made, attending to the need of solving their academic low output problems, which is the main cause of a high school desertion. It is important to comment that in the algorithms' field, one of the hardest points is the fact that there is no "recipes" made to construct them.

### 3 Methodology

The methodology (figure 1) present research resorted to a Piaget Modified Clinical Poll (PMCP), shown in figure 2. This PMCP was a tool that allowed to know how the students feel, think, and act in relation with any educational event connected with algorithms design. Also a questionnaire was applied with the idea of finding the opinion of the students about the metacognitive method and Gowin-s V. The course began with the selection of the experimental and control groups. In the first week the learning techniques were explained, as well, as an explanation of Gowin's V. During the semester the work in the computing laboratory, as well as the classroom were done resorting to Gowin` s V. The student improvement was also regularly monitored, and the possible failures detected and amended, see figure 3 and 4.



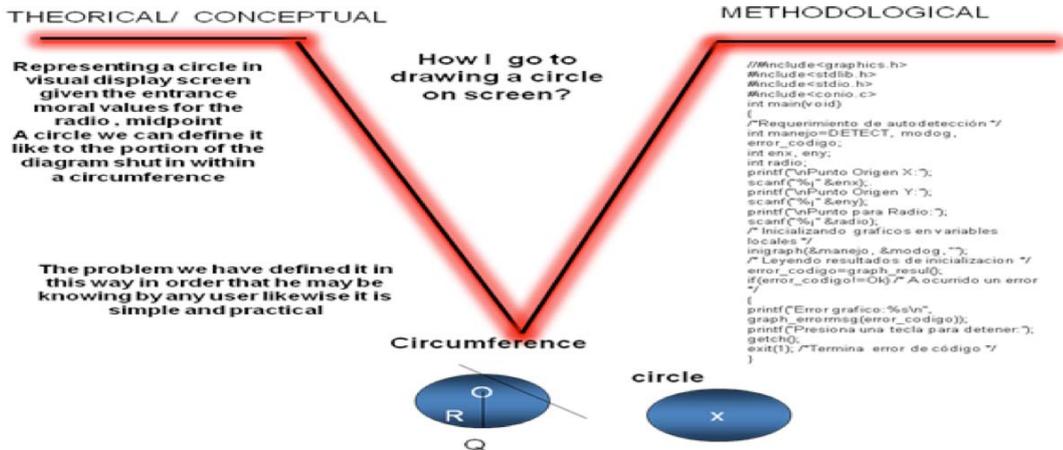
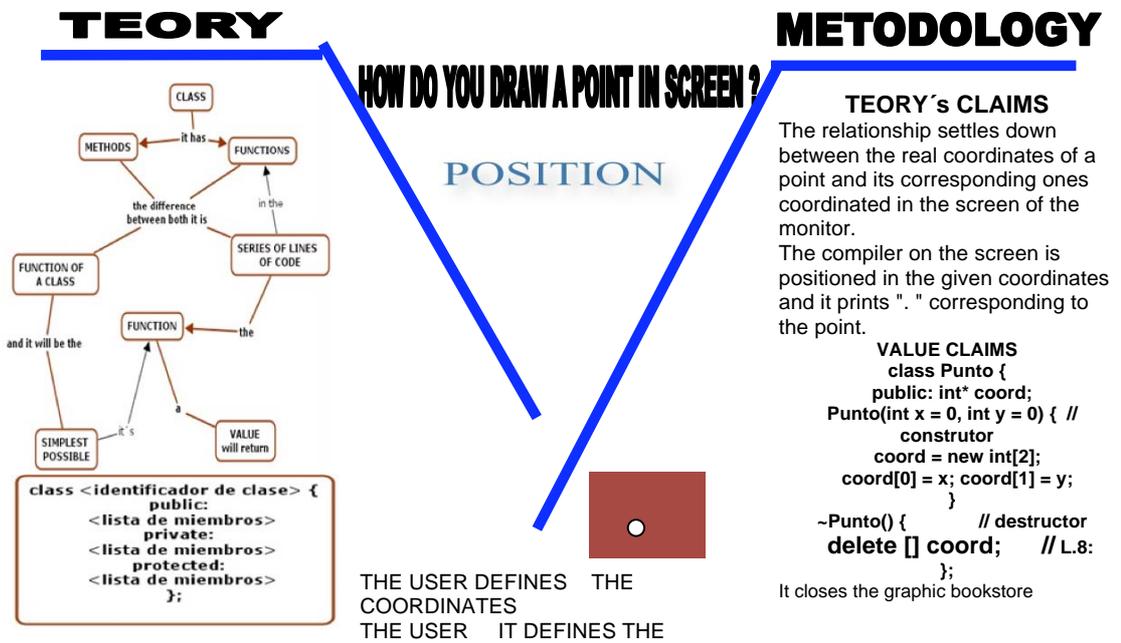
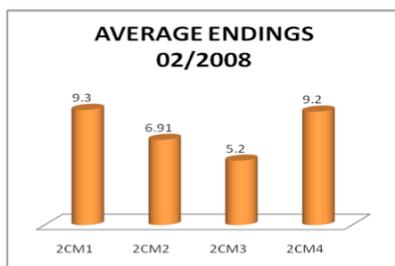


Figure 3 Example Gowin's V constructed in class

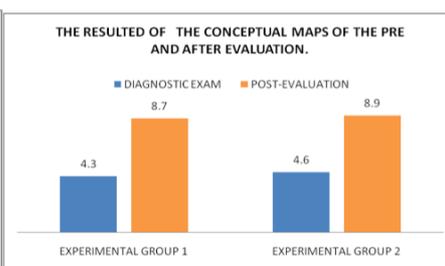


#### 4 Results

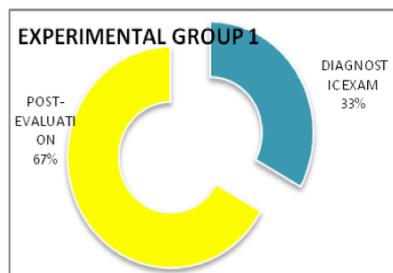
The use of strategies was an important tool in the achievement of a meaningful learning, and therefore, an important improvement in the academic results appeared as a direct consequence of the model. As a bonus the students were prepared for selflearning, see graphs 1, 2, 3 and 4.



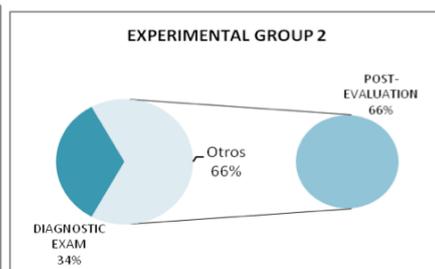
Graph 1 Averages of the the groups



Graph 2, Resulted of the ECPM



Graphic 3 The result of group 1



Graph 4 The result of experimental group 2

## 5 Conclusions

The same happens, for example, in resolving problems to Physics solution. The successful heuristic V application, by Moreira in Brazil, to the Physics teaching case, we supposed, because of the mentioned analogy between the Physics problem's solution and the algorithm construction, that it is possible to obtain the right result, hoping that its application is not already a failed project.

Metacognitive strategies in virtual environments are very useful since the results obtained in those topics in which they were applied showed a remarkable advance in comparison to those cases in which these techniques were not considered. Thanks to the good results worked out, several professors were interested in applying to his groups these learning tools, in the next semester.

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