EXPERIMENT ON THE USE OF ACTIVE METHODOLOGIES IN THE COURSE WORK RELATED TO COMPUTER PROGRAMMING

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Problem-based learning activities are often debated in academic and pedagogical centers. Active methodologies have presented good results in student training. Their use, approaches, techniques, and the environment in which they are inserted make a great deal of difference in results, as well as in students’ openness and willingness to accomplish activities. To provide an opportunity to work with research, logical reasoning, and contact with the heuristic computational language, course work on Prolog programming was employed within the Mathematical Logic course in the Computer Science undergraduate program. The methodology applied started with approaching logical propositions, truth table, logical operators, logical equivalences, and propositional algebra. This was followed by laboratory practice with structured programming language using pseudocode. At the second half of the course, introduction to the Prolog programming language was carried out and the methodology proposed followed the PBL approach. The activity planned was to be developed by pairs at most, the theme of what would be programmed was to be chosen by each team, as long as validated by the professor, and the final product should have a corporate objective. Since Prolog acts in a heuristic manner, research was necessary by the students so that they could successfully carry out their final delivery. In this case, the professor acted as a mediator, answering questions, making materials available and guiding the search for solutions to the problem proposed. This approach changed the way student participate in the classroom, from listening to lectures to a more pro-active participation, solving real problems.
INTRODUCTION

- Prolog is a logical programming language, based on predicate logic, built to model natural language processing problems [1], [2]. Its main application, however, went unnoticed and somewhat subdued until devices and systems incorporated algorithms and artificial intelligence methods [2].

- Logical programming is a standard component of a computer program curriculum, but it is still considered a challenge for students. A logical programming language, when compared to conventional languages, presents a different paradigm [4], requiring teachers to adapt teaching methodologies to encourage students to create relationships of similarities and distinctions between imperative models and logical models [2], [5], [6].
PBL (Problem-Based Learning) originated in the 1960s at McMaster University School of Medicine in Hamilton, Canada [7]. This methodology represents a teaching-learning perspective anchored in constructivism, that is, in the (re) construction of knowledge, whose process is student-centered [8].
Aiming to improve students' learning through perspective, in which the central process is based on the student, as well as develop their research skills, promoting logical reasoning and contact with a heuristic computational language, a disciplinary work, using PBL methodology and Prolog, was carried out. This paper presents the methodology adopted, the planning and preparation, the project execution and student presentations.
All activities were carried out within the academic environment and were distributed in four different sequential steps, planning, preparation, execution and presentations, as shown in Figure 1.
RESULTS

- The course plan considered hours allocation to perform the presentation of concepts and fundamentals (in a traditional more theoretic manner), practical demonstrations by the instructor and practical exercises performed individually by the students.

- From the prepared class material, slides and exercises were made available on the BlackBoard e-learning platform. All this content covered Prolog concepts, fundamentals and practical exercises. The computer laboratory was prepared with the installation of SWI-Prolog version 8.0.3 in the Windows distribution.
RESULTS

- In total, 14 teams were evaluated, among the chosen themes, we highlight three research cases focused on 1 - the knowledge base of universities in the state of Paraná and their classification before the Ministry of Education in Brazil, 2 - the knowledge base of the undergraduate programs of the Positivo University, and 3 - retail stores and their branch in the city of Curitiba. Figure 2 presents a Prolog sample source code containing the implementation of the knowledge base of Universities located in the state of Paraná and their classification before the Ministry of Education.
Figure 2. PBL Implementation Phases
RESULTS

- The final grades of those 14 teams was in average 8.17 of a maximum of 10.00, with 96% of the students enrolled and exceeding the academic average of 6 points.

- Among the student projects mentioned in section 3.2, the research about the knowledge base of universities in the state of Paraná met all the required evaluation criteria reaching the maximum score for the two team participants. The research on the knowledge base of the undergraduate programs of Positivo University, also executed in pair, scored 8 for not meeting two evaluation criteria. Finally, the project about retail stores and their branch, which was carried out individually, obtained a score of 8.5 since it did not meet one evaluation criterion.
RESULTS

- After the presentations, students were asked to volunteer and verbally give their opinion regarding the methodology adopted during the project. Of the 14 participating teams, two teams spoke for a longer time highlighting that the adopted format took them out of the comfort zone and encouraged more proactivity to perform the task. No team or student gave negative feedback, even teams with lower grades.
Activities based on PBL have spread to educational institutions at the elementary, middle and higher levels. The application of these methodologies focused on business practices and real problems enable students to get closer to the job market, corporate development and teamwork practice. The use of heuristic technologies has spread in the technological environment through the use of Artificial Intelligence. These technologies most often arrive at their end-user through abstract techniques that lessen the existing complexity of this theme. Bringing students closer to the introduction of heuristic languages enables their cognitive development and enhances the learning of technologies aimed at market demand. This work presented a step-by-step strategy to employ PBL methodologies in a programming course. The strategy divided the course approach in Planning, Preparation, Execution, and Presentation. The focus was to use real business problems in the final project. The problems were chosen by the teams and the students had to research and understand data from the chosen problem. At the end of the course, they had to develop a Prolog program to solve the problem specified and to analyze the data set they were able to research.
REFERENCES


