Graphical Abstract

Practice shows the way

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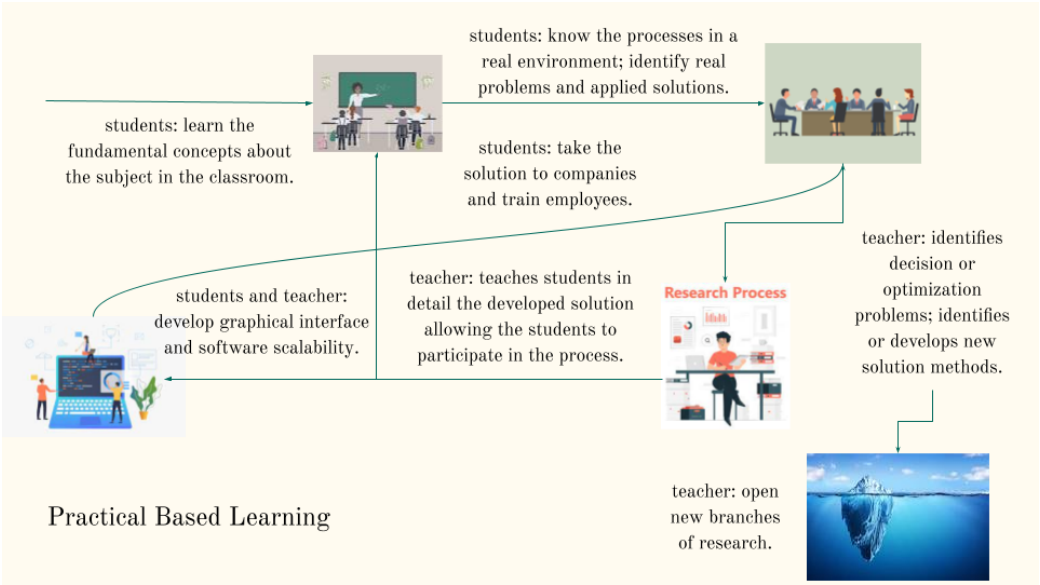

Highlights

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- This paper presents a strategy for teaching undergraduate students based on practical experience
- This strategy is strongly associated with the inseparability between teaching, research, extension and technological development
- This paper also recommends some important resources that can be used to develop group work
- And it discusses a solution to the impasse between transparency and guaranteeing the authenticity of the work, already widely used for software development but not in the development of research works

Practice shows the way

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Abstract

This paper presents a university teaching strategy, grounded on a practice-based learning approach.

Keywords: practical-based learning

1. Introduction

Problem-based learning (PBL) is a pedagogical approach applied world-wide, especially in nursing and medicine courses.

2. Practice-based learning

Practice-based learning strategy starts with students learning the basics of some science in the classroom. Concomitantly or after this first learning process, students carry out visits to an organization, through which they will be able to understand organizational processes, identifying aspects of the process that need to be better managed. Students then prepare a report of the visit, describing in detail the process studied and the real problems identified. Subsequently, this information is taken to the Teacher-Facilitator. Through discussions between the teacher and the students involved, the real problems, that is, the aspects of the studied process that need to be improved, are formatted as decision problems or optimization problems. And then a bibliographic survey is carried out on problems close to the identified problem and on methodologies that are applied in the solution of these first. Then a mathematical model and a solution algorithm are developed for the identified problem and the entire solution developed is passed on to the students, who in turn will take this knowledge to the company. Students will be responsible for carrying out tests to validate the developed solution and for training the company's employees.

For a better understanding of the difference between the real problem identified by the students and the formatted problem, consider the following example: after a student has visited a company that performs the maintenance service of hospital infusion pumps and analyzed in detail the processes of this company, she identified the following real problem:

> "The company is unable to correctly program the hospital pump overhaul service. There are delays in maintenance and services are not prioritized correctly."

After an in-depth study of the company's processes, and extensive discussions between teacher and student, it was identified that the problem was not associated with the maintenance process, but with the scheduling of equipment collection in hospitals, maintenance and return. In this context, a new allocation and routing problem was identified, defined as 'Problem of Planning the Maintenance and Transport of Hospital Infusion Pumps'. For more details on this issue see

Regarding the bibliographic survey, the teacher must identify the key words as well as what information should be sought in the consulted papers. Then, students will be able to participate in this survey, contributing to the identification of relevant works. Students should also be motivated to translate, read and understand at least one or two papers.

Modeling can be completely performed by the teacher and then explained in detail to the students, or the teacher can explain the modeling process to the students along with some more complex constraints/functions, letting the students participate in this process. The development of the solution algorithm can also have the participation of students, as long as they have had previous training on programming or on the solution tool used (R, LINGO, MATLAB etc.).

The developed SOLVER tests must be carried out with data from the studied company, collected by the students. It is important that students qualify company employees to use the SOLVER. Thus, the company will be able to take better advantage of the developed tool.

References

Donald E. Knuth (1986) *The TEX Book*, Addison-Wesley Professional.