

A new adaptive teaching method for engineering school

D. Isoc; T. Isoc

Dorin Isoc

Universitatea Tehnică, Cluj-Napoca, Romania

Teodora Isoc

Universitatea “Babeş-Bolyai”, Cluj-Napoca, Romania

Abstract: There are no teaching methods that are inherently adaptive, i.e. able to amend the systematic relationship between student and teacher during the training. To follow the principles of adaptation it would be necessary that the relationship would be controlled by certain criteria of performance. The suggested method chooses as a criterion of performance of student-teacher relationship the student's knowledge level. Measuring the level of knowledge is achieved in relation to an engineering application, a patent, and the teacher comes over using his deliveries in order to correct the ignorance proved. Effects of the method relate to reduce the unnecessary effort of the teacher and to orient his work towards effective teaching required in relation to the given knowledge of each student.

Keywords: Adaptive teaching, engineering school, knowledge level, patents, performance indicator.

1. Introduction

Engineering School of the last century has had an explosive development by the number of schools but also had the surprise of some big drawbacks often claimed by the beneficiaries.

In all contexts of reported research, engineering thinking is not ready by specific means but by other techniques such as critical thinking [1] and it is treated in a not applied manner. Special attention seems to be given to learning from specific examples of the field ([2], [3]). New studies seek to provide the cybernetic image on the training ([4]) without human intervention for that purpose.

When it comes to engineering education, research remains in the traditional: there is a course with a support, there are homework and projects, and there are practical works.

The paper approaches and solves these issues in an applied manner. The first chapter is a review of issues pertaining to the engineering profession and studies vital aspect of the levels of knowledge used conventionally by the school. The second chapter presents the interventions on conventional system in order to work adaptively with students during the course activity. The conclusions identify the contribution of the new research.

2. Engineering – an informational framework

2.1. Requirements of engineer profession

A correct view of a school of engineering can be achieved only if one knows how a graduate works, how he behaves when he comes to practice.

With this perspective, in his work, an engineer, regardless of specialty, should:

- know the world by existing technical solutions;
- ensure proper operation of existing technical solutions;
- intervene in the existing technical solutions for repairs and optimizations;
- ensure design of new technical solutions;
- ensure implementation of new technical solutions;
- ensure achievement of new technical solutions.

Despite the knowledge is common to all professions, the engineering knowledge is so oriented that it implies:

- identifying the functional parts and assemblies of the technical entities;
- retrieving the parts that can and should be designed algorithmically;
- retrieving the parts that can and should be designed heuristically.

Engineering is not an extension of mathematics or physics or chemistry, but is something else. Engineer's work involves a complex built in a speculative way of fundamental knowledge, algorithmic, and heuristic. This feature is not systematically approached and developed to any pedagogical techniques of the schools teaching engineers.

Table 1. *Engineer's knowledge builds a specialized base.*

Knowledge nature	Available knowledge sets				
Theories	The ₁	The ₂	The ₃	The ₄	...
Technical principles	Princ ₁	Princ ₂	Princ ₃	Princ ₄	...
Standards	Sta ₁	Sta ₂	Sta ₃	Sta ₄	Sta ₅
Materials	Mat ₁	Mat ₂	Mat ₃	Mat ₄	...
Components	Com ₁	Com ₂	Com ₃	Com ₄	Com ₅
Technologies	Tech ₁	Tech ₂	Tech ₃	Tech ₄	...
Measuring techniques	Mea ₁	Mea ₂	Mea ₃	Mea ₄	...
Design techniques	Pro ₁	Pro ₂	Pro ₃	Pro ₄	Pro ₅
Heuristics	Eur ₁	Eur ₂	Eur ₃	Eur ₄	Eur ₅

Table 1 a set of theoretical knowledge about standards, materials, components, technologies, and other various heuristic techniques acquired in school or later, after graduating, then his work to solve current problems leads to technical solutions

2.2. School of Engineering and impact of media development

The active element in any school is the teacher. He has the necessary qualification and vocation to provide training and skills to each student in part for a desired standard of his qualification.

The twentieth century brought new information technologies that have come to sit with the teacher and without his consent, it created for the student an initial level of actual knowledge as in **Fig. 2**. The real level is profoundly heterogeneous, messy and very difficult to assess.

3. Principle of adaptive teaching method

3.1 Teaching – cybernetic system and necessity of adaptive control

Customizing adaptive control structure for teaching is immediate. In the new system, the controller role is taken by the teacher and the desired performance consists of a requirements set such as professional nature and social utility.

It appears that the main weakness of the school of engineers is how the transmission of theoretical knowledge is done compared with the initial knowledge of the students and the needs of integrated training of the profession.

In this place, and having in mind these goals the research required a cybernetic vision of the teaching process and an adaptive control structure.

In such a context as summarized in *Fig. 1* one recognizes two levels of information corresponding to the tactical level, with short-term and dedicated to operational actions and strategic level, for long term and guidance actions.

At the tactical level is found the controlled process that is included informational in the negative feedback loop with a controller and control loop as follows. Using this fundamental cyber connection, one can achieve the desired performance as obtained performance. It is the role of controller to run commands that lead controller process to achieve the goal.

Fundamental control loop behavior is completely described if during its running, the controller "has" enough information on how to conduct the controlled process.

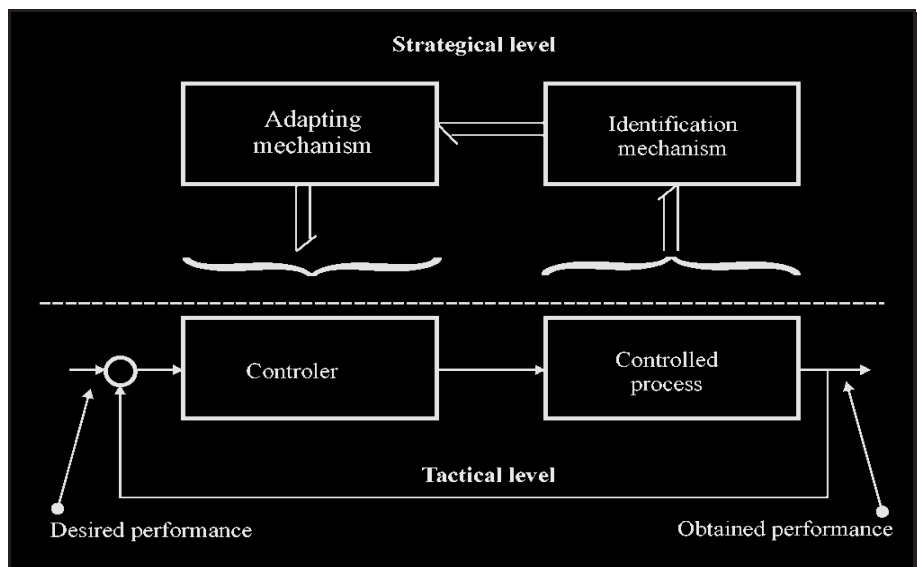


Fig. 1. Cybernetic structure of adaptive control system.

A special situation is found when the behavior of controlled process changes in that from one moment to another the controller works as it should be another technical process. In these situations, to preserve the established goal, the controller must also change its behavior, as would change the controller.

This situation, where the nature of behaviors changes in the idea of keeping the same global behavior of the control loop requires the adaptation action. In the sequence shown to retain the behavior of

control loop determined when the controlled process changes its behavior, the controller is to be adapted.

Adaptation can be done only on a higher level, where an identification mechanism which receives information from the controlled process “realizes” the change of its behavior and asks to adapting mechanism to establish new appropriate control behavior.

All the adapting actions develop without interrupting the main control loop. The work of adapting process is possible because the two levels act on different time horizons.

Controlled part is a set of students as in *Fig. 3*, which by means of teacher’s actions accumulates knowledge and skills and changes their behavior in relation to knowledge in a particular field.

3.2. Developing of adaptive control system

The presented method has as a center of attention the course activity, the university lecture. The reason for this attention is the need and opportunity of this activity.

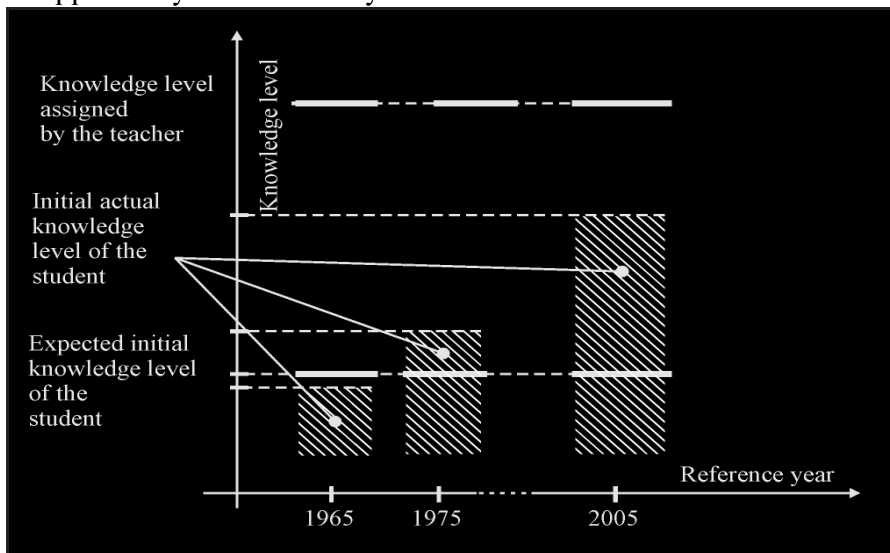


Fig. 2. Initial expected and actual level of knowledge.

Fig. 4 depicts the conventional relationship of the course. The relationship between **teacher** and **students** is within the direct or virtual meeting, with the assumption that there is a **written support** and that among teacher and students establishes a dialogue. The teacher may ask students achieve **homework**.

Any communication between **teacher** and **students** develops on

the ground of **course support** and possible experience of the teacher.

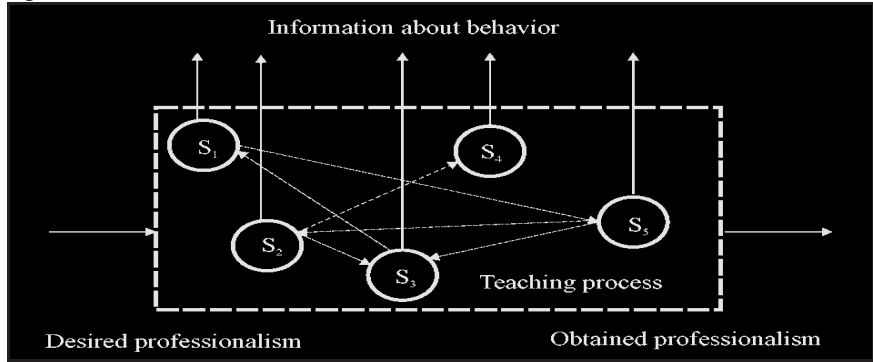


Fig. 3. Teaching process one modifies as behavior.

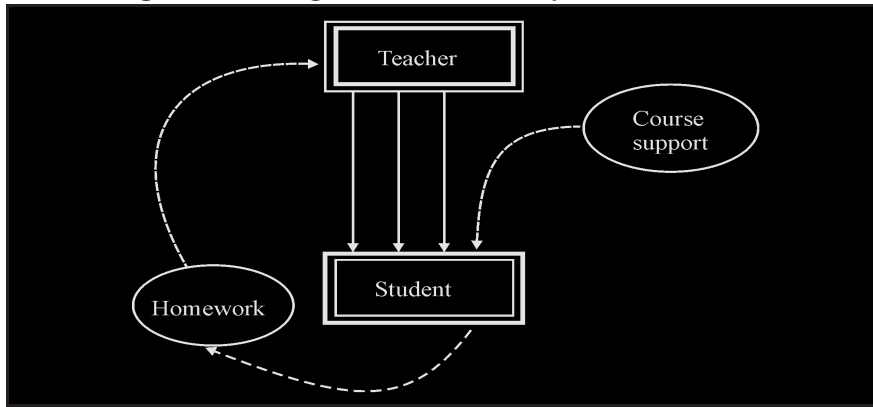
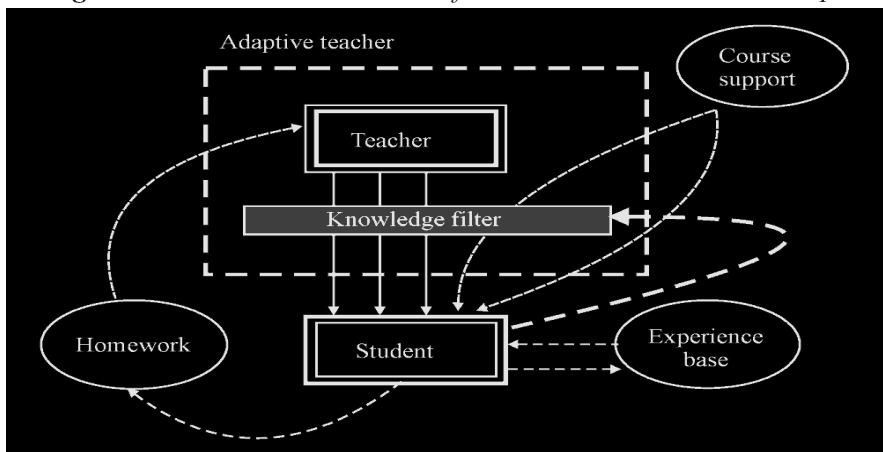


Fig. 4. Conventional structure of teacher-student relationship.



ERROR: undefined
OFFENDING COMMAND: ~

STACK: