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ScienceDirect

Procedia - Social and Behavioral Sciences 142 (2014) 123 – 126

Procedia
Social and Behavioral Sciences

CIEA 2014

Cross-curricular teaching approaches favouring the active learning of mechatronics at secondary level

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Abstract

This paper describes the implementation and application of an integrated and cross-disciplinary curriculum, as integrant part of the school curriculum, its aim being the curricular decentralization and adapted curriculum to the specific needs of personal development, to the demands of workforce on the labour market and of each community. Mechatronics as engineering education, a philosophy of education, comes to complete this approach, leading to a change in the way of thinking and action to those who practise it – the teachers, and also to those who learn it – the students. Mechatronics is based on thinking, intuition, logic and precise action, which makes the solving several themes, in parallel, possible, develops creativity and leads to higher sense of responsibility. The reality creates problems and new and major difficulties in the design and implementation of training programs in schools, in the appropriate ways of teaching, of active teaching methods and strategies centred on problem solving, but the solution comes to life through the cross-curricular mechatronics, an engineering approach at the secondary level.

Peer-review under responsibility of the Alexandru Ioan Cuza University.

Keywords: mechatronics; cross-curricular; secondary level; integrated;

1. Introduction

The complexity is a measure of the context in which the scientists try to initiate a simplified way for the man to interact with the science, the technology, in a single word, with today's society.

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Peer-review under responsibility of the Alexandru Ioan Cuza University.
doi:10.1016/j.sbspro.2014.07.620

Transdisciplinarity, the information boom, the technical approach, the progress, represent the cross-curriculum teaching approach to active teaching of the mechatronics even since the secondary level. To cope with the existing changes, the social, existential and technical progress, the students need to develop personal assessment skills, problem solving skills, learning how to train skills.

Transdisciplinarity as educational approach, applied in the secondary school, reveals to the student what is inside, across and beneath any subject, defining the student's social and personal orientation, the student being bound to a permanent dynamics.

At school, mechatronics is more than just a means of education, more than just an ordinary subject. It is a concept causing major changes in the quality and standards of performance and the students' results, having nonetheless a major impact on the indirect beneficiaries, the society in general.

The teaching activities performed in a cross-curricular manner by addressing some mechanical technology topics, taught by using the IT resources, will develop the creativity, spontaneity, critical thinking, and the complex way of students' informational processing.

1.1. Mechatronics, a cross-curricular approach

Education supplements the changes defining the actual needs the society has towards the new generations. The cross-curricular approach responds to the pupil's needs, focusing on stimulating the student to combine the knowledge and the skills inside the subject, between the subject and from a subject to another. Transdisciplinarity knocks down the boundaries of the subjects and allows the student to penetrate the challenging web of knowledge, making the student creative and innovative.

The educational development of mechatronics through an integrated curriculum at a cross-curricular level will address the students starting the 5^{th} up to the 8^{th} grade, in the form of an optional curriculum in the area of technologies.

In the undergraduate level it is necessary to create a new framework in training students, the modern student endowed with critical thinking, logical and practical thinking, creativity and flexibility in approaching the new towards innovative ideas.

The student trained through an education based on flexibility, adaptability, transdisciplinarity, will integrate more easily into the informational society. The trained student will become a navigator; he will easily cope with the new challenges.

The student's attitude will become a cross-curricular attitude based on openness, flexibility, multiculturalism, tolerance.

The training of the adult as educated man begins in the kindergarten. Mechatronics is the environment which conceptualizes the science, the technology starting at the secondary level. The student's needs for learning, the thirst for knowledge are satisfied where there are necessary tools and means for this purpose.

Mechatronics occurred early in the eighth decade of the last century, being a proof of integration of several separate disciplines which seemed to be separated in the past and which now have been integrated into a coherent and very precise whole. Along with the evolution of the society, the term mechatronics has acquired new meanings in: philosophy, science, smart machines, and educational environment for the integration, the knowledge mirror.

Mechatronics has exhausted all definitions. Mechatronics is recognised as being a special technical field; the mechatronics design involves the integration of multiple components in the same time: mechanics, computer science and electronics.

The cross-curricular approach reflected at the level of the targeted goals, of the targeted contents, the use of new technologies, of the computer as a working tool which will determine the student's educational course.

The training in mechatronics should not limit only to the higher school and the university. Starting the secondary level one can design activities that can attract the student towards mechanisms, mechatronics products and smart machines.

The principles of mechatronics lead to the development of the systemic thinking and training teamwork skills, which transforms the "little" student into a "big" adult.

The teaching of mechatronics requires a methodological reform because the methodology of teaching is one of the most important components in the teaching process. In an educational system, the methodology needs to be