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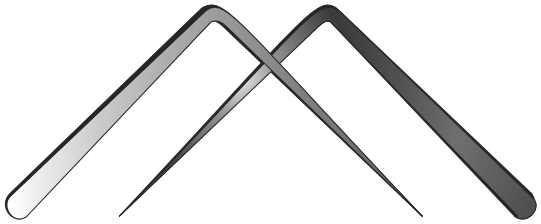

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COLLABORATIVE PARTNERSHIP FOR VOCATIONAL TEACHERS' PROFESSIONAL DEVELOPMENT IN MECHATRONICS

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Abstract. *The purpose of the research presented in this paper was to investigate possibilities of collaborative partnership between industry partners and vocational teachers for development professional experiences in mechatronics. Research was conducted on a sample of 25 industry representatives. The results have shown that there was considerable number of training and training courses that industry representatives can offer as a professional development for teachers in mechatronics. The research suggests that a significant improvement of professional competencies of mechatronics teachers with the ultimate goal of obtaining competent workforce, can be achieved. These results could be used for building a new foundation upon which new type of collaborative partnership between vocational schools and industry partners could be built.*

Key words: *Mechatronics, Vocational teachers, Continuing professional development, Partnership, Industry*

1. INTRODUCTION

Mechatronics combines the disciplines of electronics, mechanics and information and communication technologies. There are many different interpretations of mechatronics. The most frequently used definition explains mechatronics as a synergy of engineering, electronics, computer science and technical control [2]. Mechatronics is a relatively new scientific field that is developing very quickly, and which is greatly influenced by technological development. These influences have been stimulated by many factors including developments in microprocessor industry, new and improved sensors and actuators, advances in design and analysis methods, simulation tools and novel software techniques [10], [9], [7], [6].

Mechatronics is studied at a theoretical and practical level, as a balance between theory and practice, with emphasizes on hardware implementation [5]. The principles of mechatronics education can be applied successfully to all teaching levels flexible, global thinking, as a trans disciplinary approach to the educational process [1], [8], [4].

Teaching mechatronics is complex due to its multi disciplinarity. The teacher should develop students' professional competence, understanding of technical and theoretical principles, as well as interpersonal and communication skills. Solving problems in mechatronics requires cognitive and operational knowledge and practical experience in the field of diagnostics, installation, and maintenance of mechatronic systems. Therefore, teachers are expected to implement a new pedagogical approach to teaching practices, intensive cooperation with colleagues and employers and the use of new technologies in the field of mechatronics.

Continuing professional development is important for improving and maintaining teacher quality as well as contributing to improving students learning outcomes. Expected effects of teachers' professional development in the field of mechatronics, among others, are:

- development and implementation of new teaching methods;
- improving cooperation with colleagues and all stakeholders (companies, national employment service, faculty, parents, local community, etc.);
- developing partnerships with industry;
- support for the dissemination of successful initiatives;
- improving the quality of education;
- support the development and implementation of educational policies.

Previous research suggests that there is considerable diversity of activities that encourage teachers' professional development in a field of mechatronics. These activities include: [3]

- visits to other schools in order to share knowledge;
- visits to companies in order to stay in touch with new methods and technologies;
- professional training courses in companies (training centers) with emphasize on specific sectors and areas of mechatronics, such as medical equipment, office equipment, kitchen equipment, car industry, etc.;
- participation in projects, etc.;
- various teaching training courses that will help the teacher to implement: project work, real problem solving, digital access and create teaching material.

In order to maintain the high quality of professional identity, teachers of mechatronics need to be in touch with new technological developments in the field of mechatronics. Formal education cannot provide teachers the necessary knowledge and skills required for teaching in the field of mechatronics for longer period of time. The knowledge economy requires new teacher competencies and implementation of new technologies in the teaching process. Teacher competencies have become an integral part of education policy. These competencies are developed through the permanent professional development of teachers.

2. PARTNERSHIP BETWEEN VOCATIONAL SCHOOLS AND INDUSTRY REPRESENTATIVES

A collaborative partnership between vocational schools and industry representatives could result in aligning curriculum with industrial needs and bringing more realistic examples to the classroom. Such collaboration could be beneficial not only for mechatronics teachers and students but also for their future employers. Teachers of vocational subjects could gain more technical experience through cooperation with industrial representative and improve their teaching practice. As a result, whole learning process would become more interesting and clearer, and students would easily understand learning lessons. That could have a positive effect on students, motivating them to learn and acquire new skills as a crucial feature that employers demand. It also opens the possibility for the students to develop entrepreneurial skills. On the other hand industry representatives have the opportunity to present their work and collaborate with potential trainees.

As a conclusion cooperation through partnership and bilateral dialog between vocational schools and companies is the must. The main research questions are:

- what are the attitude and expectations of mechatronics teachers regarding their professional development in companies;
- what are the attitude of companies regarding delivering trainings to the mechatronics teachers.

3. METHODOLOGY

The purpose of this study was to conduct willingness of industrial representatives for a collaborative partnership with vocational schools in terms of mechatronics teacher professional development. Possibilities of a collaborative partnership with industry representatives were conducted on a sample of 25 industry representatives who are employing students that have been completed vocational schools.

This study has been developed through a quantitative and qualitative methodology in which willingness of industrial representatives for a collaborative partnership with schools in terms of mechatronics teacher professional development were researched. Interview with representatives of the industry was structured and consisted of 11 questions grouped into three categories. The first category contained questions that are related to general information about the company. The second category contained questions about the type of training that are organized in the company, and the third category is related to the forms of cooperation with vocational schools. Statistical analysis included basic descriptive statistical measures.

The interview with industry representatives was conducted on a sample of 25 companies with a very long tradition in the field of mechatronics.

Companies differ in size and they are from various sectors such as: thermo technics, energy, food production, sales, distribution and service of mechatronic machines and equipment. The structure of industry representatives in relation to sector and size are presented in Table 1.

Table 1. Structure of Industrial Representatives in Relation to Sector and Size

General information		**No**
Name of sector	Thermo technics	8
	Energy	2
	Food production	9
	Sales, distribution, and service of mechatronic machines and equipment	6
Number of employees	< 10	4
	10 - 50	7
	50 - 100	9
	>100	5

General information about the company and the results are presented in Table I. The sample consisted of five companies with more than 100 workers, four micro companies with the number of employed up to 10, while the other companies are in the category employed from 10 to 50 (7), and from 50 to 100 (9). The most common profiles of jobs in these companies are mechanical and electrical engineers, a considerable number of experts from the fields of economics and management. All surveyed companies have organized the professional development of their employees.

4. RESEARCH RESULTS

This research was oriented towards examination if there was the willingness of industrial representatives for a collaborative partnership with vocational schools in terms of mechatronics teacher professional development and what companies could offer regarding teachers' professional needs.

The most of the companies that were interviewed have collaboration partnership with universities and faculties but rarely with high schools. Results show that industry representatives have a very positive attitude towards cooperation with vocational schools because being closer to the schools could help teachers to be more focus on subjects relevant to them. Such approach could result in getting more knowledgeable trainee. It also could focus teachers' attention on changes in labor market and economic realities.

One category of interview questions was related to the forms of cooperation with vocational schools. Topics and areas of professional training which industry representatives may offer to mechatronics teachers are shown in Table II. There are also shown how industrial representatives assessed the extent to which training topics that companies may offer, contribute to the development of professional competencies in mechatronics.

Table 2. Topics and areas of professional training in companies and its contribution

Topics and areas of professional training	**Contribution**
Choosing the right tools for assembly and disassembly	83%
Computer skills and specializes software	85%
Updates knowledge or increases qualifications	85%
Compliance with safety rules	92%
Making measurements	65%
Company presentation	80%
Environmental protection	57%
Independence and creativity	58%
Communicativeness	60%
Working in a group	70%

Analyzing training that the company can offer, it can be seen that even eight topics/areas of professional development of teachers could be implemented through various training in companies (Table II). They are: Choosing the right tools for assembly and disassembly; Computer skills and specializes software; Updates knowledge or increases qualifications; Company presentation; Independence and creativity; Communicativeness; Working in a group; Making measurements.

An important task of this study was also to determine the difficulties and limitations in the process of professional development of teachers from industry representatives' perspective. The industry representatives emphasized the importance of collaborative partnerships with vocational schools and point out to some difficulties regards teacher's professional development: „... our company has its own training programs for employees and trainer,

regardless of schools, we have our own criteria, procedures, and standards; it is simply impossible to directly involve teachers in the process of our work; it is necessary to establish closer cooperation with schools in the form of partnerships; teachers can attend students' practice, monitor their performance and to familiarize themselves with new technologies and develop their knowledge...".

These research results indicate that could be possibility for developing partnerships between vocational schools and employers with the goal of obtaining competent workforce in mechatronics.

5. CONCLUSIONS

Industries representatives suggested in an interview that cooperation and partnership with vocational schools can offer advantages for both employers and teachers. From their point of view, such cooperation could lead to modernization of curriculum and developing students' professional competencies required by the labor market. Another advantage that industry representatives recognize is the ability to introduce themselves to the potential trainee, to bring closer their standards, the way they doing their business and above all new technologies in mechatronics. On the other hand through such collaboration mechatronics teachers would be able to acquire knowledge of specific skills that are valuable for the field of mechatronics, to incorporate more realistic examples in their teaching practice and teach students how to solve certain mechatronics problems they may face in the future working environment.

These results could be used for building a new foundation upon which new type of collaborative partnership between vocational schools and industry partners could be built. The finding in this research suggests that it can be achieved a significant improvement of students' professional competencies in mechatronics with the ultimate goal of obtaining competent workforce.

Finally, as recommendations for overcoming difficulties and limitations in the process of professional development of teachers the following steps are proposed:

- encouraging closer cooperation between vocational schools and businesses for the purpose of introducing new mechatronics technologies and standards;
- involve the teacher in companies training practice and adjusted those training to the teacher's professional needs;
- find an appropriate way to engage industrial representatives in mechatronics teachers professional development.

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