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# INNOVATION IN STUDY METHODOLOGY FOR ENHANCEMENT OF COMPETITIVENESS OF THE GRADUATES OF ELECTRONICS STUDY PROGRAM

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**Abstract**

**In recent years a gap between the competence and qualification of the university graduates and the labour market demand is continuously growing. That is the main reason of the overall, government supported university study curricula review and upgrade in the country, as well as motivation for introduction of new pedagogical approaches to enhance active learning.**

**This paper deals with first activities of implementation of the contemporary study methodology into Electronics Study program at the Riga Technical University. The new curricula will introduce innovation in the study process: the change of the learning paradigm – enhancement of active learning. Besides that, the innovative aspects of the new methodological approaches lie in the meeting of the market driven requirements and development of competitive new specialists. Additionally to the individual benefits of new specialists and their future employers, the new study curricula will bring remarkable impact to the competitiveness of the university and will raise the image of the whole country.**

**Innovative approach is used in the curricula development based on application of the Enterprise Knowledge Development method.**

**Keywords:**

**Study curricula, innovation, learning methodologies.**

## Introduction

The fast developing technologies and continuous innovation, especially in ICT sector, are causing the specific industry requirements towards the university graduates. In order to remain competitive in the rapidly changing world, the companies are looking for high level specialists, having professional and social competences, ability to learn continuously and adapt to the changing world. Universities have to make an effort to prepare specialists for the future labour markets.

There have been numerous studies made at different levels about the compliance of study curricula to the fast changing requirements of labour market. These studies conclude with recommendations for curricula developers. However, there does not exist a universal solution, therefore every university has to implement the curricula changes, taking into account the recommendations and their accordance to the local conditions.

National governments are paying special efforts to implement the Lisbon strategy. There are several national support programs launched for education and research development, especially in the engineering sciences. These European and state support programs give an opportunity for all the universities to improve and develop the study curricula, even if the universities own budget is modest. Comprehensive needs analysis, formation of capable project team, professional project management, and motivated students are the most important factors for new university curricula development.

The novelty of this work is in evaluation of the study program development as a classical innovation process, the output of which is a more competitive university graduate. The new study program includes innovation in methodological approaches, which ensure the meeting of the market driven requirements and development of competitive new specialists.

The aim of this article is to demonstrate the study curricula development as an innovation process and to analyze the innovation in study methodology as an essential factor for preparation of competitive graduates.

In order to reach the aim, whole curricula development is considered as an innovation process, based on research and theories. Especial attention is

paid to the implementation of the new study methodologies. The theoretical background of the methodologies contains references to the constructivist theories (Piaget, Dewey, Bruner, Biggs). Constructivist theories opened the era of student centred, activity based learning methods, which were developed by Piaget and Dewey adherents and known today as active learning, interactive learning, project – based learning, problem-based learning, cooperative learning, research-based learning: the methods which make students to construct their knowledge themselves and within this process gain competitive academic, professional and social skills.

The article is based on the former studies, literature and document analysis and the first results of implementation of RTU project for Professional Electronics curricula development. This article gives an estimated impact of new study curricula to the competence and professionalism of the graduates.

**Change of the learning paradigm – from subject centred studies to active, student-centred studies**

In the end of the 20th century, entering the era of knowledge economy, also the education paradigm had to change. However, the paradigm change in education always go slowly and cannot catch the other changes (*Beļickis*, 1994). Besides the global and European education paradigm change, Latvia experienced also a change in society structure, where the old principles have collapsed and new ones are not developed yet. The change of paradigm has caused protracted and unsolved changes in all spheres of life, including education. In the new paradigm, a human with his welfare, competence, and willingness to learn is in the centre (*Anspaks*, 2003). However, education is the weakest part in Latvian national innovation system (*Brunner*, 2003). Everyone knows that the new education paradigm includes the change from subject-centred studies to student-centred studies, but how to organize this change? The possible solution for education recovery is innovation.

Innovation does not necessarily mean completely new products or methods. Innovative study methodologies can be methodologies, which are not currently used or underestimated in the existing conditions. Implementing the well-known methods in a new way or new area also is an innovation (*Dimza*, 2003). It is essential that implementation of these methods brings positive outcomes – university graduates, characterized by the qualification and competence meeting the labour market needs.

Developing of a specialist for the existing and future labour market, it is necessary to remember that the labour market main requirement for future specialist is - professional competence and ability to learn continuously (*T.Koke, G.Lapina*, 2006). The university graduates have to be prepared for life-long learning and continuous construction of a new knowledge.

The constructivist theories are based on targeted construction of new knowledge on the basis of the students experience. Constructive learning always includes interaction and cooperation between participative parties. Constructive learning is "learning by doing" – term introduced by John Dewey in last century (*Dewey*,1938); it is experience based learning, learning within cooperation. Essential part of the constructive learning is experimenting which leads to experience. J.Dewey has defined that experience is a keyword that approximates and unites people. The concept of experience includes targeted experiment, the result of which is scientific cognition. Another part of experience is the emotional experience, which is obtained in problem situations and creative activities (*Anspaks*, 2003). The dual nature of experience is emphasizing its essential role in the constructive learning process.

In constructive study process student is not a passive knowledge recipient. The student is constructing his knowledge and thus gaining the integrated skills (*Čehlova, Grinpauks*, 2003) – academic, social and professional skills. The learning process contains several stages: actualization of existing knowledge, assimilation– transfer of the knowledge and its adaptation to the new situation, creation of new knowledge (*Piažē,* 2002).

In constructive learning the process is student – centred, and it is based on interactive learning, discussion, activities. The student has his own responsibility to utilize the teacher's knowledge and support to construct the knowledge, train the skills and gain attitudes (Biggs, 2003). The teacher has the role of advisor, offering problems, cognitive tasks and his support to solve them. The teacher respects student's attitude and opinion. The teacher maintains supportive learning situation, allows to make mistakes and to correct them, to explore and to formulate conclusions (*Rubene*, 2003).

There is a range of methodologies developed in the constructivist school, all based on "learning by doing" principle, active and targeted involvement of student in the construction of his knowledge and building his competitiveness. David Pratt supports opinion that the study methodologies have to prepare a student for a working life – if there is a competition in the working life, the study methodologies have to develop ability of competitiveness (*Prats*, 2000). Developing this idea, we can assure that the skills, required in the labour market, can be developed in the study process, by using the appropriate methods.

The project management and presentation skills can be acquired in project –based learning. Problem solving skills could be obtained in problem based

learning and communication skills – by using interactive learning methods – such as discussions, interviews etc. Teamwork skills could be developed using projects, cooperative learning in groups, teamwork etc.

In the knowledge economy it is essential for the students to understand innovation processes and the importance of its stages. Knowledge economy means appraisal of research. In order to be able to appraise research significance in the knowledge economy, the students have to practise research. In future every high qualified specialist has to have a good command of research methods. At university it could be done by using research-based learning and discovery learning methods.

There is available a range of well-developed active learning methods. Any of these methods would train some skills to the students. Using the active learning methodologies, students learn to be active and to learn, that is the most necessary ability for their future competitiveness.

However, the usage of these methods depends on the methodological knowledge of the academic staff, as well as enthusiasm and willingness to implement these methods in the study program. This is another challenge faced in the new study program implementation process.

"Lack of ability to look in future, disassociation from tomorrow's education problems is the most dangerous for our pedagogy, because it is leading to nowhere", is saying famous Latvian professor J.Anspaks. He is supported by another professor, J.Beļickis (*Beļickis*, 1994), who in this situation is suggesting really radical changes – those teachers and professors who are not willing to learn and acquire new knowledge, have to be retired. In the fast changing society everyone has to follow these changes. This opinion corresponds to the innovation theories – "That must be the goal, for both nations and companies: not just surviving, but achieving international competitiveness", says M. Porter. Only the ones which will aim for competitiveness will survive. The individuals and companies with the highest innovation capacity are the ones, which are learning continuously. In order to be competitive in the knowledge economy, learning has to be a way of life (*Bessant*, 2003).

After the long years of accustomed subject–centred learning – reading lectures, the academic staff has difficulties to change their style. They have to acquire the new methodologies and to implement them in the study process. However, in the current situation there is no motivation to that. Development of a new study program, introducing new subjects and modern methodologies, including the academic staff training, is the best solution to adapt to the new education paradigm and to produce competitive university graduates.

### ESF project "Innovative solutions in RTU Electronics study program for promotion of knowledge economy development in Latvia."

The collapse of the electronic industry in Latvia in the early nineties of last century has reflected also in the higher education. The labour market demand for electronics engineers diminished, the number of students decreased. The poor state financing for research and education caused a range of problems in education. When in the middle of 90-ties the electronics renaissance began, there appeared new problems – inadequacy of study curricula and consequently the qualification the graduates to the new market demands. The electronics study curricula has not been reviewed for 15 years, the laboratory equipment has not been changed for more than 20 years, there have appeared new technologies and new requirements for industry, the study approaches and methodologies have developed, and the students also have changed.

In order to improve the situation, several studies and activities were performed. There were several European projects supporting reviewing of the electronics curricula compliance to the industry requirements, evaluation of study program, and development of the new profession standard of electronics engineer (reg.Nr. PS 0255).

As a result of these studies it is clearly stated what qualification, skills and knowledge of the electronics program graduates is expected. The biggest problem is – how to reach the required level of the graduates.

There was made a comparative study in Faculty of Electronics and Telecommunications of the Riga Technical University. The Electronics Professional study program was compared to the EC FP5 project „Career Space" recommendations for curricula development in 21st century (*Lapina, Slaidins*, 2005). Three main conclusions were made – the study content has to be changed according to the industry requirements, the study methodology has to be changed and the qualification of the academic staff has to be improved according to the fast developing electronics industry content and implementation of the new methodological approaches.

These studies gave an impulse for development of a new project "Innovative solutions in RTU Electronics study program - promotion of knowledge economy development in Latvia" (VPD1/ESF/PIAA/06/APK/3.2.3.2./0107/0007). The project was developed by the Faculty of Electronics and Telecommunication, and is funded by the European Social Fund. The main aim of the project is to develop a new – professional electronics study

program, corresponding to the industrial requirements and international recommendations, develop Electronics study program modules and improve program implementation in general. The new program will have improved content, including e-based learning and innovation management course. The new program will differ from the old one with teaching and learning methodologies, which will be based on constructivism theories and will involve students into active and deep learning.

The project foresees following activities: development of the new study curricula and study materials (including specific electronic subjects and the innovation management course), purchase of modern laboratory equipment and development of practical laboratory works, and choice of the most appropriate study methodology.

The project activities include also piloting the new courses, licensing of the new study curricula and marketing activities. All the activities are covered by the quality management system.

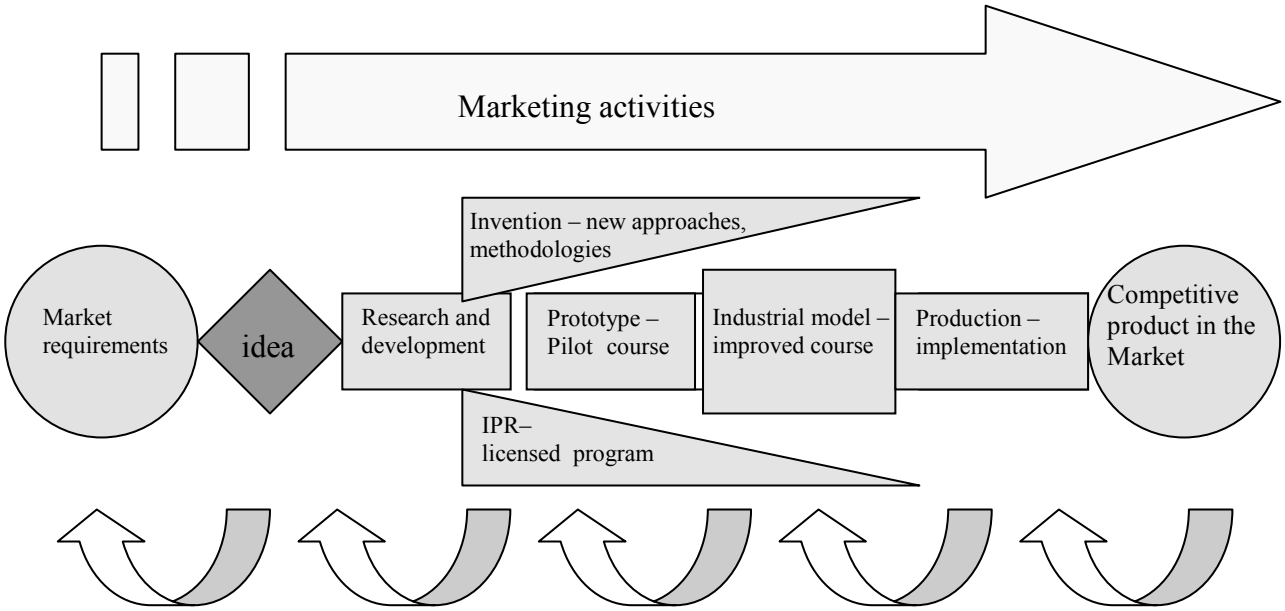


**Figure 1. Curricula development innovation process.**

What are the innovative solutions in the new study program?

According to innovation definition, innovation is a process of implementation of new scientific, technical, social ideas into marketable and competitive product or service (*National Program on Innovation*, 2003). The project activities assure a full cycle of innovation in the study program development: the market requirement leads to the idea of study program development, review of the program compliance to the industry requirements is made (including the analysis at the pre-project stage, as well as project research activities), the prototype development (pilot course), marketing, improvement of the course based on the analysis of piloting results and launching to the market as a competitive product. The innovation process of the new curricula development is shown in the Figure 1.

The innovative solutions in this process are – new approaches, new methodologies, updated program content, that lead to a competitive study program which prepares the new specialists with competitive advantage.

In the current stage the program developers are in course development stage and Innovation Management course already in piloting stage. As well as any innovation process, the course development is a team work, where are 32 experts are involved (electronics industry, higher education programs, electronics higher education, quality management, innovation) and 90 students for project pilot studies.

During the development stage the new subjects are being developed, including the content and methodology. Innovative approach was applied - the Enterprise Knowledge Development (EKD) method (*Bubenko*, 2001). It maintained well structured and effective brainstorming, open discussion and reaching consensus among experts involved on solutions to be applied in the new study programme development. The project experts discussed the most important and common program development questions, such as the program compliance to the industrial needs, Latvian electronics engineer profession standard and international requirements. Taking into account the EC FP5 project Career Space recommendations and the project team opinions, there should be implemented new study methodologies in all the subjects.

Experts agreed that it is important to develop problem analysis and research skills on graduates, learning skills and anxiety for knowledge, as well as communication and teamwork skills. It was also agreed that content and methodology must be updated.

It was proposed to strengthen academia – industry collaboration and exchange. It was devised to stimulate merging of learning process to real product development conditions.

The active learning methodologies were presented to the project team, including academic staff. The basic idea presented was that in the learning process the students have to learn the skills which are very demanded in companies: team work, research work, problem solution, project management, presentations. All these skills can be acquired during the studies, if appropriate study methods are used.

However, in this stage the biggest problem in the new curricula development and implementation is the old fashion and conservative approach of the old generation academic staff. The piloting of the new course has already proved that the students, in spite of the conservative opinions, are open to new methods: cooperation, teamwork, discussions, etc., and are welcoming the new active study methods.

**Conclusions**

Implementation of innovation in education unambiguously leads to a competitive product – competitive student in the labour market. Not only the competitiveness of the individuals grows, but also competitiveness of the companies employing these graduates will grow, and this will increase the national competitive advantage in the global market.

Development of a new study program was examined as an innovation process. In order to reach successful result – new, competitive study program, an innovative approach was applied for analysis and research – the Enterprise Knowledge Development (EKD) method. It maintained well structured and effective brainstorming, open discussion and reaching consensus among experts involved on solutions to be applied in the new study programme development.

Implementation of the well-known methodologies in a new environment is an important innovative aspect of the study program improvement. It includes the academic staff pedagogic training and change of teaching and learning style. Implementation of active learning methodologies in the new curricula requires big efforts, but is the only way how to reach competitive advantage.

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