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Multiple benefits of modern education

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Abstract

Knowledge and the implementation of innovations are considered as the key factor of success that can ensure economic growth for individuals, companies even for whole countries. It is not different in the school environment either. According to the development and current trends it is necessary for educational institutes not only to be „educating“ but also to be „learning“ to provide modern education. We developed an innovative manner of education in the subject Informatics II based on modelling and simulation at the Faculty of Economics, Technical University of Košice. The paper deals with the experience in this modern way of teaching.

Key words: education, creativity, critical thinking

1. INTRODUCTION

Information society starts to transform into a different, more organized form, so called knowledge society. From the development so far we can expect, that this form will be characterized by an urge in making the information more and more available for public, by using not only information but also knowledge stored and processed by information technology according to users' requirements. Computer technology will obviously dominate even in discoveries, formulation and gaining of new knowledge. Currently we have an opportunity to use such computer technology, memory structures and manipulation procedures with these structures that allow us to effectively represent knowledge in computer memory and use these representations in processes for problem solving [7].

These changes cause significant social impacts. Institutions, organizations, enterprises focus more on getting employees who excel in their knowledge and creative thinking. Today such intellectually exceptional people can do than they could than any time in the past create excellent working businesses. As a good example can serve Intel, established by Robert Noyce and Gordon E. Moor, or Microsoft, founded by Bill Gates and Paul Allen. What make these people special? Certainly they know a lot. However it doesn't need to be wide knowledge gained by long studies. Anyone who invests time and means into his own education can get knowledge/learned something. It is also needed to be able to change knowledge into an effective work. That is linked to a way of „system thinking" which makes us see things in relations.

Dynamic changes in society and labour market require modern, flexible, innovative and creative possibilities of education. It is necessary, especially for higher education institutions, to search for the

new possibilities of improving the skills of specialists and professionals changing personal specializations, developing individual abilities and acquiring high level professional competences. Experience gained by the major part of countries shows that the development of economy and a rise in living standards directly depend on knowledge generation and the proper usage of information that help with educating society, creating new scientific products and improving technologies. The system of university education is one of the basic parts of education, culture, teaching, social welfare and economic development in every country. University education has been accepted as the foundation for public priority, economic prosperity and life quality. The institutions of university education are capable of training an educated, intelligent and knowledgeable society and raising national intellectual and creative potential. [8]

2. NEW MANNER OF EDUCATION

In order to prepare our graduates for new economic environment and labour market requirements, we decided to include new manner of education into basic informatics course. Except of the traditional methods of teaching, as lectures and practices, we used also e-learning, learning-by-doing and project method. Using these modern methods of teaching/learning we try to develop students' logical and critical thinking, we want to support creativity and ability to solve problems by own. The students are taking part in virtual projects of building information systems (IS) of various types of firms, companies and institutions. The projects consist of the main goals determination and user requirements description of new IS.

We integrate modelling of business processes into the education as the part of students' project. We consider problem oriented project education to be a suitable one. When students actively participate in learning process they not only test their understanding of the subject matter of the course, but further develop their thinking, communication and analytical skills. Using e-learning and electronic communication via LMS (Learning Management System) Moodle we make learning more effective. Current structure of subject Informatics II is on Figure 1.

Subject Informatics II	**Traditional way of teaching - lectures and practices**				
	New manner of teaching – e-learning, learning-by-doing, project creation, modeling and simulation				
	Project proposal	**Learning in the field of IS, modeling of business processess**	**Project first draft**	**Consultation, using LMS Moodle, e-learnig**	**Project final version**

Figure 1. Current structure of subject Informatics II

We want students to use modern standards, notation and tool for effective work in the area of business process modelling – ARIS Express, accessible on the web page http://www.ariscommunity.com/aris-express [1], see Figure 2. This free software tool is an excellent environment with a wide functionality for work in the area of business and organization modelling as we can see in Figure 3.

Working with this application is a great chance for students to extend their information competencies and modelling skills. They can use "Organizational chart" to present the organizational structures, to illustrate the relationships between organizational units, roles and persons. "Process landscape" gives an overview of the value-added processes in a company. It also serves to show hierarchies. "Business

process" describes the process as a sequence of events and activities. IT systems, organizational element or data may be added. "Data model" illustrates data structures by means of data units – entities, including their relationships and properties. "BPMN diagram" enables modelling of processes according to the Business Process Modelling Notation (BPMN 2.0) - also across organizations. "General diagram" provides a selection of graphic elements to which any required meaning can be assigned. [1]

Figure 2. ARIS Express webpage, [1]

Figure 3. ARIS Express 2.4 Model Types, [1]

During the teaching process we record and evaluate information, knowledge and experience and according them we adapt present scope, content and methods. We can summarize our experience:

- this manner of the education is interesting for both students and teachers;
- there is possibility of real using e-learning, learning-by-doing, inter-subjects connections, however this way of education especially preparation for teaching is more time demanding;
- students accepted this topic and methods very well, many examples of common life can be used, definitions of many terms in the field of modelling and information systems are often only the precise definition or explanation of the common terms;
- students need not much theoretical knowledge to work out simply models and project themselves;
- students can use their own view of solving problems, their creativity and knowledge, this themes and attitude helps to develop logical and critical thinking of the students;
- teaching Informatics II via modelling and simulation doesn't depend on the technical equipment of the school, doesn't require any special equipment.

3. BENEFITS OF MODERN EDUCATION

As well as in the economic sphere also in the school environment it is necessary to count with a minimal stability and certainty. The only thing that is certain in today's world is a permanent change. New skills for knowledge society are not only classical literacy (reading, writing, counting), but also digital literacy and good creative, logical and critical thinking. Given the wide availability of Internet and other ICT tools are these technologies become a key instrument for modern form of education. Different learning environments, tools, communities and pedagogies, supported by ICT, are currently available for every single learner instead of textbooks, and blackboards as the main tools and classroom teaching as the main form of education. For students it is more motivating, if they have to solve problems they encounter every day and in that case a variety of used media can support students' learning and provide a deeper knowledge and understanding of content and concepts.

The various ICT tools can play a role of assistant in process of developing the creativity, because they help to increase the speed of a creativity process (providing partially formed ideas, associations, idea visualisations, different alternatives or applications) and at the same time they usually enables to do step-back to earlier ideas, re-visit and re-assess what they have done, discard unsatisfactory outcomes and unsuccessful attempts.

We consider following facts to be the most significant benefits in our modern way of education:

- support of development and usage students´ creativity;
- development of logical and critical thinking and system approach;
- modern ICT tool using for learning and business process modelling;

3.1 Importance of creativity development

The current time period is often referred to as to the age of creativity. Success of firms and organizations depends on creativity and innovations. Today it is necessary to use creativity potentials of all members of organizations and stimulate and develop it by providing an organizational support for creative and innovative behaviour of individuals and teams. However many professional activities are oriented to accuracy and perfection. We would probably choose experienced doctor who is perfectionist that to creative or we would be more comfortable in a plane if we knew the pilot is reliable rather than creative. Creative individuals are needed in right situations and positions. [7]

The important precondition for the people and companies, in order to be able to provide new ideas, products, services, i.e. to be innovative, is creativity. Creativity is a complex phenomenon, which is not simple to define. Structure of creativity is formed by personality, creative process, creative product and procreative environment. Most authors define creativity as a process of creating something that is original and valuable.

According to [4], creativity is a multidimensional phenomenon that manifests itself in many fields and contexts, from arts and crafts to design, science, research and entrepreneurship. It is regarded as a cognitive ability, but it is not the same as intelligence. It involves the ability to synthesize and combine data and information, but also requires confidence to take risks. In general, we can say, that creativity is the process of having original ideas that have value.

The history of our society is closely related to the permanent development of new forms of satisfying old and new needs. This development implies a creative process which leads to the permanent creation of new product and services. The understanding of principles of our society as a permanent process of destruction and creative re-combination of production factors is based on the work of the economist Joseph Schumpeter. For example he defines the entrepreneur as someone who carries out new combinations in five different cases [10], [11]:

- introduction of a new good, that is one with consumers are not yet familiar, or a new quality of a good;
- introduction of a new method of production;
- opening of a new market;
- conquest of a new source of raw materials or half-manufactured goods, and improved handling and transport of materials and goods;
- implementation of any new form of business organization in any industry, like the creation of department stores, or of a monopoly position, or the breaking up of a monopoly position.

Creative processes and stable routines have to be balanced in order to manage change, taking it as a chance, and harvesting the rewards. Not only entrepreneurial attentiveness and creativity are necessary to maintain the ability of quick reaction. In the late 1990s, the insight grew that this implied also the companies´ access to the knowledge and creativity of the employees. The stimulation of the intellectual and creative potential of the employees and its systematic management was the aim of “knowledge management”. This was a label for all attempts to collect, store, and redistribute the individual knowledge by means of ICT and transform into company-owned knowledge. “Knowledge management” or “idea management” were compared to treasure seeking: The belief was that the creative ideas of the employees only had to be collected and to transformed in usable process routines. Although the enthusiasm about idea management has decreased since some years, many tools and concepts of the general approach have survived in practice.

3.2 Development of system approach and critical thinking

As we can read in [9] a system is a set of interrelated, interacting components that function together as an entity to produce predicable end result. A business is a system composed of people, facilities, equipment, materials, and methods of work that function to provide goods or services. Components of a system can be seen as subsystems. The organizational structure of a business represents a formal recognition by its management of the subsystems from which it is composed. An organizational chart identifies these subsystems and shows their relationships. For a system function effectively, all its components should generate and communicate information. An organization is seen as a hierarchy with functions partitioned into subsystems that pursue assigned of the organization´s goals.

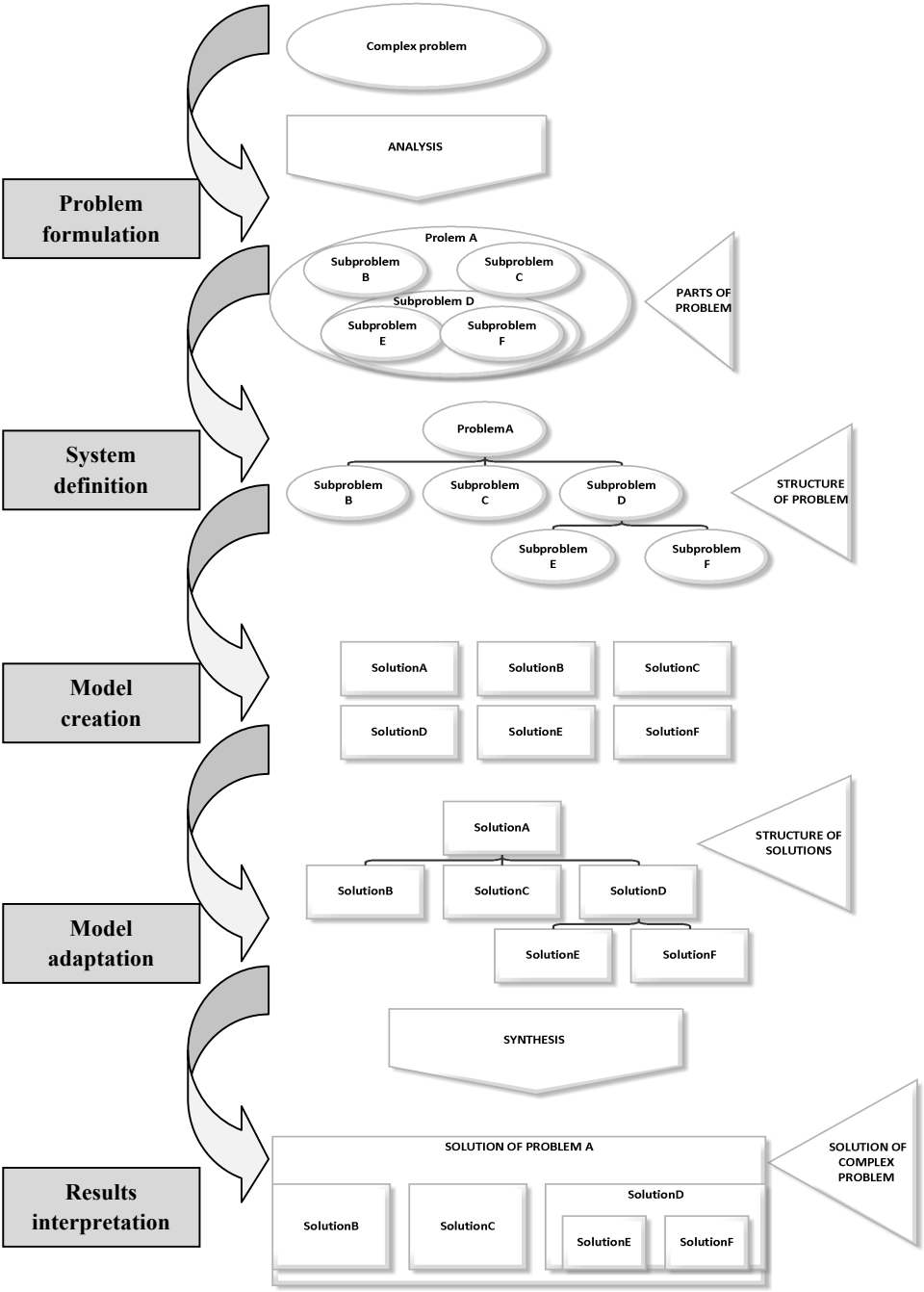

Figure 4. Application of system approach, analysis and synthesis in students´ project creation, [9]

The system approach is a way of identifying and viewing component parts and functions as integral elements of a whole system. We consider it as very important part and valuable tool in all kind of problem solving procedure. That is why we try to use it in our manner of education as it is presented at Figure 4.

Critical thinking is a complex process of deliberation which involves a wide range of skills and attitudes. It includes, according to [2], identifying other people´s positions, arguments and conclusions; evaluating the evidence for alternative points of view; weighing up opposing arguments and evidence fairly; being able to read between the lines, seeing behind surfaces, and identifying false or unfair assumptions; recognizing techniques used to make certain positions more appealing than others, such as false logic and persuasive devices; reflecting on issues in a structured way, bringing logic and insight to bear; drawing conclusions about whether arguments are valid and justifiable, based on good evidence and sensible assumptions; synthesizing information: drawing together your judgments of the evidence, synthesizing these to form your own new position; presenting a point of view in a structured, clear, well-reasoned way that convinces others.

Skills in critical thinking bring precision to the way you think and work. You will find that practice in critical thinking helps to be more accurate and specific in noting what is relevant and what is not. The skills as following:

- Observation
- Reasoning
- Decision-making
- Analysis
- Judgment
- Persuasion

are useful to problem solving and to project management, bringing greater precision and accuracy to different parts of a task. [2]

3.3 Usage of modern ICT tools

We have found, that the knowledge and abilities everybody must possess in order to work effectively and succeed in knowledge economy, have been dramatically redefined. Especially it can be seen in the field of ICT implementation. [6] The innovation potential of ICT has not been exhausted yet, because developers and visioners can still find new possibilities, products and services how to use ICT in all fields of human life. As we can see in [5], big data, HTML 5, the wireless device power, private clouds and applications stores, activity streams, Internet TV, NFC payment, cloud computing and media tablets are fastest growing technology. Some other technologies are now as a new trend - BYOD (Bring Your Own Device - bring your own equipment to working environment), 3D printing, analysis of social networks, and complex-events processing. Based on the Gartners' analysis of last Hype curve can be highlighted several expected trends in the field of ICT:

- any function on any device, anywhere and anytime;
- smarter things - as mobile robots, the Internet of Things, big data, wireless energy, machine-to-machine communication services, mesh networks sensors, home health monitoring;
- Big data, global computing power at low prices – the world presented by almost endless analytical understanding, computational power and continuously and effectively improving cost of it. In such a world, businesses can better understand their customers and effectively prevent fraud.
- Human communication technologies – technologies, which communicate with people and vice versa by much more human, more natural;
- Future of payment - no cash and all transactions are electronic, what helps companies to trace and increase efficiency of realised payments, and customers increase some comfort and safety of payments;

4. CONCLUSION

These days education and training are considered to be investments for states/nations, entrepreneurs and individuals. The educating system cannot just reflect current knowledge but it also has to anticipate the development from the view of contents and quality. According to [3], an important process is to introduce the achieved knowledge into the real life. The development of human's capital together with social capital is a key factor for building and inclusive, sustainable economic environment.

Application of modern methods, forms and content of education has multiple benefits. It helps us to create an environment in which students can without any problems use available knowledge with a high added value and in which exists possibility to support development and usage of creativity and critical thinking.

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