

## INTRODUCTION OF MODULAR AND ADAPTIVE TEACHING OF INFORMATION AND COMMUNICATION TECHNOLOGIES

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**Abstract:** Information and communication technologies play an important role in university studies. Students are expected to learn on their own whilst using modern technologies. To support this, subjects that create preconditions for this process, can be found in the first year study program. Since the first year students' skills vary in the field of ICT an individual approach is approved. The study describes the model of modular and adaptive teaching of Information and communication technologies at the J. Selye University in Komárno and discusses the results achieved

**Keywords:** ICT, modular system, adaptive teaching, information literacy, communication technologies

### 1 Introduction

Those students who are admitted have a different level of expertise in the field of information and communication technologies. There are big differences among students in the above-mentioned area. One of the reasons is that students come from different types of grammar schools. Another reason is that at the same type of schools the level of teaching Informatics differs. In addition, some students lack proper inner motivation. First two reasons can be considered as outer conditions of education, these are closely connected with the preparedness of schools, the necessary equipment and trained teachers. Supply of equipment is a financial matter and can be changed within a short period from unsatisfactory to excellent. To train the teachers is more complicated. It seems that big differences among admitted students will remain an unsolved problem for a long time.

### 2 Information literacy

The aim of the subject Informatics is to provide students with proper information literacy that is necessary to finish their studies and is essential in our information society. Information boom is a new challenge for the capacity of the human mind to absorb the growing number of information. A new approach should be introduced in education. The main aim of education is to develop skills of students, e.g. learning, creativity, critical thinking, usage of information and communication technologies. School is no longer the main source of information. There is a competition with medias and electronic information sources.

There must be a shift from the traditional concept of teaching to a more progressive one, where the emphases are put on the process and application of information and to increase the effectiveness of learning. Information literacy is an ability of an individual to get and use information (Szarka, 2017).

A computer-literate person in the modern society should be able to ascertain the need for information, recognize what sort of information s/he needs and to determine the extent of required information, to gain and use information ethically and legally, to assess critically the obtained information and its resources, to incorporate the obtained information into a system of one's own knowledge, to constantly update the knowledge and identify the problems to be solved, to use information efficiently to solve actual tasks, to understand and respect economic, legal, social and cultural problems, connected with the usage of information, to classify, archive and process the obtained or created information, to recognize computer literacy as a necessary prerequisite for lifelong education (Marks-Lajčín, 2016).

### 3 Competences and Standards of Teacher in Information Society

#### Standards

In the most of countries in the world there is a national trend to create the requirements on the work results of schools, so-called Standards, that are regularly monitored. The most of products are required to meet a predetermined standard, norm whereby meeting of the requirements are strictly controlled. However, it has not been provided in educational system. Nobody has basically guaranteed that the graduate has mastered the required knowledge, skills, attitudes and etc. The idea of Standards in education has begun to promote during the last few decades according to the example of the industry (Szököl, 2016).

The term of Standard means the degree of perfection required for a particular purpose or accepted or approved model (pattern, standard, rate) by which are real objects and processes of the same category being compared or measured. The Standards are therefore required and binding characteristics of quantitative or qualitative properties of a particular object or phenomenon.

Nowadays, multiple kinds of standards are currently discussed in the educational system. For example, the pedagogical literature distinguishes these types of standards in the United States (National Standards for Civics and Government. Draft for Review and Comment. Center for Civic Education. Calabas)

Students' Standards: have dual form: content and performance. Content Standards are requirements that state what students should know or can do.

The content and scope of the different subjects are defined by the curriculum. The subject matter is represented mainly by appointing of the knowledge to be made available to students. In the context of rapid scientific and technological development an explosion of information has begun thus resulting in an overdimension of the curriculum. The overdimension can also be caused by the fact that allocated time for the teaching of certain subjects is reduced whereby the curriculum content remains essentially unchanged. Only way to remove overdimension of school curriculum is to exempt the school from the effort to pass the maximum amount of information, i.e. to determine basic subject matter (Bilčík, 2018).

Performance Standards are detailed elaboration of the Content Standards and contain the level of achievement that is expected of them. There are three levels of achievement standards: basic, intermediate and advanced. They are also called target standard. Teachers' Standards: They essentially contain the detailed qualification requirements for teachers in order to help students to accomplish the performance standards.

Schools' Standards: They include criteria for schools. Their fulfillment is to ensure all students an equal opportunity to achieve the content and performance standards.

State and Local School Authorities' Standards: They contain criteria to assess the success of the state and local school authorities in fulfilling their mission in education.

Performance and Content standards form the Educational Standards. Each Content Standard should be determined by elaborated Performance Standards and vice versa. Both standards correspond to each other (Benedek, 2015).

#### Evaluation Standards

They are an essential building block in the development of educational programs. Evaluation Standards define the set of criterias, organizational and methodological procedures for verifying the achievement of learning outcomes or professional

competences. In relation to the acquisition of qualifications they must be based on qualification standards.

Evaluation standard includes:

- evaluation criteria for each general and professional competence. They determine how to establish the evidence that learning has been completed and demonstrated for the required competence. They must be linked to learning outcomes. Since the competences determine what a person has to know and perform within a given qualification or employment, the criteria determine according to what we know whether these competencies are actually acquired. The criteria must be specific, clear, objective and relevant in relation to the particular competence. They must relate to only one competence.
- The means and methods of evaluation - defining ways and means of verification of particular competences.
- Organizational and methodical guidelines - for the course of tests. These are the different rules and regulations for final exams and school leaving examination that are part of the valid legislation (Bendíková, 2014).

### 3.1 Information literacy standards of future teacher

Undermentioned set of standards was elaborated by IVIG - Expert committee on information literacy and output information literacy at universities. „ These standards defining knowledge, skills and abilities of information literate students or teachers relate only to study and professional work in the field. In this sense, information literate graduates of grammar school or future teachers (Hrmo-Podaryl, 2013):

- are able to understand specialized texts of their field of study, to abstract from any essential thoughts and to write professional texts themselves using knowledge of information sources that are quoted with respect to copyright law and to the principles of creation of bibliographic quotation
- know and monitor key information sources of their field of study based on advanced search methods and with respect to the legal and moral aspects of this activity they are able to obtain relevant information and thus obtained data of different types and formats they can manage and store for further use in their professional work
- can use sources of numerical and technical information, search and process numerical and technical data and use them in their professional work.
- can master the native language and can verbally and in writing express their own ideas, know and use the terminology of mother and a foreign language, especially English, at the level necessary to work with professional information sources and communication within the field community
- can use available information and communication technologies needed for searching, processing and presentation of information (of various type and format), relating to his studies and professional work. (Professional committee IVIG Association of Libraries of Czech Universities, 2004).

### 4 Key competencies, concept, meaning

Currently, in connection with changes in the Slovak Education we meet more often with the concept of competencies, key competencies. There is a tendency to speak about the key competences as of a new phenomenon in education. This concept was originated in about 70's of the 20th century in economics, where it represented a set of specific requirements for the job seeker. It was passed into the field of education late in the 90's, where it serves as a bridge between the requirements placed by employers on the labor market and graduate profile.

The concept of competence is used in a professional and in everyday language and as synonyms are also used such words as the ability, skill, efficiency, capacity, and other required quality

and so on. As a competent person in a particular area is usually regarded a man who has the skills, motivation, knowledge, skills, etc. to work properly in the required area. The concept of competence is usually applied to individuals, social groups and institutions, unless they successfully achieve the objectives and meet the requirements of their surrounding environment. The theory of key competencies is not yet fully formed and there is still no comprehensive and generally accepted definition of key competencies. Hrmo and Podaryl (2013) mentioned in their publication the Key Competences: "Competence is the behaviour (activity or set of activities), which characterize the excellent performance in any field of activity. Key competencies are the most important competencies from the set of competencies. They are appropriate to solve a wide range of mostly unforeseen problems that enable individuals successfully to cope with the rapid changes at work, personal and social life."

According to the another author: Key competences are interiorized, interconnected set of acquired knowledge, skills, abilities, attitudes and value orientations that are important for the quality development of the individual's personality, his active participation in society, employment and his lifelong learning. The next definition states: Having competence means having comprehensive amenities of personality that allows individuals to cope up with tasks and situations in life successfully, in which they are adequately able to take appropriate actions and take a beneficial attitude. Key competences should enable individuals to continuously update their knowledge and skills applicable in their everyday practice. For a learning person it may not be beneficial to do some educational (cognitive, training, educational) activities, but especially those that are useful for the life practice, providing him with quality education, corresponding to the requirements of the organizations and the labour market. The most important are educational outcomes, their quality but not only completed educational process or obtained a certificate of the education (Varga, 2015).

### 5 The concept of the information society

Information society from the point of view of an ordinary person is a society where the work with information is an everyday activity. Some different information and communication technologies (ICT) are used to work with information that means the methods, procedures and means such as computer, electronic diary, mobile phone and so on.

From a social point of view, information society is a society in which informatics and information and communication technologies are becoming an economic force, identifying and transforming the entire social system and acting as a means of creating new social, supraclass and and supranational structures fundamentally altering the mechanisms of social development (Horváthová, 2011).

Challenges of the information society and further directions of development have been the subject of a number of papers at international and national level. The following ones have an important role within the frame of documents of national character:

- Policy of Informatizing Society in the Slovak Republic for the years 2012 - 2015 with a view to 2020.
- National Action Programme of Society Informatization
- Millennium - National Programme of Education in the Slovak Republic for the next 15 to 20 years (10-13)

#### The main benefits of the information society are:

- making available the usage of information sources and their tools by the general public,
- expansion and improvement of means of services and entertainment,
- promotion of education,
- new opportunities for the application of human creative abilities, as well as the employing of handicapped people in life through "teleworking"

- increasing of cultural traditions and identity of regions,
- more efficient state administration,
- more effective management of enterprises, improving of competitiveness, facilitating of connection between the manufacturer, service provider and the customers themselves,
- new services in the telecommunications and new markets in field of software,
- more effective health care (Szókö, 2010).

Information Society was firstly taught at the J. Selye University in winter semester of the academic year 2019/2020. Since the subject of Information Society was not included in the accredited programs, the content of the course was divided into several subjects. The most of the topics was included in the basic subject of Information and Communication Technologies, taught in the first years of education at the Faculty of Economics of the Janos Selye University. Part of topics appears in the continuing subject of Information and Communication Technologies II. The subject of Informatics is taught only one semester at the Faculty of Economics so only four modules of Information Society are taught by means of presentations. Individual modules were evaluated on the basis of tests which had to be passed by all the students as the procedure within the exam. Tests were carried out in the Moodle environment where the teacher could exactly evaluate the different parts and process the percentage of success. Thematic unit on e-learning has found its place in the subject Didactics of Informatics, which is an organic part of the Master Teacher Training program. Thematic unit on legal standards of information society forms a part of the subject called Law and Ethics in the Use of Information and Communication Technologies.

## 6 Teaching modules

Demonstrate results of education in connection to content of education in singles teaching majors. Express forms, way and content of activity that students have to acquire beneath their studies. Part of educational modules are time support set for the given subject, aim of teaching, function of subject/module, specific steps, form and organisation of education, connection between subjects and didactic source.

### *Selection of tutorial*

The main criteria for selection of the tutorial are the determining those factors, which mostly influences the achievement of educational aim. As the aim changes in the connection of social improvement, the opinion for the choice changes too.

### *Arrangement of tutorial*

That in education don't occur don't wanted empty gaps, where is missing connection between, what is known and what has to be known, neither to don't reasoned duplication, it's need to correctly structuralize and sort the whole tutorial.

Subject system of education means the education of the given subject as a whole, while the sort of the tutorial is like spiral.

Modular system of education means education of the given subject divided to single parts – modules, while the sort of the given subject is modular. The tutorial is build up from modules.

### 6.1 Modular sorting of tutorial

Word module means in general as independent part (unit), which is complete, but which could be connected to another units and together with them create a bigger unit, supplying to rich wider aims, or the solution of more compounded tasks. So we can say, that module represents an independent unit of a puzzle.

In pedagogy expression module means the independent part of the tutorial, and modular sorting of tutorial means a tutorial of a specific type of school, course, etc., not divided into subjects, subjects divided into themes, but tutorial divided into modules. Time necessary for receiving the module of tutorial used to be

shorter, than the duration of the educated subject, about 15-40 teaching hours.

Expression modular system of education means expanded receiving the tutorial of the single modules, from which the school program is build up. Certain education – getting a certificate, diploma, etc., is understudied as a puzzle created from fixed number of modules. Successfully learned tutorial from a determined module is introducing the constant part of the puzzle – of the learning and it's not necessary in time, e.g. after some years, to learn again the same tutorial. (Szókö, 2010)

### 6.2 The necessity of realization the modular system of education

Quality is the measure of the perfection, preciousness, usefulness of the education and learning, fulfilling of requirement and expectations of the schools clients: pupils, students, parents, employees, citizens of the country. Quality of the education is able to continuously rise without consideration of the actual level.

Internally the subject informatics on the university is possible to reach only modularly, so all students can study only that, what they don't know. Different kinds of secondary schools have different standards, which students have to reach. There are big differences between the students, who are applying to universities from the area of informatics, and which affect the competence and practical abilities from the enfaced area. Wherever in this area are existing standards, which influences the level of information ability of the senior, in the most cases the knowledge of the students, which are starting the first year on the university, are not reaching this standard. The reasons of these imperfections are different. One of the reasons could be the kind of secondary school, as the level of teaching information and communication technology (ICT). Next reason of the big difference, that not all of the students has connection to these disciplines, and from a lot of students is missing the motivation. The first two reasons we can classify to external conditions of education, which are closely connected with the preparedness of the school, which is concerning with the tooling of material-technology basics and preparedness of the students. The material and technology tooling of the education is the question of the finance, and in a short time it could be changed from the nought to above the average. With the preparedness of the students, it is not so easy. It could be possible, that the different knowledge of the students, coming to universities, will be a problem for a long time. That's why it could be a good solution the modular system of education informatics – teach somebody that, what he doesn't know with a help of cloak test.

For ensure of the informational knowledge on single levels, the educational programs contains basic and special subjects oriented for computing, informatics and information communication technologies.

#### 6.2.1 Subject system of education on the PF of UJS in Komarno

On the Faculty of Pedagogy of UJS subject informatics is educated two semesters. The weekly schedule is the following: two hours of lecture and two hours of practice, so 56 hours of informatics for one semester. The winter semester is divided into 14 weeks, and each week has different determined contain of lectures as practices too. This contain of the subject must finish all students in the first class on PF of UJS, wherever their abilities reached on the secondary schools are respected.

#### 7 An offer for modular system of education on the PF UJS in Komarno

To avoid redundancy in the education process, and that all students could make connection between the present studies and studies before about informatics was created the modular system of education of this subject, wherever the main attention is on the type of finished secondary school. Every type of secondary

school has an elaborated standard from the subject informatics, which students have to reach.

Modules, which providing as a over to education in modular system way, has particular determined instructions to education, introduction, aims of the module, contently and effect standard, tutor text, summary, auto test, extra literature, ending and bibliographic links.

Modular system of education containing from 5 modules, where modules 1,2 and 3 are educated in the first – winter semester on the PF of UJS and modules 4 and 5 in the second – summer semester. Each module contains about 20 hours – together for one year it is 104 teaching hours. In the beginning of the first semester students works out an entering test, which is out worked modularly, and by the results they sing up for the module, which they don't know.

Offer for the content and aim single modules

Educational support of modules are divided and structured, that the learning of the participants would be maximally effective. Affectivity mainly is on, that participant could concentrate on the learning content, because he's not occupied with the study, because the study text contains elements which accelerate the right auto regulation. Participants after the signing up to the subject (course) get the study material.

The input diagnostics of the module – lector with the help of diagnostic dialog and cloak test conclude the knowledge and ability of the student. If it's need to the lector define an individual task (or more), which participant of the course solve and send in electronic way to lector for evaluation. With this way it will be ensured the comparable level of incoming knowledge and abilities of the participant and established a requirement for successful absolving of the course.

### 7.1 Methods

One of the parts of the tutorial process is feedback of the students. In consideration of, that students after the cloak test will be divided into groups, test could be anonym. The questions was selected based on them practical usefulness for the valuation of modules and according to standards for the standard high schools worked out by pedagogic institution.

In the beginning of the semester students get two types of tests. First test is dealing with the basics of the information, about the finished secondary school, number of hours from informatics weekly, as basic knowledge about the subject. The second test is divided up to 5 modules, where students must to answer for questions, wherever all of the questions has value of 1 point. By the results, were worked out individual studying plan for students, by which they visit the hours. In the end of the semester they must to take the same test – cloak test, where was checked the affectivity of the teaching process and reached knowledge from the semester, and than they were compared with the first – cloak test.

## 8 Results and Discussion

Content of Informatics as a Subject

The content of Informatics as a subject is, in a manner of speaking, regularized by the content of ECDL (European Computer Driver Licence), colloquially called as "a driving licence for PC". ECDL is an internationally respected, objective and standardized method to verify computer literacy. The ECDL methodology finds out by means of practical tests whether the candidate is able to use efficiently the basic information technologies. *The ECDL Certificate* – an internationally accepted document shows that its holder disposes of basic theoretical knowledge and has basic skills for universal and efficient using of computational technology. Its validity is unlimited as for time.

The ECDL syllabus covers entirely 7 modules. The content of these modules is the following:

1. The grounds of information technologies
2. Use of PC and file administration
3. Text editor
4. Chart calculator
5. Databases and database systems
6. PC graphic possibilities and ways of electronic presentation
7. Information network services

Given the specialization of students at UJS Faculty of Pedagogy, working with the chart processor Excel is reinforced. It is only the chart processor that is a means of teaching a whole series of technical subjects for economists. This is why it is important to master it thoroughly. The same applies to databases and database systems that constitute for economists an independent subject.

### 8.1 An effective provision of basic user's competences in the field of ICT – model of modular and adaptive preparation

It is an actual problem of every university to effectively realize and organize an acquisition of basic user's competences. How to realize an individual approach and differentiate at the same time is not easy. It is not simple to teach everyone what s/he does not know and not leaving out anything important, to pay everyone enough attention, to have time for everyone, to inspire everyone, to guide correctly, to lead to systematic work in order that everyone can gain the necessary competences and acquire a necessary level of knowledge.

Basic user's competences consist of theoretical knowledge, but mainly of skills how to use information and communication technologies (Szarka- Brestenská- Juhász, 2015). The content of the subject in each semester is 13 teaching units and each teaching unit has a precise content and specific educational aims. The students are drawn up an individual study plan upon their results of their entrance exams as a recommendation which classes to attend, and are given tasks to work out independently. The results of the tests will furthermore determine which and how many times thematic / teaching units will be repeated.

It is not compulsory for the students to attend lectures, nor seminars. The important factor is to meet the prescribed requirements for knowledge and skills. A proof of the knowledge and skills attained are the tasks worked out "at home", outside the scheduled education, and a successful handling of the test and practical tasks at the exam. The students may enrol at the exam, although they have not attended lectures or seminars. Upon their requirements and self-recognition, the students may develop their own individual study plan. If they do not accept this responsibility, the teacher subsequently recommends an "optimal" study plan according to their results at the entrance exam. The students may choose whether to respect such a study plan or not. As attending the lectures is not convenient for the students, they may compensate them with self-studying when the student solves the tasks assigned by the educator. The tasks are defined the way that by solving the tasks, the students are able to prepare themselves for a successful performance at the exam.

### An Example of Model Realization

In the first year, there are 250 students, for example. If of them we created groups of 20 students (given the number of the computers in one classroom), we would get 13 groups. It would mean 13 x 2 teaching hours, that is, 26 hours a week altogether). Having evaluated the entrance exam, we have got the requirements for realization of teaching units, as shown in the following chart.

Table 1: An Outline of Necessary Teaching Units for Planning

Theme	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
Need:	69	78	110	200	212	232	182	167	152	211	176	128	121
Need not:	181	172	140	50	38	18	68	83	98	39	74	122	129
Number of teaching units:	3	3	6	10	11	12	9	9	8	11	9	7	6

A total number of necessary teaching units is 104. For one week in case of a 13-week semester, it is needed to plan 8 teaching units, that is 8 x 2 hours, 16 hours a week altogether. 8 teaching units a week are planned centrally. Each student is given his or her individual plan and enrolls at teaching units alone. After the enrolment of students, the teacher knows exactly who is going to attend the particular teaching hour.

## 9 Conclusion

At the example stated, we may see that by way of a good work organization and efficient planning, it is possible to decrease the requirements for the number of contact teaching units in the education ICT. The students, anyway, learn what they do not know yet, where a teaching unit and its activities bring them the new knowledge and complement or create the missing competences. In order to gain the necessary skills in the field of using PC and ICT, attendance and active work at seminars is still not sufficient, but it is inevitable to incorporate these elements into everyday life and take advantage of their services to solve common tasks and problems. The students have at their disposal a whole series of suggestions and ideas for solution to check their knowledge, train and gain the necessary skills.

With respect to, that the transformation of subject system of teaching to modular system of teaching belongs to the most actual themes in the university system, the main benefits will be:

- Working out modular system of teaching of informatics in theoretical field, as in practical realisation too.
- With the survey we have find out, that the launch of the modular system of teaching is reachable with individualisation of preparing students in big quantities and finally rationalisation of the teachers work and reach higher affectivity of the teaching process.
- Launching the modular structure of content and adaptive method of teaching subject of informatics will save the needed number of contact hours of the teaching hours. It follows that the requirements for the classrooms technique will be fewer.
- The chance to use the teaching method "learning by doing" as the compensation absolving the contact hour.
- The number of needed direct teaching hours will be decreased 38%. Single thematically wholes probably will have different replacement in the time plan of teaching process.

In the validation process of the modular system of teaching it's need to work with the process of cloak motivation, with the process of rating and classification of single modules with the process of exposition of the new tutorial, with the process of defining the home work.

In the beginning of the semester its need to find out, the level of the students knowledge in the first class on the Faculty of Pedagogy of UJS in the area of informatics, and its need to find out their requirement and their preferable learning style.

By introducing the modular content structure and an adaptive way of teaching Informatics at the J. Selye University in Komárno, we assume that the number of necessary direct teaching hours will be reduced minimally by 40%. Separate thematic units will probably have a different.

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**Primary Paper Section: A**

**Secondary Paper Section: AM**