COMPARATIVE RESEARCH OF THE CONTENT OF INFORMATICS AS A TEACHING SUBJECT AT BASIC SCHOOLS IN THE CZECH REPUBLIC AND SLOVAKIA

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Abstract
The content and methods of teaching at basic schools have been changing in the emerging knowledge society, as it is indicated by the utilization of and approach towards modern and communication technologies. During the 20th century, technical and technological means developed very rapidly. These technologies became a source of stimuli and were also applied in the field of education. In our international comparative research, we therefore focus on comparing the educational (teaching) contents as they are implemented in Informatics as a teaching subject at basic schools in the Czech Republic and Slovakia. The aforementioned countries used to have a common history, however their individual curricula began to get differentiated starting from 1993, after Czechoslovakia had been divided into two independent states.

In the research, we compare binding curricular plans and strive to capture the factors that shape the content of education into the final form that is presented to pupils. The aim is to use the research base for determining the thematic units of the teaching contents that are taught at schools and to conduct a comparison between the Czech Republic and Slovakia. As a result, research-based proposals are made for curricular innovations in both countries.

Keywords: Educational content, curriculum, informatics, basic school.

1 INTRODUCTION
Technologies, whether they are cutting-edge or traditional or less known, are an integral part of today's world. They represent a sphere subject to the rapid development that we do not witness in other areas. Yes, nature undergoes changes as well, surrounding landscapes are changing, human values are developing, as are social norms, relationships, beliefs, etc. However, these changes cannot compete with the technological development in terms of its scope and speed. That makes the evaluation and selection of the content that should become a part of the curricula at basic schools even more challenging. We often discuss selection criteria, however the situation is all the more complicated as technologies are becoming increasingly complex as regards their designs, and demanding as regards their understanding by an individual. The volume of technologies has also been growing and it is only natural that not all individuals are able to master them all.

In the long term, it is indisputable that technology (engineering, information technology) teaching must be an essential part of the basic education and be fully integrated into it. Not only is it necessary to prepare pupils for their future life by teaching them how to use and apply technologies in practice. It is also desirable to develop their intellectual and manual skills, to teach them how to acquire proper habits, and to enable them form their attitudes in a meaningful manner. The phenomenon known as Industry 4.0. can be newly added to what was mentioned above. In the context of global economy, our countries like the others will not avoid blanket automation, deployment of artificial intelligence in the management of companies and plants, and in particular the interconnecting of the majority of equipment and devices with the Internet. The consequence of such automation will be a loss of the jobs based on simpler and repetitive work. This situation will require new competencies from graduates and, as a result, the Czech education system will not avoid even more radical changes in the future.

2 METHODOLOGY
The following scientific methods were used in elaborating the study in accordance with the current approaches applied in the field of study, cf. N. C. Kettley [1], M. Bray, B. Adamson, and M. Mason [2].
Above all, these were theoretical methods that consisted in studying published scientific papers, research reports, curricular documents, and strategic government documents.

The excerpted knowledge was subjected to a comparative analysis and critical evaluation with the aim to make sense of the knowledge pieces and set them in a new theoretical framework. In selected sections, we made efforts to describe problems related to the phenomena that occur within the society or in the educational theory and practice.

Analytic-synthetic approaches were also applied with the aim to understand the relations existing in the educational systems, in particular as regards technical education. Knowledge of a marginal character was left out of consideration during the analyses, and so it was possible to give it new meanings.

3 RESULTS OF THE COMPARATIVE ANALYSIS

In the conditions of the Czech Republic, the curriculum concept is understood in a simplified way, in particular as educational programmes applied at the level of a country and a school. They are content-related and organisational regulations that are designed for teachers so that they could manage and control the teaching process, among other things. These curricular documents also include educational goals, educational content, teaching plans, the time provision for a specific type of education. These programmes are implemented in a setting that affects not only what students should learn, but also how their learning process is realized.

School curricula are realized in the framework of interaction and communication between teachers and students at school and outside school as well. Curriculum should not be understood as an unchanging standard. It changes alongside the needs and values of the society and pupils’ needs. It is a living document that changes based on the experience of its implementation in practice. [3]

3.1 The curricular documents of the educational system in the Czech Republic

As a result of the development of information and communication technologies, it is necessary to implement informatics-related topics in the school curriculum at the basic school level in a number of countries, including the Czech Republic. The documents currently valid in the Czech Republic and teachers themselves however perceive this area merely as a space for developing digital literacy with an emphasis put on the user-oriented approach – mastering technologies, working with applications and the Internet, etc.

The Education Act of 2004 already provided that the educational area of Information and Communication Technologies is one of the nine educational areas at basic schools. Hence, Information and Communication Technologies is a teaching subject that is compulsory at the first and second stage of basic schools in the Czech Republic. A graduate of the first grade of a basic school will be able to operate a computer at a basic user level. [4]

3.1.1 Documents describing general education in the Czech Republic

The basics of informatics do not often occur in the documents about education at the first stage and the second stage of basic schools in the Czech Republic (that is to say not to the extent that would be desirable). Only algorithm development teaching is mentioned in the framework educational programme, specifically in the educational area of Information and Communication Technologies, where it is stated that “education leads pupils to the ability to use algorithmic thinking in their interaction with a computer”. However, the reference is reflected neither in the teaching content nor its expected outcomes. [4]

The current number of lessons devoted to the educational area of Information and Communication Technologies at basic schools is one lesson at the first stage and one lesson at the second stage. Some teachers of informatics point out that it is not possible to realize quality education due to this low time provision and the expected outcomes as they are worded in framework educational programmes. However, the fact is that every school actually has an opportunity to take advantage of the disposable lessons, can accentuate ICT topics and integrate them to other educational areas. There are many reasons why innovation is needed not only with respect to this area but actually with respect to the whole concept of ICT in the framework educational programmes. [5]
3.1.2  **State educational programmes**

The educational area of Information and Communication Technologies enables all pupils to achieve the basic level of information literacy – to obtain elementary skills in operating computer technology and modern information technologies, to get oriented in the world of information, to creatively work with information and use it in their further education and practical life. Taking into account the growing need for obtaining basic skills of working with computer technology, the educational area of Information and Communication Technologies was included as a compulsory part of the basic education at the first stage and the second stage. The obtained skills are a prerequisite for the ability to participate in the labour market and a condition for the efficient developing of professional and extracurricular activities. [6]

Mastering computer technology, especially the ability to quickly search and process any necessary information through the Internet and other digital media, makes it possible to implement the “learning anytime and anywhere” method, leads to the desired reducing of the strain on pupils’ memory, while enabling to use many times higher volumes of data and information than ever before, speeds up the updating of knowledge, and suitably complements standard textbooks and teaching aids. [6]

3.1.3  **School educational programmes**

Skills obtained in the educational area of Information and Communication Technologies enable students to apply computer technology with a wide range of educational software and information resources in all educational areas of the entire basic education system. This application level goes beyond the framework of the educational content of the educational area of Information and Communication Technologies and becomes a part of all educational areas of the basic education. [6]

The minimum output knowledge of pupils of basic schools in the educational area of Information and Communication Technologies:

- The pupil verifies the credibility of information and information resources;
- The pupil is comfortable with text, graphic and spreadsheet editors;
- The pupil adheres to the basic aesthetic and typographical rules of the working with texts and images;
- The pupil works with information in compliance with laws and intellectual property rights;
- The pupil uses information from various information sources and evaluates simple relationships between data;
- The pupil processes and presents information in the text, graphic and multimedia form at a user level.

3.2  **The curricular documents of the educational system in the Slovak Republic**

The central administration body in the education sector in the Slovak Republic is the Ministry of Education, Science, Research and Sport. Since 2008, education has been governed by new Act No. 245/2008 on upbringing and education, which provides for the principles, goals, conditions, scope and content of education within each of the standard ISCED levels. As in the Czech Republic, the law sets out a two-level school management model. The state level, which is hierarchically higher, determines the “State Educational Programme”, and the school level, which is hierarchically lower, determines the “School Educational Programme”. [7]

3.2.1  **State educational programmes**

State educational programmes are a series of documents binding for schools in their creating of school educational programmes. “They lay down general educational objectives and core competencies which education should be directed towards”. For each of the levels within the ISCED standard, there is one state educational programme consisting of the main document and its annexes. The state educational programme defines the model graduate of a given educational level, requirements for the curriculum and its syllabi, and the organisational conditions laid down on a school. Finally, it also determines the principles for elaborating school educational programmes. [7]
3.2.2 School educational programmes

“The school educational programme is a school's core document according to which education and training is conducted at schools under the law.” Its content is based on the requirements of the State Educational Programme and it is issued by the headmaster of a school. The school has the legal option to adapt its educational programme in terms of its methodology and content so that the school’s specific needs and conditions would be taken into account. The scope of such optional adaptation is approximately 30 percent. [7]

3.2.3 The educational area of mathematics and working with information

The description of the educational area of mathematics and working with information, or more specifically the obligatory subject of informatics itself, contains the most references to ICT and IE. Informatics as a teaching subject is put on an equal footing with such a subject as for example mathematics in terms of importance. The objective of informatics as a teaching subject is to lead pupils towards achieving “the culture of informatics or, in other words, to educate them about effective utilization of ICT devices, while adhering to legal and ethical principles”. This mission should be carried out not only in the teaching subject itself but also in other subjects, interdisciplinary projects, school-wide programmes and in managing a school. [7]

The objective of the teaching subject at the second stage of basic schools is to “make accessible the underlying concepts and methods that are used when working with data and in creating algorithms and computational processes”. This general objective of the document is specified by listing the requirements that pupils must fulfil. The educational and teaching process at the second stage is aimed at pupils to:

- Become familiar with definitions of data and information as concepts, with various types of data, their collecting, storing, displaying, processing, and presenting;
- Understand the concepts of algorithms and programmes;
- Become familiar with data-processing systems;
- Develop the skills to algorithmize an assigned task, develop their programming skills, learn how to work in the settings of common application programmes, learn efficiently search for information stored on a CD or the Internet, and learn how to communicate via the Internet;
- Obtain skills necessary for research work;
- Develop their cooperation and communication skills;
- Develop their personality, creativity, and logical thinking, and make efforts to educate themselves;
- Learn to comply with regulations on intellectual property rights and authorship of products, systems, and applications. [7]

The actual content of the teaching subject is divided into a total of five thematic areas, which are identical with the topics of Information Education as a teaching subject taught at the first stage of basic schools.

1. The information that surrounds us;
2. Communicating through ICT;
3. Procedures, problem solving, algorithmic thinking;
4. Principles of the functioning of ICT;
5. Information society. [7]

3.3 Comparison of curricular materials

Let us now focus on comparing curricular materials in the Czech Republic and Slovakia in terms of ICT and information education at the second stage of basic schools. Both countries use the same model at the state and school levels as the basis, where the state level contains requirements and is always binding for the development of school educational programmes at individual institutions. Both countries have gone through a reform of their educational systems, when the content of their curricular...
materials has been transformed to correspond with newly set objectives of teaching. Czech Republic underwent this change in 2004, Slovakia in 2008.

Another element considered in the comparison is the concept and importance of ICT and information education in the studied curricula. Requirements for ICT and information education permeate the Czech and Slovak binding documents. Both countries understand the need to provide graduates with skills in the field of information and communication technologies as an important part of education. Besides the set objectives, teaching content and outcome competences, Czech and Slovak curricular materials also contain requirements on the material-technical security of educational institutions.

If we compare the concept and content of informatics as a teaching subject (information technology, digital technology, etc.) in both compared countries, it can be observed that the Slovak curriculum presents the requirements for this teaching subject significantly more clearly. Its concept is defined in the document itself, the content of which is divided into five thematic areas. Requirements for what pupils should achieve are described with respect to each of the areas. The Czech curriculum directs the educational area of Information and Communication Technologies towards shaping and developing key competences, getting to know the role of information and information-related activities, understanding the flow of information, developing the capacity to formulate one’s requests, and the ability to use algorithmic thinking when interacting with a computer. Furthermore, the teaching content focuses on the following topics: comparison of information and knowledge, the use of computer technology, the use of SW and HW resources, understanding the function of computer technology, compliance with intellectual property rights, and ethical approaches.

The number of devoted lessons at the second stage of the basic school is different in both countries. The Slovak curricular materials give schools more freedom and impose the requirement for inclusion of the subject of Informatics at the second stage in the scope of two lessons. The school has the option to extend the teaching of the subject thanks to the disposable lessons. The Czech curricular materials determine the teaching subject of Informatics to be taught at the second stage in the scope of one lesson. Schools also have the option to extend the teaching of the subject thanks to the disposable lessons.

4 CONCLUSIONS

In the area of information education and the teaching of subjects aimed at information and communication technologies, both the Czech Republic and Slovakia proceed from the same thought - digital literacy of pupils, which they perceive as not only the acquisition of basic skills when working with ICT, but at the same time as the formation of habits, effective use of ICT in daily life, including adherence to ethical and legal standards. Slovakia builds this literacy within the teaching subject of Informatics, for which it has developed an educational standard, or very marginally in the cross-cutting topics of media education, project creation, and presentation skills. The Czech Republic has formulations of ICT competences in place, which can be found across a range of other teaching subjects and activities. A more detailed examination of the curricular materials found out that the way of realization of the requirements of the curricular documents in Slovakia and in the Czech Republic is largely delegated to school facilities themselves. Schools are given a sufficient space so that they could adapt education to local needs. The education system in the Czech Republic could find many inspirational elements in the system applied in Slovakia.

REFERENCES


