Pregledni članak

The Status of Information and Communication Technology in National Curriculum for Compulsory Education

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Summary

Changes brought by the knowledge society have pointed out the importance of information and communication technology (ICT) and made it one of the key contemporary educational requirements. Introduction of ICT into compulsory education was unavoidable, but at the same time it was one of the most complex curricular innovations. Although there is an agreement about the necessity of including and developing ICT in the curriculum, different countries have found different solutions, depending primarily on guidelines for the development of their educational systems. In order to find out the current status of ICT in compulsory education, a comparative analysis of national curricula in sixteen countries was conducted. While in some national curricula ICT is taught as a separate subject, in other curricula it is part of other subjects or is a cross-curricular area. Although the acquisition of knowledge and skills is fundamental, more and more countries are recognizing the advantage of using ICT in teaching other subjects. There is a notable approach to curriculum based on educational outcomes or competences all students should posses by the end of each program or stage of their schooling. By planning to bring the focus on outcomes and to introduce "Information and communication technology" as a cross-curricular area, Croatian curriculum is coming closer to the world standards in education.

Key words: information and communication technology (ICT), national curriculum, compulsory education, students' competence, comparative analysis

Introduction

For quite some time there is a discussion about changes brought to human society by the innovations in information and communication technology (ICT), networking and rapid expansion of the Internet. These changes are nowadays considered to be the key factors of transformation into knowledge society, enabling participation in global economy. ICT has become extremely important as the most effective modern technology. Besides, today ICT is a ground for effective usage and exchange of information and knowledge. It enables people to have constant and free access to information anywhere in the world. Creating networks enables information exchange, therefore improving their development. Those facts made ICT one of the key contemporary educational requirements. Living in the information society based on knowledge calls for people to possess a new sort of competence in order to function successfully in that society. Generations that are currently receiving their education and those yet to come should get prepared for everyday interaction with ICT. This was recognized by the European Parliament and the Council of the European Union (2006) who included digital competence in key competencies which each person needs to posses so he or she can adapt to the rapidly changing world.

Teaching how to find, choose, assess, store, use, but also how to produce, present and exchange information is considered to be one of the key goals of education. This implies constant use of ICT, therefore throughout education students have to learn not only its possibilities, but also the restrictions and implications included. Furthermore, modern technology is developing rapidly and new generations must learn how to constantly adjust to changes. Therefore, the European Parliament and the Council of the European Union (2006) in their definition of digital competence, along with knowledge and skills, include a critical attitude toward a responsible use of ICT.

The growing usage of ICT in schools is happening in the context of, and following wider social changes. Introduction of ICT into compulsory education was unavoidable, but at the same time it was one of the most complex curricular innovations. The role of ICT in curriculum changed with each new demand. Today ICT is a significant part of transforming the teaching and learning process, and for that to happen it is important how the curriculum is perceived and organized. In order to understand the possibilities and limitations of the changes which education is going through, we must comprehend the concept of curriculum (Yek & Penney, 2006). Although there is an agreement about the necessity of introducing and developing ICT in curriculum, different countries have found different solutions, depending primarily on guidelines for the development of their educational systems. The present study reviews the status of the ICT in different national curricula for compulsory education, including the current situation in Croatia, and gives some recommendations about conceptualizing ICT in national curriculum.

The present research

Research methodology

An analysis of national curricula in sixteen countries aimed to find out what is the current status of ICT in compulsory education. Considering the Croatia's efforts to integrate into the European Union, which also requires synchronization in area of education, most of the countries in the study were old and new members of the EU. An important factor in choosing the countries also was their educational heritage and achievements of their students in international comparative evaluations. Countries included in the sample were: England, Scotland, Ireland, Sweden, Norway, Finland, The Netherlands, Austria, Hungary, Slovenia, Canada (Alberta), United States of America (New York), Australia (New South Wales), New Zealand, Singapore and Croatia. In Canada, USA and Australia we analyzed national curricula of only one of their states or territories, so the descriptions do not apply to the whole country. Ways of conceptualizing ICT in each country of the sample were compared to each other, and with the current situation in Croatia. The status of ICT isolated as a separate subject, ICT taught as a part of a few different subjects and ICT as a cross-curricular area were all taken into consideration.

Research results

While analyzing national curricula, some similarities were spotted in defining the role of ICT between the countries, so they were divided into several groups based on the observed similarities.

Finland, Sweden and Norway

Finland, Sweden and Norway have broad curriculum frameworks, with ICT being taught within mandatory subjects. In Finland it is a part of a subject called "Crafts" (Finnish National Board of Education, 2004), in Norway "Art and Crafts" (Norwegian Directorate for Education and Training, 1997), and in Sweden it is a part of two subjects, "Crafts" and "Technology" (Swedish National Agency for Education, 2000; 2006). Timetable is not defined for any of these subjects. While describing the subject, accent is set on defining skills that students must obtain in using and understanding of ICT. Finnish national curriculum also defines main goals of cross-curricular themes called "Media skills and communication" and "Technology and the individual". It is specific about Norway that there is no subject or cross-curricular area that would deal with ICT.

Scotland, Ireland, England, Canada (Alberta), Australia (New South Wales) and New Zealand

The other group of countries consists of Scotland, Ireland, England, Canada (Alberta), Australia (New South Wales), and New Zealand countries that have both national curriculum frameworks and a subject curriculum. In Scotland (Scottish Executive Education Department, UK, 2000) ICT is primarily being

taught through the subject of the same name, while in Ireland (Department of Education and Science, Government of Ireland, 1999) and England (Department for Children, Schools and Families, England, UK, 2000) it is a part of larger cross-curricular areas. The content of each subject and area is mandatory, but timetable for their teaching is not strictly defined. During first four grades in Scotland "Information and communication technology" is a part of an area called "Environmental studies", for which 15% of the timetable is scheduled, and it becomes a separate subject in the 5th grade. While defining the goals of the subject "Information-communication technology" in Scotland, special accent is put on its role in developing problem solving skills.

Besides the cross-curricular areas "Social, environmental and scientific education" and "Art", ICT in Ireland is being taught as part of the subjects "Technology" and "Technical drawing", in which most of the content is related to the use of graphical communication. Irish curriculum is distinguished from others because special attention is given to ICT as a tool for teaching "Science" and "Arts", with a goal of developing creativity and thinking.

In England, ICT content was arranged in a form of two interdisciplinary areas, "Information and communication technology" and "Design and technology". Knowledge, skills and understanding required from students on all three levels are listed along with links to other subjects and curricular areas.

All provinces in Canada agree that ICT is an integral part of education, and that it also has a key role in preparing students for participating in information society. Alberta has a centralized curriculum, which defines what students must learn, for all grades and all subjects (Alberta Education, Alberta, Canada, n. d.). In Alberta ICT curriculum defines general and specific outcomes, but also illustrative examples and assessment framework for each of the four divisions. The "Information and Communication Technology" curriculum provides students with a broad perspective on the nature of technology, ways to use and apply a variety of technologies, and the impact of ICT on themselves and on society. ICT program of studies is structured as a 'curriculum within a curriculum', and it is infused within core subjects of "English Language", "Arts", "Math", "Science" and "Social Studies".

ICT has an important role in curriculum frameworks of all Australian states and territorial units, most frequently as a cross-curricular area (Australian Education Systems Officials Committee, 2006). K-10 Curriculum Framework of Australian federal state New South Wales contains widely defined learning results which briefly describe knowledge, understanding, skills, values and attitudes all students must acquire throughout and upon completion of their schooling (Board of studies, New South Wales, 2002). Plans and programs clearly describe the standards which show what is expected from students to know and be able to do in every stage from kindergarten to 10th grade. ICT statements listed for each subject are organized by stage, then by outcome, and finally by content or other syllabus requirements. Although ICT is a part of all key learning areas,

the central area in primary school in which ICT knowledge and skills are being taught is "Science and technology". In stages 4 and 5 ICT content is a part of a key learning area called "Technological and applied studies", i.e. mandatory subject "Technology" which has a range of 200 lesson-hours. The area is also connected to elective subjects "Information and software technology", "Design and technology" and "Graphics technology".

The New Zealand Curriculum comprises a set of national curriculum statements which define the learning principles and achievement aims and objectives which all New Zealand schools are required to follow (Ministry of education, New Zealand, 1995). The framework sets out the knowledge, understanding, skills, and attitudes to be developed by all students. In the New Zealand Curriculum ICT is a part of essential learning area called "Technology" which is compulsory only until the end of year 10. Achievement aims are expressed through eight progressive levels of schooling. This area of learning has application to all subjects of the curriculum, but some make a particular contribution to learning in technology, such as "Science", "Mathematics", "Home economics", "Social studies", "Workshop technology", "Music", "Art", "Graphics and design", and "The study of information systems" (Ministry of education, New Zealand, 1995).

Austria, Hungary, Slovenia and Singapore

In a group of countries which consisted of Austria, Hungary, Slovenia and Singapore, ICT is separated into subject curricula. These subjects are mandatory, and their timetable is between one and two hours per week. ICT content is represented in the Austrian curriculum through subjects "Technical education" and "Technical education, textile education" (Federal Ministry for Education, the Arts and Culture, Austria, 2003). "Technical education" is created in a way that it contributes to each of the five educational areas: "Man and society", "Nature and technology", "Language and communication", "Creativity and shaping", and "Health and exercise".

In Hungary subjects "Technology and the way of living" and "Information and communications technology" are being taught, and they have a defined list of activities, content and skills that students have to possess in order to continue to follow that subject in higher grades (Ministry of education, Hungary, 2000).

In Slovenia ICT content is a part of mandatory subjects "Perceiving environment" (in grades 1 to 3), "Science and technology" (4^{th} and 5^{th} grade) and "Technics and technology" in 6^{th}, 7^{th} and 8^{th} grade (Ministrstvo za šolstvo, znanost in šport Republike Slovenije, n. d.). Apart from that, ICT is taught through non-mandatory subjects "Robotics and technics" in the eight grade, and "Electronics with robotics" and "Electro technology" in the ninth grade. There is also a cross-curricular area called "Information literacy" represented in different grades. For all the mandatory and non-mandatory subjects and the cross-

curricular area general and operational aims are defined in order to determine ways of acquiring conceptual and procedural knowledge.
Unlike other countries in this sample, Singaporean education system has only six grades of mandatory education, although almost all children continue their education in secondary schools that have differentiated curriculum according to streams (Ministry of education, Singapore, n. d.). Despite this difference, Singapore stands out with a highly-developed and successful economy, which depends heavily on exports of information technology products. Current education system can also be regarded as highly successful, especially if indicators of participation rate are considered, literacy rate and mean years of schooling, but also with a lot of funds spent on educational upgrade (Yek & Penney, 2006). Besides that, Singaporean students have regularly ranked top when competing in international science and mathematics assessments (Gonzales et al., 2004). In primary education one of the aims of the mandatory subject "Mathematics" is using ICT as a tool for studying and application of mathematics. Based on their results on the national Primary school leaving examination at the end of Primary 6, students are placed in different secondary education tracks or streams: Special, Express, Normal (Academic), or Normal (Technical). In Normal (Technical) students take subjects more technical in nature, such as "Computer Applications", "Technical studies" and "Design and technology". "Design and technology" is a compulsory subject in all streams, but in the Normal (Technical) it includes more ICT content than the curriculum for other secondary education streams. At the end of Special, Express and Normal (Academic) stream students take a Singapore-Cambridge General certificate of education Ordinary level (O-level) exam which can include elective subjects such as "Design and technology" and "Computing" that include ICT content. Based on education systems in other societies, such as those in the USA, Singaporean education has put a bigger emphasis on creative and critical thinking and on learning for lifelong skills.

The Netherlands, and USA
Curriculum approach found in the Netherlands, and USA (New York) is different from all the other countries in the sample because it provides for flexibility, and a high degree of decentralization. An important aspect of education system in these countries is that, although the government sets policies and expectations about outcomes and student achievement, including assessment and reporting on outcomes, schools have autonomy in conceptualizing and enforcing the national curriculum. Each school formulates its own curriculum – within and beyond the requirements of national regulation – at the local level. They plan their teaching and learning programs to support the needs of their particular students. Their curriculum is focused on defining learning standards or student achievement.

ICT related content in the Dutch curriculum is taught through learning areas "Technology" and "Drawing, art and crafts" (Dutch Eurydice Unit, Ministry of education, culture and science, the Netherlands, 2006). There are no specifications neither about school levels on which themes are supposed to be taught, about the amount of time it requires, nor if these programs are mandatory or not. Schools in the Netherlands are responsible for all the curriculum innovations, including using ICT in teaching, and the government just stimulates and encourages these innovations.

The state of New York (USA) has a curriculum based on the national learning standards (New York State Education Department, 1996). Standards have two primary dimensions, content and performance, specified for every subject area and each grade level. Relevant area for teaching ICT is "Mathematics, science and technology" which includes Standard 2 called "Information systems" and Standard 5 called "Technology" with a "Computer technology" as its integral part. Through the "Information systems" standard student will learn how to access, generate, process, and transfer information using appropriate technologies.

Situation in Croatia

Croatia has a tradition of a centralized prescriptive subject based curriculum consisted of teaching program for each subject. In 2005 Croatia began preparing its educational system for education that will be coherent with requirements of the knowledge society, and which will contribute to its development. In this way, one of the priority-areas in "The plan for development of the education system in Croatia 2005-2010" (Plan razvoja sustava odgoja i obrazovanja 2005.-2010.; Ministarstvo znanosti, obrazovanja i športa Republike Hrvatske, 2005) was the application of ICT.

Currently, the compulsory school students in Croatia have a chance to obtain ICT related skills and knowledge only if they choose an elective subject called "Information science" between the 5th and the 8th grade, or if extra-curricular activity is enabled in the area of "Information science" between the 1st and the 4th grade (Ministarstvo znanosti, obrazovanja i športa Republike Hrvatske, 2006). The only ICT content mandatory for all students in compulsory school is being taught as a part of a subject called "Technical culture", which is mandatory between the 5th and the 8th grade. In the curriculum for compulsory school (Nastavni plan i program za osnovnu školu; Ministarstvo znanosti, obrazovanja i športa Republike Hrvatske, 2006) it is recommended that while teaching the subject "Information science", teachers should encourage the use of ICT in other subjects. Apart from that, ICT teaching program is separately outlined in a form of a cross-curricular area, with knowledge and skills that students have to acquire during their schooling.

Conclusion

This comparative analysis has indicated some significant conceptual, structural and content differences between the status of ICT in the Croatian curriculum and in national curricula of analyzed countries. While most of the countries have national curriculum framework which serves as a base for developing detailed school curriculum, Croatia still has fragmented subject based national curriculum. Although there are some efforts, Croatian curriculum still isn't oriented towards learning outcomes as most of the analyzed countries. Curricula of some countries like New Zealand, Australia (New South Wales), Canada (Alberta) and England, define competencies that every student has to acquire to enable him or her for work and life. Using ICT through the curriculum is an example of the way to acquire digital competence. Even though approach to planning and curriculum control differs among states, ICT is recognized as an important segment of education in all of the countries.

While in some national curricula ICT is being taught as a separate subject, in other curricula it is a part of a few different subjects or a cross-curricular area. Although the acquisition of knowledge and skills is fundamental, more and more countries are recognizing the advantage of using ICT in teaching other subjects. By planning to bring the focus on outcomes and to introduce "Information and communication technology" as a cross-curricular area, Croatian curriculum is coming closer to the world standards in education.

A general trend to determine the status of ICT which could be drawn from the national curricula of 15 countries can be a useful starting point for the development of national curriculum for compulsory education in Croatia.

Recommendations

Development of information society based on knowledge, technological innovations and new forms of communication is reflecting onto educational system. One could expect that it will be necessary to have highly developed competence in ICT area in order to successfully function in contemporary society. Therefore it is recommended that ICT is included in national curricula as a compulsory cross-curricular area, and it can also be retained as a separate subject. In the constantly changing environment there is a need to possess knowledge and skills, but also attitudes concerning ICT, so every curriculum should emphasize the digital competence (The European Parliament and the Council of the European Union, 2006).

In order for every student to have a chance in obtaining and developing digital competence, it is necessary to elaborate the status of ICT in curriculum of every system, to ensure adequate infrastructure and Internet access in every school, to provide network and multimedia materials, and to develop teachers' skills in using ICT. Teachers ought to be given support in getting those skills in order to fully exercise potential that ICT has in making learning easier. This is confirmed by "The plan for development of the education system in Croatia 2005-

2010" (Plan razvoja sustava odgoja i obrazovanja 2005.-2010.; Ministarstvo znanosti, obrazovanja i športa Republike Hrvatske, 2005) in which using ICT in teaching is a priority area for initial education and permanent training of teaching staff.

ICT is becoming vital part of educational system as a support for class realization and for teaching and learning process. If adequate infrastructure and content are ensured, ICT can make learning faster and easier (Yek & Penney, 2006). Therefore investing in the ICT is a key stake in preparing students to actively take part in knowledge society.

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