

# Curriculum for Introducing Information Technology in Lithuanian Primary Education: Role of Logo

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## Abstract

During the last years a need of a new policy for implementing information technology (IT) in education has emerged. The Strategy for ICT implementation in Lithuanian education for 2005-2007 has been developed. Standards for school students' as well as teachers' computer literacy have been prepared and implemented. Teaching and learning IT course in schools is one of the most relevant issues in information society. The paper deals with the goals and nature of the IT introduction into curriculum. It discusses the links with other school subjects. Regarding the decision to shift the compulsory IT course to younger grades (5th and 6th), the main attention is paid to the curriculum of the course. Logo as a design activity is the most important part of this curriculum.

## Keywords

Information technology, computer literacy, curriculum design, teaching Logo

## 1. Introduction

The use of information and communication technology (ICT) in education has been steadily increasing in the last few years. It is also constantly evolving and facing new developments and learning aids. The future of education shall be searched in utilizing ICT, especially in the opportunities provided by the internet.

Informatics in Lithuanian schools is a separate subject with a goal to summarize knowledge and skills getting when computers were used in other lessons or at home.

The main goal of teaching IT in Lithuanian compulsory schools is to develop an information culture of students. That is a deep-going, comprehensive attitude. In the course of time, the concept of information culture may change. This goal is striven for both primary and secondary education; however, in the latter, the concept is deeper, more comprehensive. In our opinion, the information culture is a wide concept, considerably wider than information skills or abilities to work with a computer.

## 2. Computer literacy: the whys and wherefores

During the exponential growth of the quantity of information and the establishing of ICT in all fields of life the concept of computer literacy as well as literacy in general has been transformed. Until the middle of the 20<sup>th</sup> century literacy was understood as the ability to communicate in the written form. When computers entered human life, the concept of literacy as the capability to "read, write and count" has shifted to the universal ability to "decode and

encode” the provided information independently of its form and the means by which it was provided. Currently a wider attitude prevails, according to which literacy are even more complex abilities such as critical thinking, ability to learn, competence to perceive and convey socio-cultural experience, than just technical skills to read, write, count or encode and decode (Lonsdale, 2004; OECD, 2001).

By the end of the 20<sup>th</sup> century education community in the world and at the same time in Lithuania was not satisfied any more with too narrow and forthright concept of computer literacy. It was influenced by the ideas of famous education strategists on global literacy (Cezarini, 2004; Hawkrige, 1996). Development of computer nets and information technologies has also revealed too narrow concept of “computer” used in secondary education (National Research..., 1999; Papert, 1993).

Besides basic literacy components – the ability to read, write, and calculate – the ability to use digital technology, communications tools, manage, evaluate and create information order to function in knowledge society is more and more important. Today’s student must be able to decipher meaning and express ideas through a range of media.

Usually three main groups of basic skills are emphasized (e.g. enGauge, 2003): in relation to language proficiency (reading, writing, listening, speaking), in relation to innumeracy (arithmetic computing, mathematical reasoning, problem solving), in relation to information and technological literacy (recognizing when information is needed, locating information, evaluating all forms of information, synthesizing and using information effectively).

The 2005–2007 year strategy for implementation of information and communication technologies (ICT) in Lithuanian education<sup>1</sup> points that modern technologies are increasingly penetrating into education, influencing the teaching and learning of various subjects as well as methodology and a whole process of upbringing; thus, the new and qualitatively higher stage of the school computerization is formatting. Schools, *i.e.* students and teachers, should feel a clear benefit of implementing IT in the teaching process: the breakthrough of ICT in teaching of certain subjects is scheduled. One of the main works in order to implement these statements is intense formation of ICT skills in the younger grades of secondary school. Namely, this as one of the factors of ICT breakthrough in teaching is foreseen in the strategy.

### 3. Technology foundation standards for students

The international technology foundation standards for students are divided into six broad categories (International..., 2000):

1. Basic operations and concepts (students demonstrate understanding of the nature of technology systems and are proficient in the use of technology).
2. Social, ethical, and human issues (students understand the ethical, cultural, and societal issues related to technology, practice, responsible use of information and software, and develop positive attitudes towards technology uses).
3. Technology productivity tools (students use technology to enhance learning, promote creativity, collaborate in constructing technology-enhanced models, prepare publications, etc.).
4. Technology communications tools (students use telecommunications to collaborate, publish, and interact with peers, experts and use a variety of media).

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<sup>1</sup> Approved by the Ministry of Education and Science (2004-12-15, N. ISAK-2015)

5. Technology research tools (students use technology to collect information, process data, evaluate and select resources for specific tasks).

6. Technology problem-solving and decision-making tools (students use technology for solving problems and making decisions in the real world).

The Standard specifies the guidelines of the most general value attitudes of students: 1) to perceive the importance of learning in the life of society and the importance of ICT in learning during lifetime, 2) to grasp the importance of ICT in professional activities as well as in everyday life and to become citizens enjoying full rights and taking an active part in society, 3) to penetrate not only the advantages provided by ICT, but also its dangers to equal opportunities of learning and democracy, 4) to understand that ICT shall be based on respect for traditional values of the state and people and shall assist to use the Lithuanian language correctly, 5) to be able to use the opportunities provided by ICT with great responsibility and perceive the importance of observing ethical norms in that area, 6) to be interested in the progress of ICT, improve and update skills of technology application, and enable feeling safe and confident while working with hardware and software with great responsibility.

#### **4. Synthesized model for training information culture in basic schools**

The main goal of ICT teaching is to provide proper conditions for students to get skills, knowledge and experience in contemporary information technologies, at the same time, associating it with the perfection of student's learning process and their settlement within the knowledge society.

Information culture is the broad objective in primary and secondary education with the following main goals:

- to systematize the knowledge of ICT that the students have gained before the school or outside it;
- to develop logical and operational thinking, operation planning skills, creativeness, ability to improvise, self-confidence;
- to refresh their IT knowledge and improve their skills to think and act;
- to give an opportunity for students to choose the direction of their further studies in the field of informatics;
- to develop a general literacy of students' information activities together with other school subjects;
- to get familiar with the elementary ICT and the related concepts and to be able to apply that creatively in daily life and cognition;
- to learn the basic concepts of ICT and understand their meaning, and put it into practice;
- to get familiar with the history and development of IT and their impact on the evolution of society and its culture;
- to improve their skills on ethical issues: to operate with ICT legitimately and reasonably, to link ICT with general issues of the culture of the society;
- to foster a resolve to continuously develop the content and style of one's information activities.

It is highly important to introduce computer not only as a technological device, but also as a tool that helps to develop person's working, creative and daily activity. In teaching IT, human being should be the central axis. It is said, the old computing is about what computers can do; the new computing is about what people can do.

The curricula of 5<sup>th</sup> – 10<sup>th</sup> grades of secondary school include compulsory course in IT (General..., 2003). Students are being prepared to the further life as the citizens of information and knowledge society that are able to use modern technologies, are prepared to adapt themselves in the changing world and are ready to develop their professional skills constantly.

IT curriculum emphasizes the value-based attitudes and general skills. However, these abilities are the objective of all informational training. The aims of separate IT course are much narrower and more pragmatic. In the last two grades of primary school (9<sup>th</sup> and 10<sup>th</sup>) students are taught to summarize ICT knowledge that was obtained in school and out of it, improve their ICT skills, and are prompted to get deeper awareness of informatics as a science which might encourage them for further studies of the subject. The aims of a general IT course for the 11<sup>th</sup> and 12<sup>th</sup> grades are cognitive as well, while the advanced course is intended for the training of specific application skills in one of the three chosen areas of ICT (data base, programming or multimedia).

IT standards and contents of its courses are divided into the main ICT topics as it is shown in Table 1. The intended aims for the 9<sup>th</sup>-10<sup>th</sup> and the 11<sup>th</sup>-12<sup>th</sup> grades are essentially different. The IT standards for the 9<sup>th</sup> and 10<sup>th</sup> grades very precisely define the ICT knowledge and skills the students should obtain. The IT standards for the 11<sup>th</sup> and 12<sup>th</sup> grades are comprised of two components. The first one describes general ability, while the second one is provided to define the particular achievements related to particular topics and chapters. The general ability is rather broad and matches the common goals of the course. The content of the curriculum is close to that of European Computer Driving License (ECDL), thus the main stress is placed on the substantial intelligence of ICT and on the formation of practical skills.

Table 1. Contents of IT subject curricula

<b>Compulsory course, 9-10 grades</b>	<b>Compulsory course, 11-12 grades</b>	<b>Advanced (optional) course, 11-12 grades</b>
1. Computer (principles of the work with computer)	1. Advanced elements of text editing	1. Data base
2. Text processing	2. Presentation	2. Multimedia
3. Information (basics of information handling)	3. WWW and electronic mail	3. Programming
4. Algorithms (main concepts and commands)	4. Social and ethical issues of using IT	
	5. Using spreadsheet	

Before graduating from the 12<sup>th</sup> grade, students can choose IT school-leaving examination (starting with 2006 it will be possible to choose State school-leaving examination in programming). The topics of school examination fully match the curriculum and standards of IT compulsory course, while the State examination additionally embraces the programming module of the advanced course. Both examinations include test questions on the theoretical part (mainly) and practical tasks which rather reveal practical skills of problem solving.

## 5. The new challenges – teaching IT in 5<sup>th</sup> and 6<sup>th</sup> grades

In Lithuanian informatics' course, constructive pedagogy is linked to upbringing of younger grades students in computer activity. It introduces the main concepts in informatics in a simple non direct way. It is important to propose a practical course, especially problem solving, to develop creativity, cultivate systematic and consistent thinking. IT course for secondary school, in fact, was prepared on the basis of constructive methods and cognitive theory.

Starting with the 5<sup>th</sup> grade, a separate subject on IT is introduced; in future, part of it should be taught integrally with other various subjects. Partial integration is being executed: the separate IT course is coordinated with its implementation in other subjects.

It is generally agreed that students learn better and are more actively involved in learning when they work on a concrete, important goal. In addition, learning does not naturally happen in discrete, separate exercises but, on the contrary, makes its greatest strides when the leaning experience demands a variety of cognitive skills which incorporate the students' own individual experiences (Papert, 1980). Successful learning is learning that is meaningful, useful and seems effortless to the student.

Project-based learning allows students to develop and apply the basic skills, develop deeper thinking skills, and, in many cases, relate learning to a real life. This method makes it possible to cope with different interests, abilities, and activities of students.

Teachers of IT were the first who started to use the project-based method several years ago. It is common to combine project-based methodology with Logo (Chard, 1992; Dagiene, 1997).

Consenter for the 5<sup>th</sup> and the 6<sup>th</sup> grades suggests to assign 64 hours to IT course; besides 34 hours should be integrated in other subjects. As it is proposed, it should be integrated into the fine arts lessons (theme "Computer drawing") and Lithuanian and foreign languages lessons (theme "Acquaintance with internet"). The examined themes are directly connected to the mentioned subjects although other subjects are also prompted, especially designed activity of several subjects. General themes for teaching IT in the 5<sup>th</sup> and the 6<sup>th</sup> grades are presented in Table 2.

Table 2. IT curriculum for 5-6th grades

Themes, subthemes	IT hours	Subjects, integration is addressed to	Integrated hours
<b>1. Introduction to computer application</b>	<b>16</b>		
– Calculator, clock, calendar			
– Simple educational programs			
– Storing information			
– Files, directories			
– Saving information			
– Archiving			
– Search for information in computer			
– Computer and health			
– Educational computer games			
<b>2. Drawing with computer</b>	<b>4</b>	Art	10
– Introduction to graphic editor			
– Drawing tools			
– Operations with graphic objects: rotation, flip, inversion			
– Gallery			
– Elements of animation			
<b>3. Text writing and handling</b>	<b>14</b>	Lithuanian language	10
– Keyboard, levels			
– Keyboard typing tutor			
– Writing with computer			
– Lithuanian characters			
– Fonts			
– Styles			
– Formatting of paragraphs			

– Spell check			
– Inserting graphics into texts			
– Introduction to text layout			
– Printing			
<b>4. Internet and electronic mail</b>	<b>10</b>	Lithuanian language	4
– Information search in Web			
– Internet and its dangers			
– Downloading documents, files			
– Web mail			
– Reading, writing, sending emails			
– Attachments, viruses in attachments			
– Chats		Foreign language	10
<b>5. Modelling with Logo</b>	<b>24</b>		
– Computer control understanding through Logo program			
– Control the dynamic object (turtle): by commands, keyboard, mouse			
– Repeating			
– Drawing, scanning, composition			
– Using several objects (turtles)			
– Turtles and their shapes			
– Basics of animation			

After the analysis of upbringing traditions in our country and the reformed concept of school have been made, the following main directions of Logo teaching were defined: 1) development of creativity; 2) cultivation of thinking; 3) designed working method; 4) development of algorithmics skills; 5) development of designing skills; 6) rendering of component programming ideas. All these directions and principles are directly or indirectly introduced in general curricula of IT teaching, educational standards and methodical recommendations.

Some basic trends could be distinguished in using Logo (Blaho 1998): 1) to teach drawing; 2) to teach mathematics (shapes, angles, etc.); 3) to control the turtle (to simulate its behavior); 4) to control a computer (to use Logo commands in the right way); 5) to teach programming (to use more complex commands and procedures); 6) to create multimedia; 7) to work on projects. We may consider the first six points as the components of the last one – project development and we suggest teachers to use Logo in that direction.

IT educational standards describe the results of learning: the main knowledge and skills that should be obtained by the majority of students after the graduation from the certain grade are indicated. They are designed for students, teachers, education managers, and parents. The standards are oriented towards value-based attitudes of information technologies, abilities, knowledge and skills that are necessary to every educated citizen of contemporary society. These standards should be obtained by the compulsory course of information technologies or by the optional course, if school (school board) believes that it is worth providing conditions for the major part of students to seek for the better results.

The standards are formulated according to the basic level of the 6<sup>th</sup> - 8<sup>th</sup> grades, *i.e.* the main level of informational literacy that characterizes good subject's results sufficient to continue successful learning. This level should be accessible to the major part of students. Students that reach the level have to understand the main IT notions and terms, be able to implement ICT solving the practical tasks according to the provided prescriptions, be capable to formulate conclusions and summarize the obtained knowledge. The Logo part of IT educational standards is presented in Table 3.

Table 3. IT standards in Logo for 5-6th grades

<p><b>5. Modelling with Logo</b></p>	<p>To be able to consider and prepare a project – image or animation.</p> <p>To understand the main actions of Logo Turtle (repetition, condition, description of the new command, usage of variables) and to be able to use them.</p> <p>To be able to create algorithms for the drawing of geometrical shapes.</p>	<p>5.1. Are able to draw using several technologies</p> <p>5.2. Are capable to use images created using other graphics editors.</p> <p>5.3. Penetrate the main principle of working with Logo – to control the Turtle.</p> <p>5.4. Investigate behavior of the Turtles using the simplest commands.</p> <p>5.5. Is able to create objects (program buttons, new Turtles).</p> <p>5.6. Learn to distinguish consecutive and parallel actions controlling several Turtles.</p> <p>5.7. Understand the principles of animation, are able to use animated objects in projects.</p>	<p>5.1. Understand for which purpose the programs and procedures are needed and are able to give examples.</p> <p>5.2. Are able to perform the main actions: repetition, condition.</p> <p>5.3. Understand the concept of variable and are capable to use it.</p> <p>5.4. Are capable to use procedures and their parameters.</p> <p>5.5. Read and understand the most ordinary recursive algorithms.</p> <p>5.6. Create not complicated geometrical algorithms, develop procedures with parameters.</p> <p>5.7. Are able to plan and complete geometrical shape.</p>
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## 6. Conclusions

Informatics and IT teaching in Lithuania is based on constructivism, certain movement towards humanistic upbringing philosophy is quite obvious. It is especially obvious in the initial stage of IT teaching – the main role here is played by the constructive education philosophy principles.

The main goal of informatics' teaching in the secondary school is development of informational culture. Certainly, the goal is quite difficult to approach and it is rather ideal towards which all school teaching should move. There is no doubt that in order to seek the goal, integration of all subjects is needed. Therefore, IT teachers should be especially concerned about integration of subjects and contemporary working methods.

That is why further concern of IT education theoreticians should be to validate the content of informatics curricula for each teaching stage in a more comprehensive way, to summarize the results obtained by teachers and to compare them to the experience of different countries. Only then will it be possible to speak about systematic and modern nature of informatics and IT teaching.

The trend to teach computer skills to younger students is currently very clear and widespread all over the world. Everything is all right if students are able to use them practically in their activities and if they get tasks that match their age. If computer teaching is not continuous and is not applied anywhere, it is useless for a child then. Moreover, if the teaching contains extremely particular issues, purely technical details (just “pressing of the buttons”) and it is not oriented to purposeful implementation of computer and other deeper goals, the time will be spent worthless and children's heads will be overwrought with useless knowledge. Therefore, Logo as a tool of thinking development is highly important part of teaching.

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