Teaching Information Technology and Elements of Informatics

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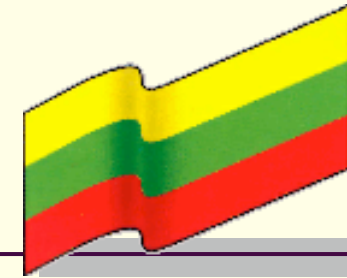
Institute of Mathematics and Informatics

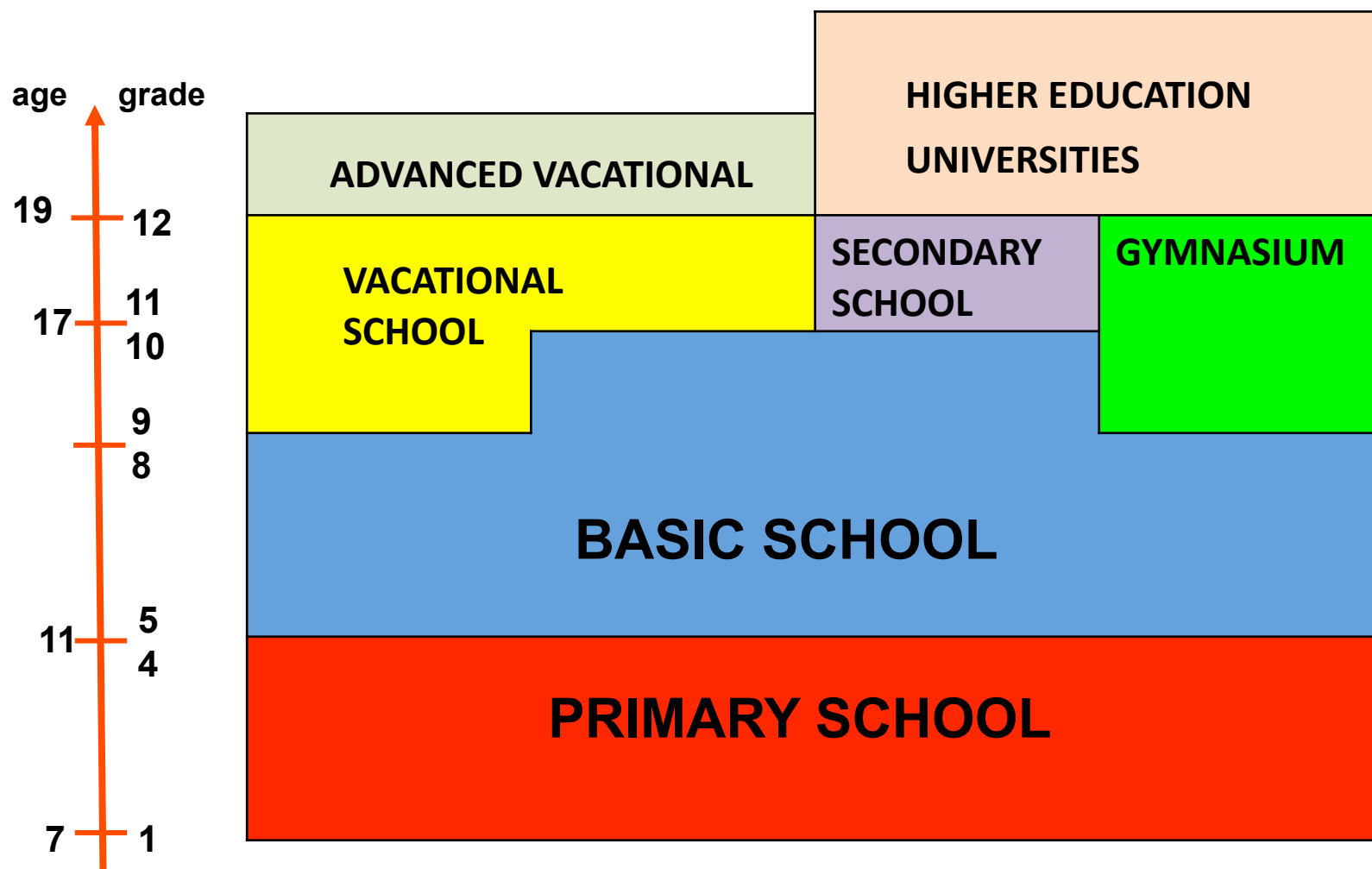Head of Informatics Methodology Department

Vilnius University

Lithuania – **LIETUVA**

- Territory – 65 200 km²
- Population – 3.35 mln.
- Lithuanians – 84%
- Vilnius – 550 000
- Currency – Litas
- Borders: with Latvia, Belorussia, Poland, Russia and Baltic sea

The Educational Structure in the Republic of Lithuania

Informatics is defined as the science dealing with *design, realization, evaluation, use, and maintenance of information processing systems*, including hardware, software, organizational and human aspects
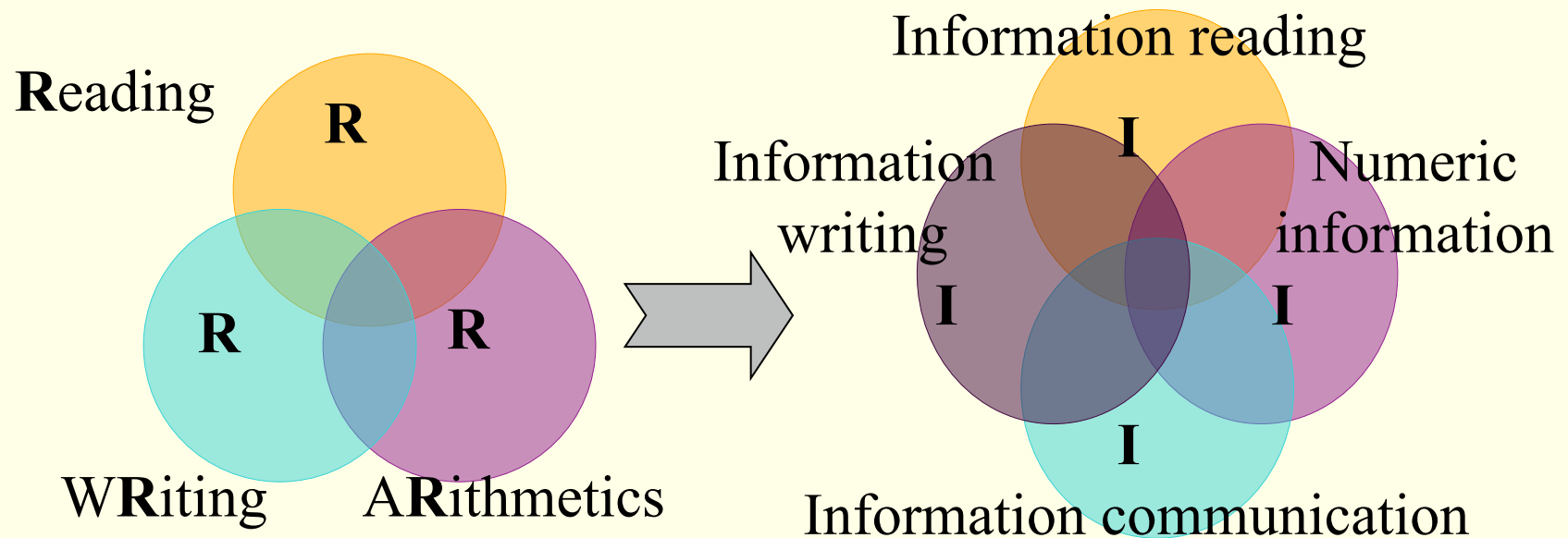
Informatics

Computer
literacy

Information
technologies
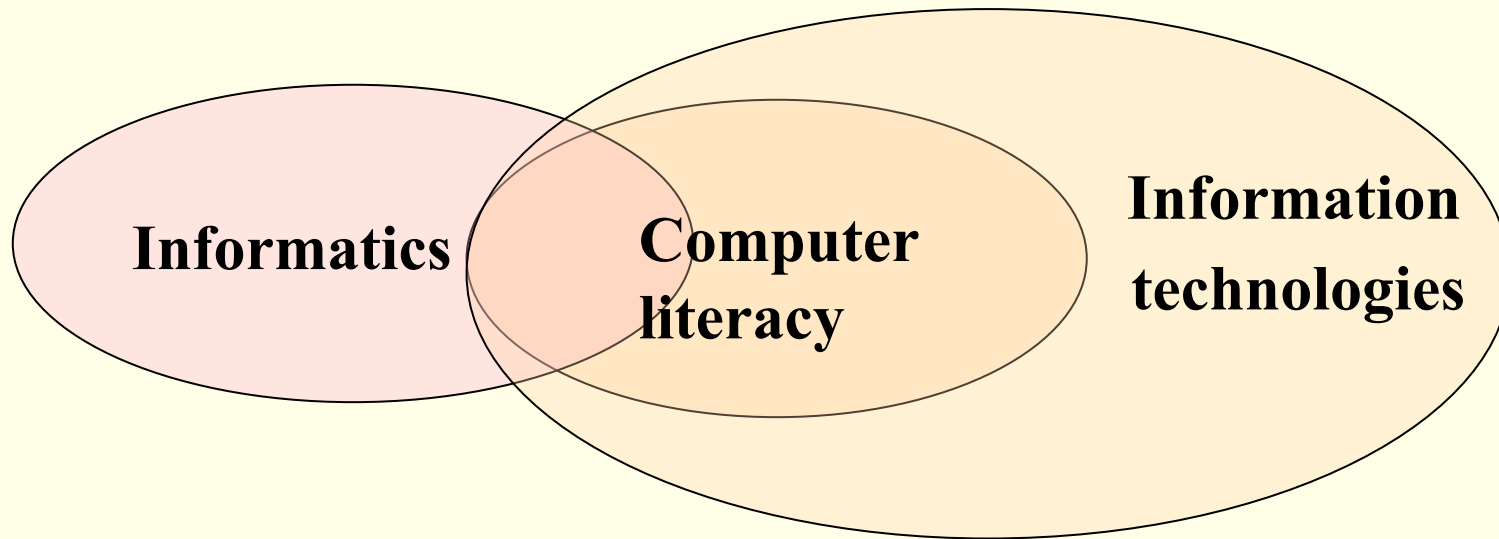
Information Technology is defined as *the technological applications of informatics in society*
ICT means the combination of IT with other, related technologies

by UNESCO

Teaching Informatics and Information Technology

Reading

R

R   **R**

W**R**iting   A**R**ithmetics

Information reading

I

Information writing   Numeric information

I   **I**

I

Information communication

Teaching Informatics in Schools: Beginning

- The history of computers in the secondary schools all over the world goes back to the early 1980-ies

- Introducing computers into Lithuanian schools was going together with teaching informatics

- A significant role for teaching Informatics was played by the scientists (Institute of Mathematics and Informatics)

- Concentration on teaching programming

Young Programmers' School: Beginning

- In 1981, the Young Programmers' School by Correspondence was established
- The school continues to function nowadays
- The activity of the Young Programmer's School in distance learning was one of the first examples concerning informatics and had a strong impact on many phenomena related with informatics' teaching

Pirmoji pamoka

ALGORITMAI

Gyvenime labai dažnai sutinkame iš anksto numatytus nurodymus, kuriuos reikia vykdyti norint atlikti konkretų darbą. Pavyzdžiui, prie telefono automato galima rasti instrukciją, kurioje trumpai ir aiškiai pasakyta, ką reikia daryti, norint paskambinti:

„1. Įmeskite dviejų kapeikų monetą į automato skylę.

2. Nukelkite ragelį ir laukite signalo.

3. Išgirdę ilgą, nepertraukiamą gaudesį, surinkite reikiamą numerį ir laukite atsakomojo signalo.

4. Išgirdę ilgus gaudesius, laukite, kol abonentas atsakys.

5. Išgirdę trumpus, dažnai pasikartojančius gaudesius, pakabinkite ragelį ir išimkite monetą; jums reikalingas abonentas užimtas".

Panašios instrukcijos sudaromos ir uždaviniams spręsti. Pavyzdžiui, dviejų skaičių a ir b aritmetinio vidurkio radimą galima nusakyti nurodymais:

1. Sudėkite duotus du skaičius.

2. Gautą sumą padalykite iš dviejų.

Skambinimas telefonu ir aritmetinio vidurkio ieškojimas —

tai du labai skirtingi procesai. Tačiau jie turi ir bendrų bruožų. Abu procesai aprašyti trumpais ir aiškiais nurodymais. Tų nurodymų seka ir sudaro algoritmą. Tiksliai atlikę aprašytus nurodymus, gauname reikiamą rezultatą: paskambiname telefonu, randame aritmetinį vidurkį.

Algoritmu vadinami aiškūs ir visų vienareikšmiškai suprantami nurodymai, nusakantys veiksmų procesą, kaip iš turimų duomenų gauti reikiamą rezultatą. Turimi duomenys vadinami pradiniais. Jie žinomi prieš atliekant algoritmą. Rezultatai dar vadinami galutiniais duomenimis. Jų reikšmės sužinomos atlikus algoritmą. Dviejų skaičių vidurkio algoritmo pradiniai duomenys yra du duoti skaičiai, o galutinis — vidurkis.

Algoritmai užrašomi įvairiai. Jų užrašymo pavidalas, nurodymų skaičius ir detalumas priklauso nuo to, kam jie skirti, t. y. kas atliks algoritmo nurodymus (sprę. uždavinį). Jeigu norima, kad uždavinį spręstų mašina, ji reikia užrašyti mašinai suprantamu pavidalu. Tokie algoritmai vadinami programomis. Mes ir nagrinėsime programas. Pradėsime nuo paprastų uždavinių, kuriuos nesunku būtų išspręsti ir be ESM. Palaipsniui uždavinių „svorį" didinsime. Sudarysime ir tokių uždavinių programas, kuriuos be ESM išspręsti būtų per sunku ar iš viso neįmanoma.
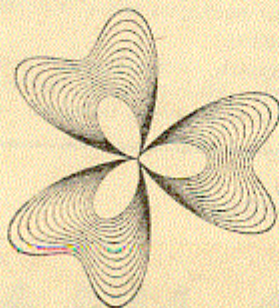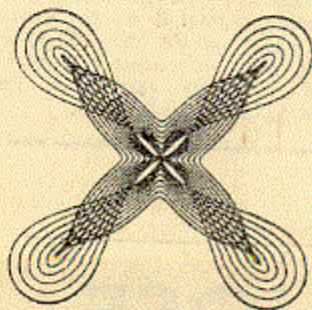
Šių fantastinių piešinių autorė — ESM.

The first lesson of **JPM**
(Young Programmer's School)
published 1981-01-27
in daily newspaper
"Komjaunimo tiesa"

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Obligatory Course of Informatics in Schools

- The official beginning of informatics as a subject in Lithuanian schools -1986

- A founder of the Siberian School of Computer Science prof. Andrei Ershov announced: "Programming is the second literacy"

- Idea: to introduce every student with computers through programming

Informatikos ir skaičiavimo technikos pagrindai II dalis

Informatics in Lithuanian Schools: **1991**

- An original Lithuanian textbook of Informatics was published just after Lithuania has regained independence

- In parallel, in 1991, the first curriculum for teaching informatics in secondary schools was developed

V.Dagienė, G.Grigas
INFORMATIKA
10 - 12
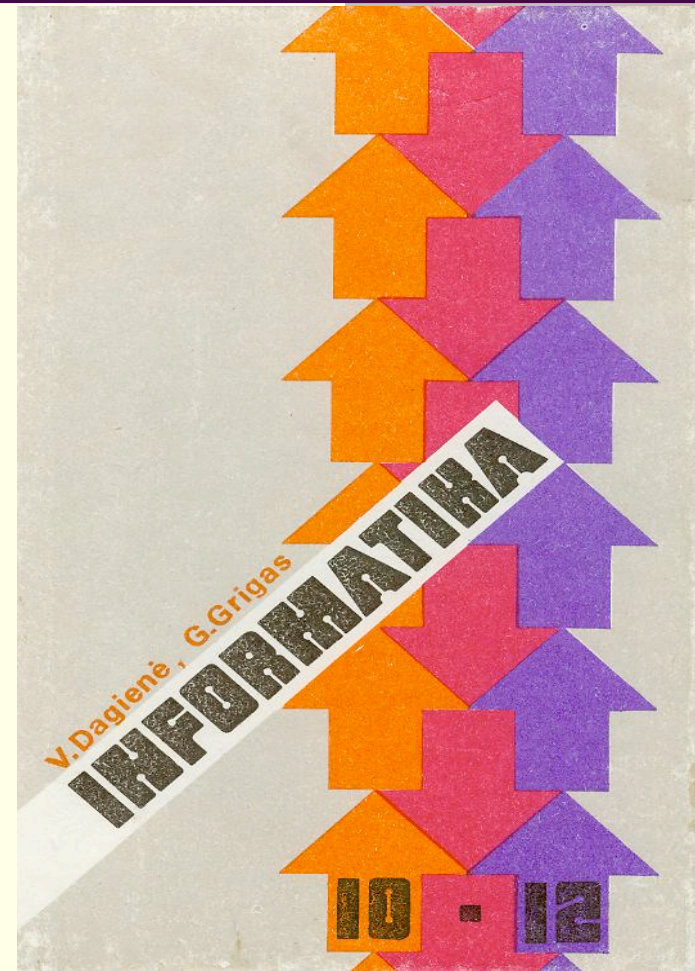
Computerisation of Schools: **2000–2004**

- ICT implementation in education: **the first strategy and program**

- Student/computer ratio in grades 9–12 became 7:1

- 89% of teachers in 9–12 grades acquired ICT skills

- School libraries were equipped with basic software

- Computer literacy standard for librarians was drawn up and librarians received training

- more than 40 teaching aids

- over 200 original author's sheets of methodology materials

- schools were gaining access to the internet

Computerisation of Schools: **2005–2007**

Renew: **ICT implementation in education**

Goals:

- Breakthrough in teaching and learning while using modern **information technologies** in school subjects

- Educational **computer network** – an electronic space for teaching and learning, for the modernization of education management and school communities' communication

- Citizens' computer **competence** (include teacher training and ICT skills in junior, 5 th grade)

Computerisation of Schools: **2008–2012**

Four goals:

- Developing of **digital learning and teaching resources**

- Expanding the digital learning and teaching **infrastructrure**

- Focussing on electronic learning culture of **school societies**

- **Education management** through electronic means

Teaching Informatics / Information Technologies (IT)

Years	Grades	Mandatory subject	Optional subject
1986-1997	grade 10-12	Informatics, 2 lessons/week	various IT modules
1997-2004	basic school, grades 9-10	Informatics, IT 2 lessons/week	
	secondary, grades 11-12	Informatics, IT 2 lessons/week	various modules, 2-4 lessons/week
Since 2004	grades 5-6	IT, 2 lessons/week	
	grades 7-8	IT, 1 lesson/week 1 lesson integrated	
	grades 9-10	IT, 1 lessons/week	1 lesson/week, programming module
	grades 11-12		IT, 2 lessons/week, advanced modules

IT Curricula: Competencies

- Almost all Lithuanian schools now use computers for teaching (97%)

- 95% of schools have internet access, however, only 1/3 have broadband connection

- Computers are widely used in the school libraries (62%, EU25 - 33%)

- ICT are very effective when developing **communicative**, **cognitive**, **working** and **practical** abilities and competences

Communicative abilities and competences

- to be able to maintain civilized communication using different ICT tools and technical equipment

- to correctly use the main terms of computer and information technologies, to be able to explain them, and to understand their meaning

Cognitive abilities and competences

- to be aware of the significance and importance of ICT to the continuous change of the modern society and cultural development

- to see ICT relations in the analyzed processes

- to apply the acquired knowledge in ICT when learning different school subjects

- to associate the acquired knowledge in ICT with the existing life experience and to apply it in solving real-world problems

- to be capable of recognizing and applying the acquired knowledge when using new computer tools

Working and practical abilities and competences

- to be aware of the purpose and the principles of computer technologies

- to be capable of using the basic software for processing information

- to use the computer aids in order to improve learning

- to develop systematic, structural and critical thinking and to take decisions

- to be capable of searching information according to the set goals

- to analyze, critically evaluate, and summarize information and to convey it to others

IT course for grades 5-6 and 7-8

- In 2005, the new model of teaching IT for basic school was elaborated

- IT are taught in grades 5–6 (2 lessons weekly)

- Since 2006, IT are taught in grades 7-8 (1 lesson per week, 1 integrated lesson)

- Students are being prepared to the further life as citizens of the information and knowledge society that are able to use modern technologies

IT textbooks for grades 5 and 6
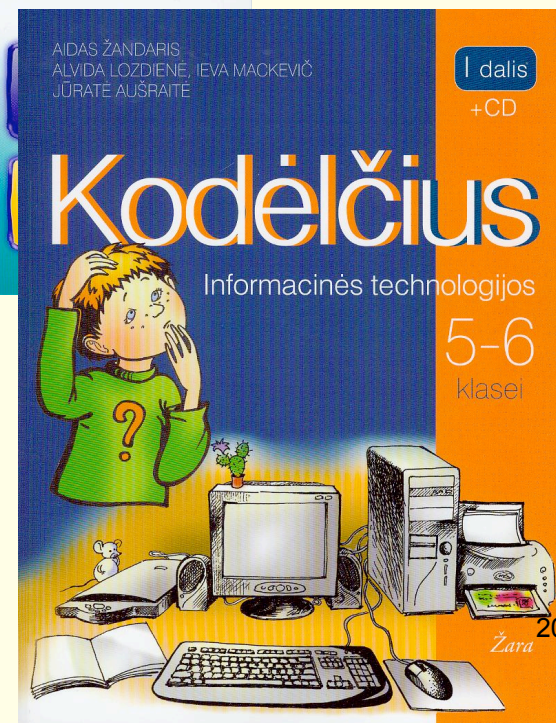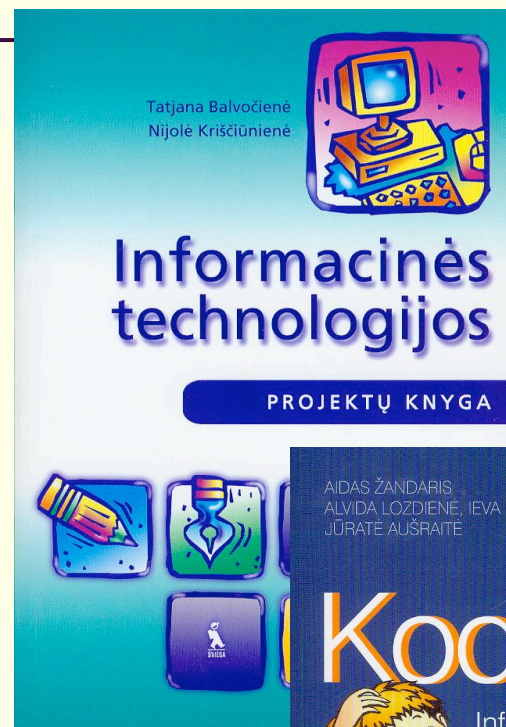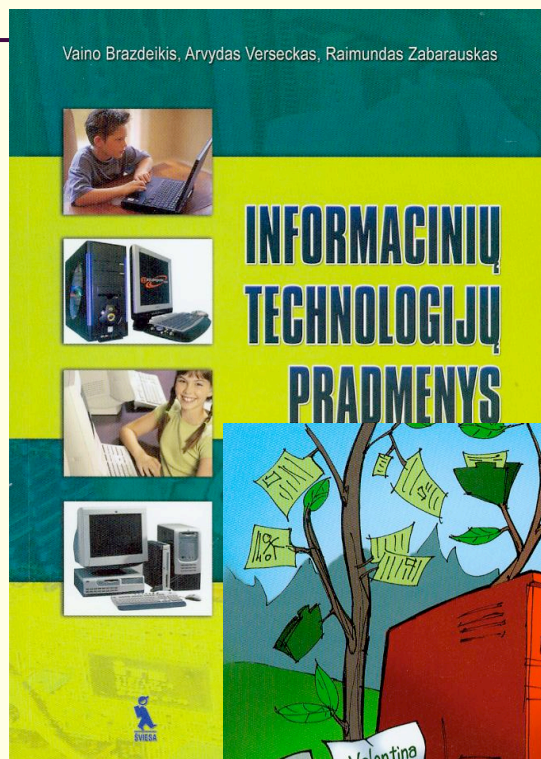
Distribution themes and time for grades 5-6

Themes, subthemes	IT hours	Subjects, integration is addressed to, and hours
Introduction to computer application	14	
Drawing with computer	8	+ Art; 10
Text and keyboard	14	+ Mother tongue; 10
Internet and electronic mail	8	+ Mother tongue; 4 + Foreign language; 10
Modelling with Logo	24	

Modelling with Logo

- Computer control understanding through Logo
- Control the dynamic object (Turtle): by commands, keyboard, mouse
- Repeating
- Drawing, scanning, composition
- Using several objects (Turtles)
- Turtles and their shapes
- Basics of animation

Distribution themes and time for grades 7-8

| Themes, subthemes	IT hours	Subjects, integration is addressed to
Information precessing	4	
Creation, editing and publishing a text document	6	+ Mother tongue; 4
Internet and electronic mail	4	+ Languages; 10
Elements of spreadsheats	18	+ Mathematics; 10
Preparation and demonstartion of presentations	2	+ All subjects; 10

Four main concepts in Informatics Curricula for grades 9-10

1. Basics of informatics, i.e. the concepts of information and computer science
2. Practical informatics – work with computers
3. Basic principles of text processing
4. Introduction to algorithms

Lithuania has chosen the synthetic and optimal enough relation of these elements

Textbooks for informatics in grades 9-10
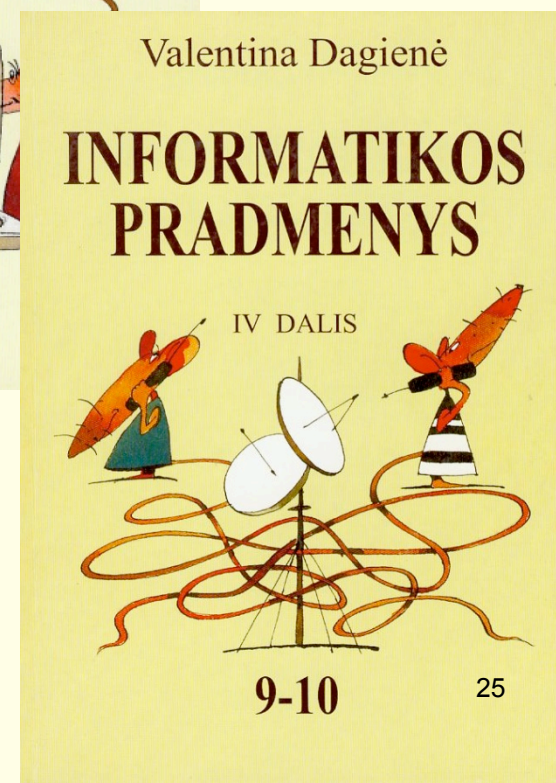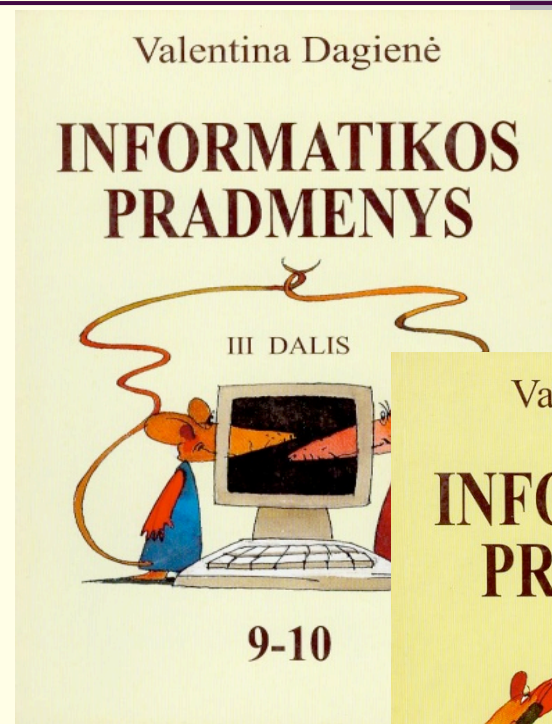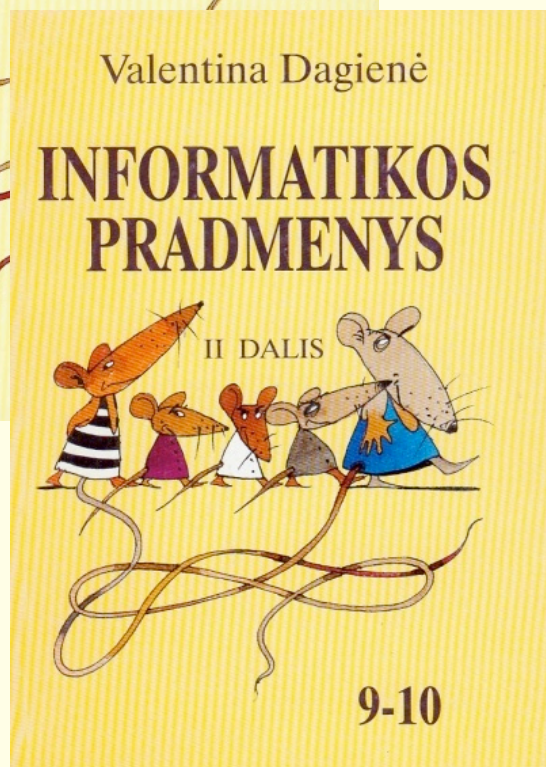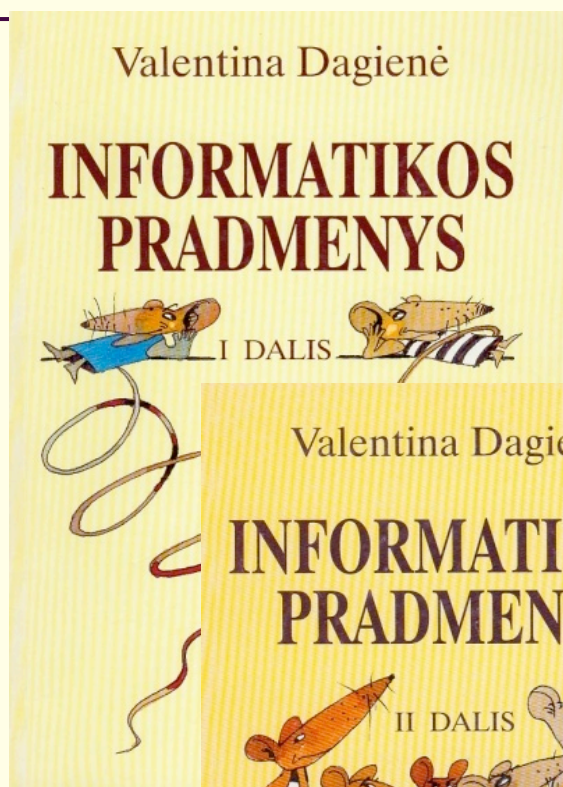
IT curricula for grades 9-10 and 11-12

Compulsory course, 9-10 grades	Optional course, 11-12 grades	Additional modules, 11-12 grades
Computer (principles of the work)	Advanced elements of text editing	Data base
Text processing	Presentation	Multimedia
Information (basics of information handling)	WWW and electronic mail	Programming
Algorithms (main concepts and commands)	Social and ethical issues of using IT	
	Spreadsheet	

Information Technology Maturity Exams

- 1995-2002: Informatics Maturity Exam – Scool level

- Since 2005: National Information Technologies Maturity Exam (75% on programming – Pascal)

Components of curriculum of programming exam

Algorithms	Data structures	Control structures
Calculation of the sums (of product, quantity, and arithmetical average). Search of the maximal (minimal) value. Data input/output. Data sorting. Ability to modify algorithms according to the particular data structures	Integer and real, char, boolean, and string Text file. One-dimension array. Record. Ability to create uncomplicated data structures.	Program structure. Commentary. Variables Assignment and sentence. Relational and logical operations, if statement Loops. Compound statement; Procedure and function. Lists of parameters and arguments. Standard mathematical procedures and functions. Procedures and functions related with files.
Programming environment. Technology of structural (procedural) programming. Testing. Program documentations. Arrangement of dialog. Program writing (style)		