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THE CURRICULUM CONTENT OF INFORMATICS AS A TEACHING SUBJECT AT BASIC SCHOOLS IN THE CZECH REPUBLIC BETWEEN 1996 AND 2005

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Abstract

Although informatics is a discipline that emerged not long ago and has been increasingly developing, and it is only for a relatively short period of time that we have been able to witness its integration into the curriculum at the level of basic schools (ISCED 1 and ISCED 2), it has gradually acquired a strong presence in curricula. It has either been incorporated in them in the form of a separate school subject or integrated into wider theme and subject based units (e.g. STEM). In a number of developed countries, such emphasis is placed on informatics that it has gradually become a compulsory part of their respective curricula, which is also reflected in the current situation in the Czech Republic.

In this paper, on the basis of an analysis and comparison of the curricular documents valid in 1996 – 2005, we present the course of the gradual integration of informatics into the curriculum prescribed at the national level. We have thus followed on from publications by authors who dealt with a similar topic in other countries. Through our comparative research, we have come to an ascertainment that although Informatics already existed as an optional subject in 1991, further developments were not unambiguous, in particular because there were three various curricular documents (national programmes of education) that were then in effect in the Czech Republic. As is detailed in the paper, all three programmes included the teaching content on information, informatics, computer science, and information and communication technologies. Where they had the form of separate teaching subjects, they were always optional (voluntary). However, it was also possible to come across the version where the aforementioned teaching content was incorporated into other teaching subjects as their part. In some cases, they were even compulsory teaching subjects, for example mathematics or practical activities.

Because informatics has been a part of the curriculum for a relatively short time, many terms have not yet been definitively set. Therefore, this study also includes definitions of core terms, which is substantive for their unambiguous interpretation. Divergences are also caused by translation to foreign languages.

Keywords: Curriculum, curriculum content, research, information and communication technology, ICT, informatics, teaching subject, history, Czech Republic.

1 INTRODUCTION

In line with global trends, in the past the Czech Republic proved to be no exception in integrating the teaching content related to information (obtaining, processing, sorting, storing, disseminating and utilizing it) as well as information and communication technologies, algorithm development, program coding, computer operations, etc. into the education system at the level of basic schools. The beginnings of incorporating this content into the curriculum structure side by side with traditional teaching subjects such as mathematics, chemistry, biology and physical education were not easy; nevertheless they date back as far as 1991. In that year, the Ministry of Education, Youth and Sports of the Czech Republic (hereinafter MEYS) approved the basic school syllabi for the Informatics subject (Fortuna, 1991). Although it was an optional teaching subject, its content was very well elaborated for that time1. From 1993, the obligatory basic schooling in the Czech Republic was prolonged by one year. In the ninth school year, it became newly possible to incorporate the Practical Class of Computer

[1] The *Informatics* subject was designed for the 7th and 8th classes. In the 7th class, it included the subject areas of Introduction to Microcomputers (8 lessons), Working with Canned Software (14 lessons), Algorithm Development and the Basics of Program Coding (36 lessons), and Editors (8 lessons). In the 8th class, the subject included the subject areas of the Basics of Program Coding (26 lessons), Working with Canned Software (10 lessons), Computer Graphics (10 lessons), Working with Editors (14 lessons), and Databases – Introduction (6 lessons), see Fortuna [1].

Skills2 subject, see Fortuna [2]. Thus, it is not possible to identify any major tendencies regarding the incorporation of informatics content into the basic school curriculum before the 1996 – 2005 period. For this reason, this will be the period that we will pay more attention to in our paper.

During the whole period, there were three governing curricular documents in the Czech Republic that obligatorily determined the content of education at basic schools at the national level. They defined the obligatory teaching content that had to be delivered in classes. However, some topics were designed as optional or the respective educational programmes allowed for changes to be made to some extent so that schools and teachers could respond to local conditions and current social science and scientific and technological development. As we will see, the subjects where the teaching content related to information (obtaining, processing, systematization, storing, disseminating and utilizing it) and information and communication technologies, algorithm development, program coding, operating computers, etc. is allocated, are variously named, let us randomly mention the titles of Computer Skills, Information Education, Computer Technology, Informatics, Practical Class of Computer Skills and Information Technologies.

On one hand, the titles were proposed by the authors of the curricular documents, and on the other hand, school practice, i.e. actual subject titles, is also substantial in this respect. Another important factor in determining a title is the content of the respective subject. If for example a teaching subject is based predominantly on information science knowledge, it is justified to use the Information Education title.

The authors V. Guerra, B. Kuhnt and I. Blöchliger [3], who made a comparison across 15 countries from all over the world regarding subjects that can be included under the Informatics title, also draw attention to conceptual divergences. It turns out that a subject with a content that would deal with informatics, information or merely information technologies existed as a separate subject in only a few countries at the time when the research was conducted. However, currently a separate teaching subject has been gradually incorporated3 into curricula in many developed countries, drawing its content in particular from the following scientific (or technical or other) fields: Informatics4, Information Science and Information Technology. This does not exclude other fields; nevertheless the content of education reflects them to a lesser extent than in the case of the aforementioned fields. The term Informatics has been increasingly established as a title for a teaching subject designed in the above specified manner. This can also be illustrated with examples of the titles of textbooks for basic schools, see J. Vaníček [4], P. Roubal [5], D. Hawiger [6], E. Gurbiel, G. Hardt-Olejniczak, E. Kolczyk, H. Krupicka and M. M. Syslo [7], L. Kovářová et al. [8], P. Břicháč [9], M. Pokorný [10], or the titles of other methodological publications, see V. Sehnalová and A. Závadská [11], J. Balarinová [12], E. Gurbiel, G. Hardt-Olejniczak, E. Kolczyk, H. Krupicka and M. M. Syslo [13], I. Kalaš, K. Mayerová, M. Veselovská [14] J. Vaníček [15], O. H. Kang [16], G. Hajdin and B. Divjak [17], S. J. Kim, Y. Jeon, S. Lee and T. Kim [18] also write about Informatics as a subject at basic or secondary schools. For the above mentioned reason, we will also use this term in this paper. However, this does not exclude the existence of subjects with a different designation and content, for example the subject titled Computer Skills that will focus on the skills needed for operating a computer as a user.

We may also come across the identification as ICT, which J. Vaníček [15] perceives as a part or initial stage of informatics-related knowledge. As he literally states, “Therefore, we do not perceive ICT and informatics as two different fields” (ibid, p. 46). The approach to computers also seems to be of the essence. I. Kalaš et al. [19] set (school) informatics and ICT apart by means of the approach to computers, which is the user’s approach in the case of ICT, and the author’s approach in the case of informatics.

Apart from organizing a teaching content into a separate teaching subject, the knowledge related to informatics, information science and information technologies can also be integrated into other subjects. A. Blaho and L. Salanci [20] also pay attention to this. We very often come across integration

[2] The subject areas of the *Practical Class of Computer Skills* subject were Introduction to Computers, Computers in Practice, Working with Canned Programs, Working with Editors, Using Computers for Administration Purposes, Algorithm Development, the Basics of Program Coding, and Process Management.

[3] Or there are clear tendencies towards incorporation in the future.

[4] Issues exist as regards the determination of Informatics as a subject field (which means outside the school environment). Let us quote the following example: The Science of Information and the Engineering of Information Systems have been developing in a very close mutual relation. Informatics is a discipline interconnecting both fields. Informatics studies the structure, behaviour and interactions of natural and artificial computing systems. Informatics includes many aspects – Artificial Intelligence, Cognitive Science, and Computer Science that is also termed as Mathematical Informatics, see TUE, 2016.

into mathematics. Furthermore, we must mention that in particular in the USA the knowledge corresponding to informatics as a school subject as we approach it is integrated into wider thematic and subject based units (e.g. STEM, see S. J. Zilora, [21]).

2 DEFINITIONS

Taking into account the differences among the systems of education in individual countries and terminological instability, it is necessary to unequivocally define the basic terms that will be used herein. In doing so, we are following on from definitions made by respected authors.

The teaching subject is a content unit of a curriculum. The content of a teaching subject is elaborated in syllabi and textbooks. It is a concentration of a didactically adapted content of the knowledge of a scientific discipline (or a block of related scientific disciplines) so that pupils of a certain age would be able to master the content as a set of their own knowledge and skills (Z. Kolář et al. [22], p. 112). The authors J. Průcha, E. Walterová and J. Mareš ([23], p. 356) mention that segmentation of the content of education into individual subjects has been criticized as a factor that leads to the separateness of individual pieces of pupils' knowledge.

Curriculum. This is seen as the content of education that includes all of the experiences that pupils gain at school and during activities related to their school attendance, especially their planning, presentation, and evaluation (J. Průcha et al., [23], p. 117).

The content dimension of a curriculum is a determinative component of the curriculum. The content that is being presented predetermines the keystones of education, specifies educational objectives and, to some extent, co-determines the choice of optimal methods and resources in its mastering by pupils (J. Průcha et al., [23], p. 139).

Curricular document. The requirements for school education are codified in curricular documents. They include curricula, educational programmes, standards, textbooks, and teaching guides. In this paper, we focus on analysing educational programmes (J. Průcha et al., [23], p. 139).

Planned curriculum. Educational programmes, curricula and syllabi, educational standards. This determines what the content of education should be. The question is, what is actually implemented, and to what extent ("the implemented curriculum").

Onthodidactic transformation. The type of didactic transformation, resting in transferring field-specific contents to curricular contents (J. Průcha et al., [23], p. 139).

Basic school. In the Czech Republic, this comprises 2 stages - the first stage (ISCED 1, 1st – 5th classes) and the second stage (ISCED 2, 6 th – 9th classes or the first classes of the secondary general school /in Czech: gymnázium/).

Informatics (as a teaching subject). A content unit of a curriculum including a didactically transformed content, in particular from the fields of informatics, information science and information technology.

3 ANALYSIS OF THE BASIC SCHOOL EDUCATIONAL PROGRAMME

A paper should contain the description of your study and should be structured in different sections such as: Abstract, Introduction, Methodology, Results, Conclusions, Acknowledgements (if applicable) and References. Please note that title and authors list should be coincident with the accepted abstract.

On 30 April 1996, MEYS approved the new Basic School Educational Programme 5 under Ref. No. 16 847/96, which came into force from 1 September 1996. Among other things, this document determined educational objectives, defined the teaching content and its distribution into individual years, specified the time allowances for individual subjects, and characterized the manner of evaluating pupils. The analysis leads us to the conclusion that Informatics (or another subject with a similar content) was not contained in the programme as a designated subject; however the Practical Activities subject included a teaching content that was related to computers.

The Practical Activities subject as a whole contained the teaching content, the substance of which lay mainly in technical education, handicrafts and crafts, horticulture, etc. The teaching content regarding computers was newly added to it in response to the then existing educational needs. Through its

[5] Lessons according to the Basic School Educational Programme were given at most Czech basic schools.

specific forms of education and defined teaching content, the subject made use of the knowledge gained in other areas of education and experience obtained by pupils in their life to that point, enabling them to obtain the necessary set of knowledge, working skills and behaviour necessary for their normal life and shaping their personalities by developing certain characteristics, motor and creative skills and competences. The process of teaching through practical work activities was targeted at enabling pupils to recognize selected materials and their functional characteristics, raw materials, crops, to learn how to choose and use suitable instruments at work, tools, aids, to work with available technical equipment, including computing equipment (at the basic user level) and to master simple work procedures necessary for everyday situations (see MŠMT, 1996, p. 228).

It is obvious that the subject area including the teaching content about computers could be perceived as somewhat marginal, nevertheless with the potential for further development. It was intended for the secondary general stage of the basic school (i.e. 6th – 9th classes), however, a recommendation was given that it was more suitable for the 6th and 7th classes of the basic school. The content was determined as follows: Basic information about a computer, its operations and possibilities for its use; computer software; Using a keyboard, commencing and finishing work on a computer; Data storing, hard disk, floppy disk, copying; Operating peripheral devices (printer, etc.); Operating a gaming computer; Working with canned didactic programs; Mastering basic user skills.

Pupils should be able: To have a good understanding of the structure and operations of computers and to know the possibilities of their utilization; To handle a computer in a user manner; To work with canned didactic programs.

Examples of the extension of teaching content: Development of common everyday situation algorithms; The basics of program coding, Computer graphics, working with editors; Databases.

4 ANALYSIS OF THE NATIONAL SCHOOL EDUCATIONAL PROGRAMME

Apart from the Basic School Educational Programme, MEYS also approved another educational programme for basic schools, identified as the National School Educational Programme (Asociace pedagogů základního školství ČR, 1997) under Ref. No. 15724 / 97-20 on 17 March 1997, with effect from 1 September 1997 [1]. The programme included Practical Activities as an obligatory subject, which was followed up by the Technology subject in the 8th and 9th classes. The lessons on computers included only a very small part of the teaching content for the 8th class, which is obvious from the following overview6 (ibid, p. 95).

The physical nature of simple technical devices: Composition of forces; Simple machines; Underpressure, overpressure, pressure vessels; Boiling temperature of liquids (changes in pressure and temperature); Heat engines.

Significant technological processes: Drinking water; NaCl, acids, hydroxides; Basic foodstuffs.

Operation of apparatuses: SI-system; Household (food processing, cleaning, clearing, etc.); Information media; Sound and image carriers; The basics of operating computers; Principles of health and safety protection.

Technologies and mankind: The history of outstanding and interesting inventions; The role of technology in some areas of human activities (depending on pupils' interest).

In this respect, the National School Educational Programme seems to be non-progressive. However, in the extension part of the curriculum, we arrive at a contradictory observation. The purpose of this part is to create a system of content units that schools could use in practice without any procedure being required to approve the syllabi of the subjects that schools want to teach in the extension part of the curriculum. However, these are not classes that would be provided to all pupils, as their focus is on developing talented pupils and satisfying pupils' interests.

In its extension part, the National School Educational Programme offers 2 subjects related to the topic of our research, specifically Computer Technology and Probability, Statistics and Informatics. We present the contents of the above specified subjects herein and once again in their unabridged version. First, we will focus on the Computer Technology subject.

[6] To make the overview more explicit, we present a summary of the teaching content of the whole class. As it can be seen, the teaching content focusing on computers constitutes a very small percentage of the total.

Objectives of the subject: To develop pupils' logical thinking; To teach pupils how to analyse and deal with issues in depth; To guide pupils towards understanding that computers are only machines making human activities easier.

Development of pupils' skills and competences: To communicate with a computer; To code simple programs; To use the available functionality of computers.

Content of the subject: Computer composition: operational unit, controller, memory; Operations of the computer; Operating a computer, computer network; Numbering systems; Development of computers; The basics of program coding; Programming languages; Origin of programs, types of programs and their protection; Utilization of computers in the construction industry, medicine, accounting, banking, etc.; Computers as a means of education – multimedia; Computers as a means of communication among people – networks – the Internet (ibid., 1997, p. 121).

Now, let us proceed to the Probability, Statistics and Informatics subject.

Objectives of the subject: To practice logical thinking and judgement; To teach pupils how to use data for decision making; To acquaint pupils with information systems and their functioning; To guide pupils towards recognizing whether submitted data are feasible; To guide pupils towards personal responsibility by drawing their attention to the influence of the mass media on the subconscious mind.

Development of pupils' skills and competences: To estimate results, to ascertain the probability of forecasts; To use tables, graphs, diagrams; To learn to work with information, to obtain, evaluate, sort and use it; To verify estimates.

Content of the subject: Probability - a random, certain, impossible event; tabulation, calculation of probability, relative frequency, the law of large numbers, geometric probability; Games, lotteries, betting, sport, probability of winning; Probability in scientific disciplines, economics, industry, transport; Statistics - statistical population and samples; Means - arithmetic and harmonic mean; Frequency distribution, mean and modal values; Enumeration of quantities that cannot be exactly established; Statistical tabulation and using statistic tables; Informatics - information and its collecting and systematization; Information systems, mass media, information transmission, coding; Evaluation of information with respect to its objectivity, importance, and possibility of utilization; Utilization of information for the purposes of problem and situation solving; Computers - the principle of their functioning, individual parts, connection systems, utilization (ibid. 1997, p. 122).

Taking into account the above specified contents of the Computer Technology and Probability, Statistics, Informatics subjects, it can be observed that they fully met the educational needs as regards the societal demand at that time, and they can be termed modern and progressive for the time. However, a significant deficiency was that they were only optional subjects and the fact that only a small percentage of the population was educated according to the National School Educational Programme also played its role. Its effect was therefore minimal and in actual fact they were curricular plans of subjects that remained only "on paper".

5 ANALYSIS OF THE GENERAL SCHOOL EDUCATIONAL PROGRAMME

The third key educational document that was in force in the Czech Republic at that time was the General School Educational Programme, which was approved by MEYS under Ref. No. 12035/97- 20, with effect from 1 September 1997. The analysis of the part concerning compulsory subjects leads us to the conclusion that the teaching content concerning computers or informatics is not included therein. However, this handicap is considerably remedied in the part containing optional subjects. Here, the Information Education, Technical Education, Practical Technical Classes and the Basics of Computer Skills have been included.

In the General School Educational Programme, Information Education is approached as a subject that teaches pupils how to become oriented with the plethora of information surrounding them. Through its concept and content, it contributes to developing self-education and self-knowledge, helps to shape relationships with other people, nature, education, arts, it teaches and develops information-related knowledge and skills, monitors and guides the level of obtained habits of working with information sources (see MEYS, 1997, p. 324).

Information Education pursues a specific goal: Through the content and methods of the subject, to introduce pupils to such cognitive activities that will arouse in them a desire for knowledge, discovery and education. The optional Information Education subject is designed for two classes of the general

school, at the scope of 1 to 2 teaching hours a week. We present the summary of the teaching content herein (ibid. pp. 324 - 326):

Topic I. Information and its importance for individuals: Information with respect to self-knowledge and self-evaluation (development of sensory perception - memory and visualization, imagination, development of logical thinking); What constitutes information, types of information, expression, speech, language, writing, ancient texts, Understanding various types of texts, working with books: title, content, the meaning of illustrations, text structure: title, chapters, typefaces in terms of the meaning of information; Works of art – visual and musical – image of the world; Events in nature from the point of view of the information concept.

Topic II. Importance of information for shaping interpersonal relationships: Social communication; Verbal and non-verbal communication (a) The word and its factual meaning, Making use of various means of transmitting information in society /postal traffic: telegram, telephone, fax/; b) Social intercourse: information capacity of greetings, introducing people, private and public conversation, spoken and written language as regards the use of verbal and non-verbal communication; c) Using (and understanding) facial expressions, gestures, body language as regards the expression of feelings, moods and simple communication); The importance of pictographs as regards the development of writing systems and their current utilization.

Topic III. Significance of information for discovering the surrounding world:

1 Becoming aware of the dominant role of information and its processing in the 20th – 21st century. Information helps man:

   a) To become oriented in nature,

   b) In the world of technology,

   c) In the world of interests and arts.

2 Information processing – practice in working with:

   a) Reference literature (textbooks, dictionaries, field guides, encyclopaedias) and periodicals,

   b) Audio-visual means,

   c) Reprographic applications.

Topic IV. Information and its significance for professional orientation: Practice in intellectual processing of information (abstract, excerpts, annotations, reports, etc.); Practice in working in a team; Using computers from the user's perspective;

Topic V. Sources of information and their utilization: Working with primary information sources; Information centres: libraries, archives, museums, galleries, specialist information centres, etc.; Secondary sources of information as regards the efficient utilization of information (catalogues, card files, bibliographies); Working with reprographic devices, informatics;

Topic VI. Papers and essays, comprehensive team work, collective analysing and evaluating (Regional specificities are given preference with respect to the informational effect)

As pointed out in the General School Educational Programme, it is expected under the Information Education subject that the activities of pupils will be active, practical and in particular carried out independently. However, the necessity to concurrently provide basic theoretical knowledge from the field of information, information systems, education and studying techniques is also emphasized. In terms of the overall concept, the character of the teaching subject is integrative because its objectives are directed at meeting the objectives of all of the teaching subjects. By completing the subject, a pupil will acquire the following knowledge and skills: To search for, receive and process information so that he or she could use it in a reasonable and well-arranged manner in the course of his or her life; Knowledge about information; Knowledge about sources of information; A certain complex of knowledge, skills and information-related habits.

The Technical Education and Practical Technical Classes optional subjects include topics concerning computers and informatics at a very limited scope. However, this is not surprising because, besides the above mentioned subjects, this educational programme includes two key subjects, which are the already mentioned Information Education and furthermore the Basics of Computer Skills. Below, we present the teaching content of the Technical Education subject (ibid. p. 354):

Technical Communication (7th class): Technical documentation adjustments; Rectangular projection on three mutually perpendicular planes of projection; Representation of simple machine parts; Introduction to operating a PC; Using graphic programs.

Communication Technology and Communication Systems (8th class): What constitutes communication technology and when we need it, dependence on communication technology in the Information Age; Computer technology in communication; Communication subsystems and transmission channels; Trends in communication technology.

Production Systems (9th class): Manufacturing process development; Manufacturing system management; Inputs (people, materials, instruments and devices, energies, finances, information, time), processes (management, production), outputs (positive and negative influences), feedback; Production development; Using a computer in model control[7].

Furthermore, we present the teaching content of the Practical Technical Classes subject (ibid., p. 358) which was taught in the 9th class and where teaching about computers was included:

1 Electro-technical works: Use of electricity in manufacturing and households. Simple wiring work. Assembling and connecting simple electric circuits by means of pupils' construction sets. Construction and assembly of a simple electro-technical installation according to technical documentation. Safety rules in handling electro-technical installations.

2 Maintenance and technology of repairs of simple devices: Connecting electrical sources and appliances to electrical circuits. The electrical circuit of a bicycle and maintenance and simple repairs of mechanical and electrical low-voltage appliances in households.

3 Computers as a technical means: The basic configuration of computers. Connecting up and commissioning a computer. Working with canned software simulating technical operations.

4 The content of the most frequent technical occupations: Introduction to occupations that are related to the area of electrical engineering.

We have already mentioned that the General School Educational Programme includes the Basics of Computer Skills which comprises the thematic areas of Introduction to Computers, Using Computers, Working with Canned Programmes, Working with Editors, Using Computers for Administration Purposes, Algorithm Development, the Basics of Program Coding, and Process Management. Their teaching content is as follows (ibid., p. 364):

1 Introduction to Computers. Using Computers

Hardware and software. Local computer network. The basics of computer skills. Motivational games. Examples of using computers in various areas of practice. Basic information about the structure and operations of a computer. Operating peripheral devices.

2 Working with Canned Programs

Working with canned didactic programs for various teaching subjects. Computer games developing combinatorial capabilities and logical thinking. Application programs.

3 Working with Editors

Text editor, graphic editor. Using editors in practice. Working with text editors. Drawing pictures by means of a graphic editor.

4 Using Computers for Administration Purposes

Examples of computer applications in administration. Text processing. Working with databases. Working with a table processor. Working with programs typical for this area developed under a database (accounting, stock records, etc.).

5 Algorithm Development, the Basics of Program Coding

Algorithms and their characteristics. Setting up algorithms, various forms of recording them. Program and its debugging on a computer. Problem solving.

6 Process Management

Real-time process management.

[7] Already at basic schools, program coding and algorithm development can overlap with the field of industrial applications, obviously in the didactically adapted form; see for example T. Kozík and P. Kuna (2014).

At the time when the educational programme was in force, schools were equipped with the necessary technologies at various levels. Some schools had excellently equipped computer classrooms, while others had only obsolete technology available, and even then only at a limited extent. Consequently, sometimes one computer was allotted to as many as 3 students. Therefore, neither any of the above mentioned thematic units nor their content was binding. Teachers selected the specific content under which individual topics were gone over taking into account the technical equipment available at the school, pupils' interests, educational needs and the level of knowledge. The languages Karel, Logo, Pascal and BASIC were recommended for use when teaching algorithm development and the basics of program coding.

6 CONCLUSION

In a general context, the performed analysis produced new pieces of knowledge that are significant in particular at the international level, thus complementing the already existing studies that map the curriculum of the Informatics subject (or similar teaching subjects focused on information and computers) at basic schools. Apart from the papers already stated in the introduction hereto, let us mention for example the website project titled "News about computing education in schools in Europe"8, which features interviews with significant experts in education in the field of informatics from Poland, Switzerland, Germany, the Netherlands and Belgium. As regards the Informatics subject, compared with the above described knowledge, the education at Czech basic schools is somewhat above average, including in the historical context. Although not at the level of obligatory subjects, Informatics was incorporated into the curriculum of basic schools in the Czech Republic as early as 1991.

Nowadays, it is however essential to continuously innovate the curriculum since the nature of knowledge in Informatics is time-limited because this field is always rapidly evolving. It is a distinct specificity compared to the other teaching subjects where it is more the concept of teaching that changes than the knowledge, which remains without change for a longer period of time. A typical example is Mathematics. The selection of teaching content is also a problematic area. Within the context of the Informatics subject, it is not possible to reflect the total volume of scientific knowledge and it is necessary to select the areas and topics with good prospects that will be conducive to the development of pupils' competences and their application in their personal and professional lives.

From the current perspective, it is also necessary to singularize the integration of information and communication technologies (or computers) into education. Firstly, we come across the integration of ICT into education in the form of teaching aids and instructional technology (for example interactive whiteboards, see A. Kyriakou and S. Higgins, 2016). Another area is the integration of the teaching content about informatics into the curricular framework. This refers to computer teaching and this area has been dealt with in this paper.

As information and communication technologies permeate into an increasing number of areas within industries and people's lives, we can also come across the growing integration of information and communication technologies into teaching subjects, the traditional content of which, is not computers or other information technologies. For example experiments are conducted in natural science subjects with the use of information technologies. These applications suitably support the development of pupils' digital literacy.

Of course, apart from the three above mentioned application possibilities, we also come across the utilization of information and communication technologies as a means for managing the studying agenda and administration.

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