Development of A New Syllabus for the "Digital Information Search and Find" Pathway – Cyber Informatics

Avi Cohen¹, Orit Zeichner²

¹Inspector-in-chief of Computer Science and Information Technology in the Ministry of Education
²Lecturer & Researcher Kibbutzim Collage Of Education

Abstract—Computers and information occupy an increasingly growing place in our life. Hence, syllabus designers worldwide concur that basic knowledge and understanding of the technological aspect of the Internet technology and its uses, information on the Internet and social media as well as information security are an inseparable part of the education which should be inculcated among learners. The present paper aims to describe the process of developing a new syllabus for the "Digital Information Search and Find" pathway. This is an action research. The present paper presents the theoretical sources and practical tools which entailed the development of the syllabus. The new "Digital Information Search and Find" syllabus is oriented at the pathway high school teachers who teach five study units (advanced level) of the leading subject "Digital Information Search and Find" and additional five study units in the "Information and Knowledge on the Internet" project. The first part of the syllabus presents its principles: the background for writing a new syllabus, fundamental principles that guided the syllabus writers. The second part specifies the foundations that organize the syllabus, its central ideas and concepts, universal and unique values which the teaching aims to nurture. The third part illustrates the ideological perception of the syllabus and the theoretical models in which the syllabus is grounded. Moreover, the key competences and skills that students should acquire as well as preferred teaching methods are described.

Keywords: syllabus, 21st century competences, informatics, cyber, computers, STEM.

I. INTRODUCTION

Up-to-date policy documents ICILS and the international IEA organization (The IEA International Study of Computer and Information Literacy) have been reviewed. This review clearly indicates that at the beginning of the 21st century, the goals of education in general and of computer sciences in particular shift from underscoring disciplinary knowledge of facts to in-depth understanding of scientific ideas and concepts and to high order thinking integrated with informatics.

The new syllabus provides students with innovative knowledge and tools for the purpose of understanding and implementing multi-lingual advanced Cyber retrieval, while emphasizing the development of creative awareness and Cyber informatics (Dede, 2010; Chai & Kong, 2017, Lavonen & Korhonen, 2017).

Today, people are required to know how to search for new knowledge, understand it, be able to distinguish between reliable and unreliable knowledge. Furthermore, they should use the new knowledge in a variety of ways and situations, work as a team in order to solve complicated problems, demonstrate inter-personal cooperation and create new knowledge. The changes facing us in the 21st century considerably affect the educational goals. The vast quantities of information which are frequently renewed as well as innovative technologies which render this information accessible to everyone, change the way we perceive the role of school. To these are added the changes which the labor markets around the globe are undergoing. Examination of the demands of the labor markets in countries with developed economy shows a sharp decrease in positions requiring low cognitive skills and a steep increase in the number of jobs requiring high level thinking skills (Ananiadou & Claro, 2009; Liyana & Noorhidawati, 2017; National Research Council, 2013; Zeichner, 2018).

The informatics syllabus is designed to reflect these demands while highlighting the importance of the students' cognitive skills. People should be able to make an extrapolation on the basis of what they know, apply information in new ways or new situations and create new knowledge (Schleicher, 2010). We are living in the age of Big Data (a database whereby many data are unorganized). Firms collapse under the burden of information and need people who will organize it, deriving data and drawing conclusions. Studies indicate that one of the professions in demand will be evolution of the business analyst – referred to as ‘data scientist’. Informatics is perceived as the language of technology which serves for the description and comprehension of information and knowledge structures, links and processes.
As a language, this profession enables problem solution, knowledge representation and processes formalization. Consequently, it supports the understanding of technology and scientific-technological development and its principles are applied today for scientific and engineering work in many areas (Fraillon, Ainley, Schulz, Friedman & Gebhardt, 2014).

Cyber informatics can be characterized as a trend using a language that facilitates the finding of formal information about processes, information representation and problem solution. On the other hand, there is a certain similarity between informatics and humanities. Hence, the syllabus enables learners to understand the empirical and academic principles underlying the digital information search and find as well as principles of critical and creative thinking (Binkley, Erstad, Herman, Raizen, Ripley, Miller-Ricci, & Rumble, 2012; Bohannon, Arnett & Greer, 2017).

Moreover, engagement in cultural, value-oriented and social issues in the digital space might increase the social, ethical and cultural awareness of those who learn it. The syllabus aims, among others, to encourage students to become leaders of tomorrow in the world of science and technology. The learning subjects attribute inspiration to science, engineering, technology, emphasize creativity and nurture life skills (Voogt, Erstad, Dede & Mishra, 2013).

Dealing with cultural, value-oriented and social issues in the digital space and the ability to explore by means of varied research tools exposes the students to problem solution processes, starting from their analysis and up to their actualization by varied tools. The students are required to implement cognitive processes, both on a high abstraction level that relates to understanding the problem and on a low abstraction level on the way to solve the problem. Thus, the syllabus allows development of high order thinking skills, awareness of abstraction levels as well as critical reflection capabilities for understanding the solution process and assessing it. Modeling and abstraction are demanded from the learners so that they can implement them also in numerous areas of knowledge (Csapó & Funke, 2017; Fraillon et al., 2014; Zeichner & Zilka, 2016).

III. DELIBERATION TEAM – OPERATIONAL WAYS

PROLOG

In the 2016 academic year, a steering committee was set up in the Information Technology department of the Ministry of education, headed by Dr. Avi Cohen, Inspector-in-chief of computers and information technology and Dr. Orit Zeichner. The role of the steering committee was to advise the Science and technology Administration in outlining the syllabus policy for the teaching of cyber informatics in the education system. The deliberation team consisted of content experts in the office of the Science and Technology Administration in the Ministry of Education, content experts from the Intelligence and Industry Department and the IDF (intelligence division) cyber headquarters as well as academicians.

The meetings of the deliberation team were aimed then to discuss the implications and functions of the new "Digital Information Search and Find" syllabus. Three main points were raised during the meetings: a. The essence of cyber informatics and its place in the education system; b. The importance of Information Search and Find education and its objectives in the education system of the 21st century; c. Contents that should be included in a syllabus adapted to the 21st century. The discussion was oriented at writing a position paper that served informatics policy makers in general and writers of the "Digital Information Search and Find" syllabus in particular. The position paper constitutes a basis for the processes of developing the syllabus in the pathway. It presented the variety of opinions offered by the deliberation team members regarding the questions raised during the meetings about the new syllabus rather than one accepted opinion (American School Counselor Association, 2012; Liyana & Noorhidawati, 2017; Rubin, 2017).

The deliberation team met in the Ministry of Education and the university during the 2016 academic year. There were six meetings, each four hours' long. They comprised presentation of papers dealing with the areas of the discussion, a discussion in the plenary session. Moreover, there were discussions in small groups and the summaries of them were presented in the plenary session and integrated in the discussion among the members. Supervisors, in-service teachers, informatics lecturers, information management people as well as people from the industry and security bodies who are associated with the fields of information search and find and information on the Internet were all invited to join the deliberation team. The participants joined the deliberation team on a voluntary basis. The lectures and discussions were documented and professional papers that became part of the discourse were summed up. In fact, each of the meeting had its own title.

II. WORK PROCESSES

1. Setting up a subject committee – steering committees
2. Determining a position paper
3. Writing the syllabus, deciding the topics of the syllabus
4. Assessment methods
5. Teacher education programs and in-service training courses
6. Implementation in six schools
However, the conversation was fluent and frequently debated new topics or topics that have already been discussed in the past (Figaredo, 2017).

IV. STRUCTURE OF THE POSITION PAPER

1. Status of the subject in the education system and proposed ways for improving the teaching of the subject.
2. The syllabus and its implementation.
3. Changes and innovations in the teaching of the subject.
4. Assessment of accomplishments in the subject.
5. Teacher education programs and in-service training courses.

The experts team set up for developing the syllabus maintained that it is essential to use information technology in the education system of the State of Israel. The objective is to educate and teach the citizens of tomorrow to function in a changing world and to be competitors in the human society during the next 20 years. The continuous study by means of the information technology will improve our human capital, enabling us to continue maintaining our democracy, safeguard our ability to compete in the production and labor markets and facilitate self-development (Fukuyama, 2017).

The over-arching goal presented by the team during the meetings underscored the need for preparing a skilled generation that surfs the Internet and is capable of and interested in a life-long learning while exploiting the information technology. The syllabus of the pathway emphasizes the acquisition of information competences. Learning information search and find competences in the digital space is learning a multi-channel use of information, its gathering and processing. Teaching informatics combined with data security facilitates the development of independent learners who are self-motivated as well as the development of cognitive skills, learning competences and high self-image.

The perception presented here is well integrated with the perception of the report of the Supreme Committee for Scientific and Technological Education. The information technologies acquired through the syllabus are meant to serve as a tool for inculcating learning skills and competences among learners, teachers and teacher-educators by impacting the teaching and learning processes, syllabuses, learning outcomes and learners' assessment methods. (Scardamalia, Bransford, Kozma & Quellmalz, 2012; United Nations Educational, Scientific and Cultural Organization, 2011; Voogt & Roblin, 2012).

The new goals manifested by the new syllabus are:

- Enlighten and clarify the relation of informatics to everyday life, various technological applications and additional areas of knowledge and interest.
- Respond to the increasingly growing need of individuals and of society to better understand value-oriented, social and cultural issues that constitute part of environment, medicine and police issues.
- Provide an up-to-date and appropriate response to the training of intelligent people living in the age of developing knowledge.
- Satisfy the need for suitable manpower that will specialize in future in the field of knowledge in an academic, empirical and applied framework.
- Build an interesting and diversified syllabus that offers a variety of challenging and innovative topics, while inculcating principles of knowledge management, preservation of knowledge sharing and development for the good of the future, with an emphasis on scientific writing.
- Maintain a high level of flexibility and a constant renewal ability and encourage the use of the most innovative teaching aids.
- Build a syllabus that will be "the jewel in the crown", namely the leverage through which we will draw the students to study informatics and data security and evoke real interest in them.

The experts team defined the principles in which the syllabus is grounded.

Principles of spirals and sequences

The principle of teaching-learning in a spiral structure is one of the considerations for teaching the learning subjects detailed in the syllabus. The syllabus consists of five main subjects: coping with a foreign language, data security, Information and informatics, preservation of knowledge sharing and development. The Internet and social media - The key contents are repeated every year. However, at each new stage they are studied by addition, expansion and enhancement (Chu, Reynolds, Tavares, Notari & Lee, 2017; Figaredo, 2017).

Principles of relevance and authenticity

Another starting point for reference to the learning subjects specified in the syllabus is their level of relevance and authenticity to the learners.
The meaning of the studied material and its relevance and authenticity in the eyes of the students are meant to guide the teachers also in the choice of various information resources to be used during the teaching-learning process (Kramarski & Zeichner, 2001; Griffin, Woods, Mountain, & Scoural, 2013; Soulé & Warrick, 2015; Yates, Woelert, Millar & O’Connor, 2017).

**DESCRIPTION OF THE SYLLABUS COMPONENTS**

As part of the syllabus, the students experience a complex process of finding, retrieving and processing information until securing it on the web. This process requires a series of competences and tools that will allow the students to understand the various logics underlying the information databases, the optimal approach to databases combined with a sufficient ability to cope with them.

Furthermore, the students of the pathway experience information mining abilities based on advanced tools for "Big Data" analysis. An important element of the pathway is the process of distinguishing between what is primary and what is secondary, enabling the informatics practitioners/analysts to retrieve key messages and essential items. The pathway is designed for students who excel in multi-lingual pathways. They must have abstraction thinking capability as well as high level analysis abilities in the field of language and informatics and be willing to rise up to challenges. (Jenkins, Purushotma, Weigel, Clinton & Robison, 2009)

The pathway graduates who are high-achievers will be prioritized in admission to intelligence units of the Israeli army. The graduates can be integrated as social media managers in a variety of workplaces: different marketing companies, organizations, education institutions, learning institutions, public relations offices, advertising agencies, consultants and tutors to managers in these areas, quality assurance in various firms, employee recruitment institutes, interaction with the world of labor and employment and so on. Alternately, these graduates can continue their studies towards a Bachelor and Masters degrees in the subjects of social media, the Internet, information and informatics systems or information and communication technologies.

**Goals of the "Digital Search and Find" syllabus in terms of thinking development**

- Understanding of the essence of the information and its function in society.
- Specialization in the use of information and communication technologies.
- Ability to analyze information structures, develop management strategies and systems for the access and distribution of information.
- Capability to respond to information needs of different consumer groups.
- Research competences.

**Goals of the "Digital Search and Find" syllabus in terms of values**

a. The students will identify information and knowledge in the cyberspace. These will help them to make use of what others have learnt and done and thus they will always be able to have a better starting point.
b. The students will effectively and efficiently share information and knowledge with their near surroundings (tight relations: friends and acquaintances in various circles) and distant surroundings (loose relations: people in the cyberspace) in order to respond to the challenges that they are facing.

c. The students will organize the extensive information and knowledge at their disposal in a way which allows them to find the information and knowledge whenever they need it, in spite of their vast scope.

d. The students will contribute to themselves and to the community in the preservation of past heritage and knowledge of the experts around them.

e. The students will acquaint themselves with tools and competences of empirical and practical development of new information and knowledge for their own benefit and for that of the people around them. They will also analyze cultural, social and value-oriented issues in the digital space.

**Digital Information Search and Find: The Syllabus**

**Technology Pathway**

**Cyber Informatics**

Specialization subject

Leading subject

Introductory subject

Information and knowledge on the Internet

Information analysis and finding

Additional foreign language

See study units

Final project

Information analysis and finding C

Information analysis and finding B

Information analysis and finding A

**Information Analysis and Finding A – 2 Study Units**

This unit constitutes the first part of the "Digital Search and Find" syllabus as part of the leading subject "information analysis and finding". This unit consists of 2 study units.

The time required for learning the unit is 120 learning hours, 60 laboratory hours which include 2 hours of experimentation per week.

The unit subjects: coping with a foreign language – contents and themes of languages, syntax, morphology, introduction to machine translation; information and informatics – information sources, information finding, info-ethics.

The Internet and social media: development of the Internet, sharing on the net, channels in the media, preservation of knowledge sharing and development – from data to information to knowledge, knowledge sharing, preservation of past knowledge for the good of the future; information and communication technologies – personal computers, working with documents, Internet technology, structure of the Internet, introduction to security.

**Information Analysis and Finding B – Laboratory Unit**

This unit constitutes the second part of the "Digital Search and Find" syllabus as part of the leading subject "information analysis and finding". This unit consists of 1 study unit and is defined as laboratory unit. The time required for learning the unit is 90 laboratory hours which include 3 hours of experimentation per week.

This unit deals with the production of a project for submission. The subjects of the project will be chosen from the students' world under the guidance of the tutoring teacher. The students' work will manifest capabilities of text analysis, information analysis and knowledge usage and sharing.

Experimenting with the submission of the portfolio – at the end of this unit is an important element in the understanding of the subject and its implementation. Content experts should be invited to the classrooms. These experts will share with the students their actual experience in managing a community, analyzing/developing an application which allows in-depth engagement in various cultural, value-oriented and social issues.

Frontal lectures, discussions in the computer lab and in the classroom, guest lecturers, experimentation with existing applications. It is recommended providing examples and clear instructions for executing the project. Throughout the entire syllabus, Hebrew, Arabic, English, Mandarin, Japanese, Persian, French and other foreign languages should be used in an informed and integrated way. See comment relating to this topic in the "General didactic comments" appendix. Choice of the subject for learning and experimenting in the lab should demonstrate one or more of the following:

1. Text analysis
2. Information analysis
3. Knowledge preservation and sharing
4. Behavior of Internet users.

**INFORMATION ANALYSIS AND FINDING** – 2 STUDY UNITS, MAKING UP A TOTAL OF HIGH STUDY CREDIT

This unit constitutes the third part of the "Digital Search and Find" syllabus as part of the leading subject "information analysis and finding". This unit consists of 2 study units – making up a total of High study credit. The time required for learning the unit is 180 learning hours, 60 laboratory hours with 1 recommended experimentation hour per week.

The unit subjects: coping with a foreign language – advanced machine translation, text patterns analysis, drawing information and informatics conclusions – search engines, information area, external and internal accessibility; Internet and social media – Internet applications, digital consumption, promotion on the Internet, preservation of knowledge sharing and development – covert information to overt knowledge, development of business and organizational knowledge, mapping personal, organizational, business, security and social knowledge needs; information and communication technologies – defense and attack in the cybernetic space, entrepreneurship and information security in the organization.

**INFORMATION AND KNOWLEDGE ON THE INTERNET – FINAL PROJECT – THESIS – HIGH STUDY CREDIT**

This unit is a specialization subject and consists mainly of a final project of additional High study credit in the "Digital Search and Find" syllabus. The time required for learning the unit is 180 learning hours and 270 experimentation hours.

The unit is designed for consolidating all the learnt knowledge into practical actualization. After finishing the studies of the subject, students will be able to specialize and implement a project in the studied field. They will define a research question, initiate practical activity associated with the learning subjects and materialize the knowledge studied in the syllabus. The students will distinguish between different information items and assess their significance. The students will document the stages of their work as is customary in the academia.

The final project will focus on the following subjects: coping with a foreign language, information – research, the Internet and social media, collaboration on the Internet, security and cyber, entrepreneurship and information security in the organization.

**OUR FUTURE ACTIVITIES:**

National conferences with the cooperation of industry sector
Teachers and students conference at the Indigence army unit.
Conference of Ort pathway opening
Teacher workshop at the national library
Course for leading teachers
3 cycles of teacher in-service courses
Collaboration with hi-tech and knowledge management people
Teacher mentors from the field of knowledge management
A website for every teacher
Lectures, workshops and tasks for students

**THE SYLLABUS RATIONALE**

**THE IMPORTANCE OF ENGAGING IN INFORMATICS**

People engaged in intelligence work need to be familiar with the information "ocean", while understanding the various logics underlying the databases. Abilities of information mining based on advanced tools for the "Big Data" analysis are necessary in an era whereby online information is available to everyone. Above all, the mainstay of the intelligence process is the distinction between what is primary and what is secondary. Such distinction will allow those engaged in intelligence to retrieve main messages and principal items.

Internet information and knowledge as a leading subject in the pathway is a central area with many implications for other areas. Information analysis and finding is perceived as the technology language used for describing and understanding information and knowledge structures, relations and processes. As a language, this subject facilitates problem solution, knowledge representation and processes formalization. Hence, it supports comprehension of technology and scientific-technological development and its principles serve today in informatic and scientific work in many areas. (Ananiadou & Clar 2009).

The syllabus emphasizes among others the cultural, value-oriented and social issues in the digital space, social networks analysis, information leaks on social networks, for example dissemination of disease-related information on social networks (Bell, 2010).
Every intelligence process is grounded in a layer of information items. Throughout the years, the databases reservoir available to intelligence practitioners is growing. As part of this process, the information finding, retrieval and processing turn into intelligence knowledge, into a more complicated and complex procedure. This process requires a series of competences and tools that will allow intelligence practitioners an optimal access to databases as well as a sufficient ability to cope with them.

According to the Chambers dictionary (1999), intelligence is defined as:

1. News or information
2. Army corps or police division responsible for gathering information.

Intelligence work is based on information gathering in order to be aware of our challenges, threats and enemies and to provide a consolidated and reliable intelligence evaluation. For that purpose, we have to gather varied and representative information to support any decision we make. From this perspective, intelligence work has not changed very much over the years. The methods have obviously changed and with them the technology and perceptions. However, intelligence has essentially remained a work of information gathering and analysis. The significant change which has been more emphatically experienced in recent decades, is in the information itself – its scope and nature.

First and foremost, the quantities of information with which we have to deal every day have considerably increased. We are living in an era of information explosion – overwhelmed at any hour of the day by indefinite number of information items from different media and different sources. Posts on Facebook, tweets on Twitter, messages on WhatsApp, mails and text messages are but a few examples of the digital information which surrounds us during the day. The ability to orient ourselves in this digital ocean, extract the information appearing in it and retrieve the information details which are of interest to us is one of the essential competences in the 21st century (Griffin, & Care, 2014). The burden of this information affects all areas of our life and we are required to deal with it in our personal life as well as in our work and studies. When we gather information for a certain need – writing an assignment, making a personal or professional decision, writing an outcome at work – we must adopt other methods of information searching. We have to know how and where to find the information (Häkkinen, Järveli, Mäkitalo-Siegli, Ahonen, Näykkki & Valtonen, 2017; O’Sullivan, & Dallas 2017).

The vast quantities of information come from varied sources and in varied formats and shapes. In the past we used familiar and relatively close databases, such as archives, reservoirs of information papers, news sites and more. However, today, the information can be found anywhere and it is almost always accessible on line. The Internet encompasses information which does not always come in the form to which we are accustomed – information can be part of a post on a social media. Important and reliable information can be found in Internet videos or in photos. Information relevant to certain disciplines might be structured in databases and in tables. The information is not always textual and therefore access to it is not as intuitive and simple as we have been used to see. Modern information sources and new information types might provide us with a more representative and more authentic information when for example we wish to examine social issues about public opinion. Discourse in the social networks might be for us a "sensor" for what is transpiring in the field. Obviously, we have to thoroughly check the reliability of the information in the social networks. However, this information is the most up-to-date and of first hand and it being updated in real time immediately following the publication of a certain event.

The more extensive and diversified the information is, the harder to assess its quality and reliability is. Everyone can upload information on the Internet, even if they are not qualified in the subject of the information. Moreover, purposeful and intentional or political use might be made on the Internet in order to influence the public opinion. How then are we to know whether the information we find on the Internet is reliable and well-founded? When we search information on the Internet, we have to define the criterion for the quality of the material we are looking for: Where does it come from? When was it uploaded on the Internet? Who uploaded it and what is the background of that person? In which site or forum the information is found? Is there any reference or bibliography attached? How is the information formulated? All these and other details could help us realize whether the information is reliable and whether we can rely on it for our own needs (Hesse, Care, Buder, Sassenberg & Griffin, 2015).

Within the framework of the "Information Search and Find" syllabus, the students are required to learn an additional foreign language. The challenge of the language; In the global age in which we are living, information items which might interest us originate in different places around the world and they are written in various languages most of which are not comprehensible to us. In fact, much of the information on the Internet today is available also in English.
Nevertheless, we have to understand that in order to gather reliable and authentic information we have to deal with information in the relevant language of origin. For the purpose of exploring the issue of refugees in Germany, we have to deal with materials in German and Arabic, side by side with materials in English. In order to investigate the rivalry between North and South Korea we must deal also with materials in Korean. Materials written in the original language are the most representative for examining a certain topic, particularly when a social, cultural and value-oriented issue is concerned. When coming across information from social networks or forums, the language challenge becomes even more complex. In such sources, the language in which things are written or said is not literary and formal. The spoken language is frequently used on the Internet, making it even harder to understand the information, even if it written or said in languages which are familiar to us.

The fact that global Jihad organizations have stormed into our life in recent years have made the intelligence challenge even more complex. These organizations recruit combatant members from different countries of the world who speak in languages which up to now have not been used for the consolidation of the intelligence. The recent technological development in the field of machine translation allows us to understand texts written in foreign languages. The quality of the translation is indeed far from perfect. However, acquaintance with the world of content and the use of such linguistic tools will enable better comprehension of the translation engine outcome.

These challenges oblige us to approach the information gathering differently. We have to refine our questions and elucidate what exactly are we looking for. We have to focus the question, breaking it up into sub-questions. We should understand precisely what are the sources in which we want to find the information and verify that we are using a variety of types and formats. We must carefully check the reliability of the information we find on the Internet, examining a series of criterions that characterize the information before we decide to rely on it. We must know how to formulate the question on the Internet and in which languages in order to find as representative information as possible. The information is around us all the time and in vast quantities. We only have to know how to choose the value-oriented and reliable information and use it for our purposes. These days this concerns a necessary competence that will help us in all areas of life and any framework in which we take part.

To sum up, the information search and find process is perceived as the technology language which is used for describing and understanding information and knowledge structures, relations and processes.

As a language, this subject facilitates problem solution, knowledge representation and processes formalization. Consequently, it supports the understanding of technology and the scientific-technological development and its principles serve today for informatic work and scientific work in many areas.

**THEORETICAL MODELS ON WHICH THE SYLLABUS IS BASED**

STEM is a wide reform movement conceived in the United States in the fields of science, technology, engineering and mathematics, aiming to cultivate a qualified labor force in these areas (Research Hannover, 2011). The main goal of the STEM education is the development of STEM literacy, namely the ability to implement the understanding of "how the world functions?" within and between the fields of science, technology, engineering and mathematics (Dede, 2010).

STEM literacy comprises four literacy types: • Scientific literacy: the ability to use scientific knowledge in order to understand the natural world as well as to take part in decisions affecting this world. • Technological literacy: the ability to use, manage, comprehend and assess technology. • Engineering literacy: the ability to understand the way by which technologies develop through the engineering process. • Mathematical literacy: the ability to efficiently analyze, give arguments and present ideas, formulate, solve and interpret solutions of mathematical problems in a wide variety of situations. Students who are STEM literate experience problem solution, analysis, presentation/sharing and technological competences (Bell, Morrison-Love, Wooff & McLain, 2017).

The CEPS Research Report (2017) recommended a series of measures designed to improve education in the STEM areas. Such education is a means of nurturing a culture of innovation and support of the next generation of inventors that will facilitate the shaping of the nation's future in the globalization and technology revolutions of the 21st century.

One of the central areas is **Technology**. This area deals with human innovation that is changing the natural environment. It involves knowledge and processes with the purpose of developing tools and systems for solving problems, responding to human needs and wishes and extending human capabilities. Changing the natural world is done by means of various approaches and processes, such as: problem solution, research and development, invention, innovation, experimentation. The STEM movement indicates that technology is part of human culture and it enables us to enhance our abilities to change the world. Technology is defined as a process whereby people adjust nature so that it matches their wishes and needs. Informatics is included in the field of technology.
Thus, teaching should focus on the entirety of methods and processes beyond the teaching of the disciplines themselves, enabling the development of new knowledge.

**HORIZON REPORT 2017**

The computer, communication and Internet technologies have generated meaningful changes that affect the way we learn and teach. The Horizon Report (2017) - presents technological trends that during the next five years will impact education. Moreover, it presents examples of existing and future educational applications. The report illustrates among others new educational methods, i.e. project-based learning (PBL) and challenge-based learning; in-depth learning approaches, namely delivery of extensive core content to the students in innovative ways, allowing them to learn and then implement what they have learnt. Project-based learning, problem-based learning, inquiry-based learning, challenge-based learning and other methods encourage more active learning experiences, both inside and outside the classroom. Schools welcome more the use of technologies such as tablets and smart telephone devices that in any case are used by the students, leveraging them in order to link the syllabus to real life. These active learning approaches are mainly oriented at the students and allow them to decide how to deal with the learnt subject, engage in brainstorming and solve urgent problems on the local and global level. It is anticipated that on the basis of these approaches learners, who connect what is being studied at school to their private life and the community in which they are living, will enjoy learning more and will be more involved in it. (Johnson, Adams Becker, Estrada, Freeman, Kampylis, Vuorikari & Punie, 2014).

The co-learning approach of both students and teachers is increasingly prioritized at school. It mainly relates to the question of how to encourage adoption of an educational technology. A transition from perceiving students as consumers to perceiving learners as creators. The focus of the pedagogical practice is changing today in schools around the world. Students in varied disciplines learn through practice and creation rather than by the consumption of a simple content. In recent years, creativity has been manifested by an increase in the number of self-produced videos, appearance of ‘makers’ communities and crowdfunding projects. It is becoming more and more an active and applied means of learning.

**THE CHAMSA MODEL**

The researchers Cohen and Bruria (2010) suggest exploring the issue what should be taught from now on. What should children be taught now that will help them later in life, in an age of a changing world.

The model comprises five types of language (Chamsa) as follows:

"*Our language*" – includes subjects such as literacy, language as a culture, heritage, history, geography, bible and Talmud studies and other subjects of this kind.

"*Their language*" – means knowing the other, our fellow man, conducting a discourse with the religious, secular, Arabs and Jews from different circles and any member of another culture without posing a threat to their first language.

"*Mathematics language*" – a way of thinking that requires accuracy and unambiguousness and constitutes a basis for sciences in particular and for all the disciplines which attempt describing and decoding the reality.

"*Culture, body and soul language – Physical education and art*" – contents and activities based on a proven empirical relation between engaging in sport and in various types of art and academic achievements.

"*Technology language*" – the simple definition of the concept “technology” is everything that is manmade. In recent years this concept has been increasingly used and it has been implemented in various contexts: technology of objects dealing with the manufacture and application of instruments, machines, tools and other inventions as well as information technology that concentrates on research, knowledge and inventions.

Education and thinking in the environment of the computer and the Internet in the open cybernetic space are particularly relevant when we relate to high order thinking and the ability to experience processes and apply creative thinking.

Moreover, we should remember the values. Not as a separate language but rather as an inherent part of the engagement in the above-mentioned languages. Dealing with values, their formulation, examination and implementation is a natural part of language studies and school culture. We concur about some values which are relevant to all of such, i.e. granting social equality, aspiring to excellence and exhausting our potential. Some other values are unique and entail typical dilemmas in every language separately. The school management and teacher community are free to discuss these value-oriented issues like any other issue, implementing them according to their unique needs.

**PEDAGOGICAL PRINCIPLES**

The principles of the constructivist approach to learning. According to the constructivist approach, learners construct knowledge in their mind through a deep approach to learning with the help of the teacher.
Learning-teaching processes make use of varied teaching methods in order to adjust them to the different learners and in order to evoke interest and motivate independent learning and inquiry learning. The students are active partners to the knowledge creation process – knowledge structuring.

Using diversified information resources, simulations and computerized models, databases and computerized learning materials, relevant articles from newspapers and news from other communication media (Voogt & Roblin, 2012).

Using a concepts map, critical reading of a scientific paper, executing projects and inquiry learning.

V. KEY COMPETENCES AND SKILLS

The key competences and skills required for information search and find studies are developing while learning the syllabus and are addressed throughout all the years of learning it. During the first year, the students develop a certain competence on a basic level and by a gradual procedure and with time their level of performance and control is improved (Goos, Vale & Stillman, 2017; Rubin, 2017; Wadmany, Zeichner, & Melamed, 2014).

A Big6™ Skills Overview –

The competences specified below are emphasized and enhanced while learning the subjects of information analysis and finding A-C and in the project unit, High study credit of information and knowledge on the Internet.

ESSENTIAL COMPETENCES FOR RESEARCH STUDIES OF CULTURAL AND VALUE-ORIENTED ISSUES ON THE INTERNET

- Developing thinking that comprises a distinction between what is primary and what is secondary as well as the ability to link them while understanding that the behavior of the microscopic world accounts for occurrences in the macroscopic world.
- Developing an ability of written expression.
- Understanding the development of an occurrence on the Internet and the relation to theory.
- Developing an abstract perception of concepts in the world of the Internet and the social media.

- Competences of reading a scientific text, its understanding and critical assessment
- Identification of main ideas.
- Ability to ask questions emerging from the text.
- Ability to distinguish between fundamental assumptions, hypotheses, findings and conclusions.
- Ability to check compliance between different forms of information representation (verbal, numerical, table, graphic representation)
- Ability to examine a connection and match between data and findings.
- Ability to examine a connection and match between experiments and conclusions.
- Ability to formulate answers to questions about the topic discussed in the text.

- Competences of informatics – find, classify, process, represent information and present it
- Finding information – searching for scientific material in the library, databases and on the Internet.
- Being able to scan the information by a quick scan.
- Classifying information – ability to examine the information level and reliability.
- Processing and representing information – ability to process the material in an intelligent manner and represent the new insights while using the tools available in the digital media.
- Reflecting critically and judging the conclusions – ability to critically assess the quality of the information.
- Presenting the final product – ability to present the outcome (poster, lecture, written assignment) in an informed manner.

Comment: the abilities of critical reading of a translated text, forums, blogs and chats are part of informatics skills.

VI. SUMMARY AND CONCLUSIONS

We have presented above the process of developing a new syllabus for the matriculation, entitled cyber informatics. The paper is based on an action research that describes collaboration of educators, academicians and industrialists in the development of a syllabus. The paper presents the theoretical sources underlying the syllabus. Then the components of the syllabus are specified according to the subjects: information and communication technology, the Internet and social media, preservation of knowledge sharing and development, coping with a foreign language, information and informatics. We have emphasized the importance of teamwork in the design of the syllabus.

To sum up, collaboration between schools, academic institutions and content experts from the industry sector can be enhanced by means of an action research.
Collaborative thinking of these bodies encompasses many opportunities for success and implementation of syllabuses. We recommend supporting collaboration between researchers, teachers and academicians for the purpose of promoting syllabuses suitable for the 21st century.

REFERENCES


