Utilization of Web-Based Services and Applications for Educational Purposes in Vocational Education and Training (VET)

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Abstract—This paper introduces new web-based tools that can assist the teaching of Informatics courses in a Vocational Education and Training (VET) environment. In order to be able to utilize these tools for educational purposes, a web-based information system needs to be created (analysis, design, implementation, check). Such systems take advantage of already available on-line software which does not require an installation on a localized server, i.e., the installation of software at the individual school Informatics laboratories. This approach meets the educational needs of the courses, and avoids possible costly in terms of time and resources malfunctions. The tools we introduce can thoroughly cover the educational needs of modern Informatics courses which are taught during Vocational Training in accordance with the analytical schedule of the last three grades of Lyceum as well as afterwards.

Index Terms—VET, Educational Resources; Informatics Innovative Learning Methods; Laboratory Practices.

I. INTRODUCTION

The Informatics study program in the field of Vocational Education and Training (VET) in Greece is divided into two separate categories. The first one can be characterized as practical or lab training and consists of a particular and predetermined sequence of events, observations, and representation and interpretation of informative data as well as principles of applications’ operation. This entire process takes place in the labs of Laboratory Centers and it is supported by Vocational Lyceums, by the fourth year of apprenticeship and by Public Institutions of Vocational Training. The regulatory framework of the Computer and Informatics Technology’s laboratory is described in http://www.etwinning.gr/files/1161677398kanonismos_sepe.pdf. The second category is of a more theoretical approach. It covers algorithmic formulations and mathematical models or equations that are partially presented during lab courses when needed. The “spine” of this category includes the various theoretical courses. According to the aforementioned division, the majority of Vocational Training courses include a variety of cognitive fields. The course of learning that is followed each time varies from lab to lab and even from instructor to instructor.

The learning goals of this course include the development of skills which are necessary in the fields of Science and Informatics. The study of Informatics subjects can lead to a better future and broaden the already wide range of labor integration, by providing innovative and intriguing career opportunities, as international studies indicate [1]. The different strategies that aim at the development of various Informatics scientific fields are designed to prepare specialized technologists who will either continue their studies and acquire a higher level of education, join the fourth year of apprenticeship or get employed based on the skills they already have.

From an educational point of view, there needs to be an introduction to a teaching system followed by proper infrastructures as far as the laboratory equipment is concerned, so that the student can be introduced to the principles and functions of Informatics, within a predetermined time schedule. As Gurstein wrote [2], Information and Communications Technologies (ICT) are the essential means of production in an information society. The instructors are responsible for designing and organizing the right context for this plan to be accomplished. During the first years of study when the students get acquainted with the “reality” of Informatics, all the various scientific fields defined by the term Informatics should be introduced and approached so that the respective educational context can be created.

Through the open platform of the Internet the visions that opened the research area nearly 25 years ago of the potential of physical information in a connected world to enrich our lives are indeed at our fingertips [3]. Almost everyone uses and benefits from the Internet. Worldwide research activities in education have proven that implementing enhancements improves the learning process in many different ways, such as the promotion of the students’ cognitive abilities, the acceleration of memorization and learning and the alleviation of understanding of abstract, micro and macro entities [4]. Businesses, organizations, universities and schools utilize the World Wide Web, the most widespread application, in order to retrieve information, cooperate with a third party and communicate thanks to the existence of a vast variety of technologies and infrastructures. As the Internet and the Web evolve, the usage of applications and development environments becomes easier and without the need of installing software on a localized server. Modern platforms support Model Driven Development (MDD) and team collaboration, facilitating the rapid development of advanced applications in the cloud [5].

There is no doubt, at the present stage that both educators

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and students can benefit from the technology of online software. As Kotevski and Tasevska suggest [6] all the primary and secondary schools must obtain a high speed Internet connection that is necessary for real time online access. Teachers have at their disposal a large amount of educational software which is available at any time and to every computer with an Internet connection. Our training program’s flexibility must change its requirements in response to the changing environments and merits the attention of programmer engineers [7]. Thus, many bureaucratic procedures, required for the acquisition of such software, can be bypassed. We can achieve the eradication of preservation and maintenance of cutting-edge technology on a localized level (e.g. research and educational software, new processors, higher capacity memories). The Web allows the usage of applications and resources that are not available locally and, as a consequence, we can use any computer, with rudimentary potential, to aid our cause [8]. As a result, an immediate reduction of expenses required for the upgrade and maintenance of hardware and software of lab computers (motherboards, hard drives, memories etc.) can be achieved. The students on the other hand, are able to enrich their knowledge and experience especially regarding interaction with a plethora of software while doing their schoolwork, even outside the school environment, and also to cooperate with groups of students from different schools. In addition, the software that is proposed for use in this paper can be accessed and utilized regardless of time and space restrictions through any portable device with an Internet connection, while educators and students can easily access their data (notes, papers, photos, videos etc.) without the use of a temporary storage device (CD, DVD, USB flash drives etc.), but by just using the Internet cloud [9].

II. EXISTING STAGE OF INFORMATICS SCHOOL LABORATORIES

By analyzing the Internet’s circle of life, we can ascertain that it was initially used for the stationary publication of information and context through web-pages. Because of the high pervasiveness of the Internet, different synergistic consortia and businesses utilize it to trade goods and services. The initial purpose of the World Wide Web was to simply display information. In modern times, contemporary web-applications have become much more complex. Nowadays, web applications take advantage of the infrastructure of the Internet to redirect their function to every point of the world where Internet can be accessed. Web applications do not use the traditional client/server technology, but various Web technologies such as browsing programs and web servers. As a platform for the development of content and applications, the World Wide Web has been transformed into a multidimensional field where technologies and development models from various disciplines meet [10]. Such examples are Hybermedia, Multimedia, Databases, Software technologies, Network technologies, Human-Computer interaction etc.

The subject at hand becomes more complex if we take into consideration the speed of the Internet technology evolution and the manner in which the range of possible applications constantly broadens, thus increasing the complexity of the circle of life of the educational approach.

On the other hand, some models can create improvements within the existing education system, while others offer an alternative method outside of the traditional system [11].

The term web application or web-app is used to describe any software accessible through the World Wide Web. The aforementioned software is stored on a web server, and it is accessible and can be run by authorized users of a network such as Intranet or Internet. The most important advantage of that type of applications is that no installation, other than a browser (e.g. Mozilla Firefox or Internet Explorer) is required since they usually interact with a database. In other words, the web applications can be renewed and updated at will, without needing a programmer to redistribute and install software on each one of the computers owned probably by thousands of users.

Modern technology is an indispensable part of the educational process [12]. Computer labs are used in every level of education, offering a large amount and variety of educational and research activities [13]. The maintenance of those laboratories is a difficult, demanding and strenuous process which is necessary in order to ensure their regular function and through it, maximize the benefits of the use of the lab during the educational process. The regulation for the School Informatics Laboratory and Computer Applications of the Hellenic Ministry of Education, determines the institutional context of operation, management and maintenance of the above mentioned laboratories within the school units across the country [14]. This regulation highlights the multidimensional role of the laboratories, because during the teaching process they are used both by educators and students of different specialties and different needs. A single person is appointed as head of the laboratory in every school unit of Gymnasiums and Lyceums, as the aforementioned regulation commands. This person cooperates with the corresponding Center of Informatics and New Technologies. This person is charged with the management of the lab, the maintenance of the equipment as well as the necessary restorations after a software or hardware problem has occurred, so that the lab keeps functioning appropriately. Among other responsibilities, the head of the lab is responsible for installing and handling (updates, notifications, restoration) all the software packages used in the lab. Such actions can be performed either on every computer terminal or by using the lab server centrally. At the same time, he or she is required to keep backup files and files with important codes, check the validity of usage licenses and, finally, efficiently support the use of software that offers protection against viruses and other threats. Unfortunately, the existing condition of the Informatics laboratories is problematic and has to be handled by the chief of the lab, but also by educators and students. This situation could be caused either by not complying with the regulation’s requirements or by the following facts:

- computers are sensitive pieces of machinery that are vulnerable to breakdowns and damage, and
- since the progress in the field of Informatics is very rapid both software and hardware become outdated extremely fast.

On top of all that, we have to point out that there are omissions in the regulation itself, since no responsible

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professor is appointed for the maintenance of the Computer and Informatics Technology’s laboratories or for the renewal of equipment. Another noteworthy fact is that the computers of each school lab (even the computers within the same lab) may use different versions of software which are used and taught. For instance, the operating system of certain computers is Windows XP, while others use Windows 98, Windows 8, or Linux. At the same time, the computer labs across the country are equipped with hardware that differs regarding its capacity (http://edulabs.minedu.gov.gr/). This is the case, because schools have obtained their equipment from different companies, through different tender procedures and at different points in time when technology evolved in different directions. Therefore, it is impossible to install certain software packages in certain computers since their hardware is unable to support such programs.

III. NEW SUBJECTS AND RENEWAL OF INFORMATICS COURSES

According to the analytical study guide of Vocational Lyceums [15], students should obtain skills and knowledge based on the development of web applications with the usage of HTML, CSS, PHP and MySQL. The main purpose of these courses is to aid students to gain some essential knowledge and skills on the subject of Design, Development and Management of websites and web-based applications. The goal is for the students to get acquainted with the web-applications’ software setting and the corresponding technology as well as with the architecture of software development online. In general, a student is supposed to be able to report on the architecture of an informative system’s app and outline the interrelation between its various parts. The courses are practically-oriented and that is exactly why the school’s Computer and Informatics Technology’s laboratories should be regularly used, even for some theoretical courses. In the school lab and in the context of various activities, the students are granted the opportunity to use computational tools and techniques, to take action and experiment, to create and discover knowledge. The teaching and learning process should also be supported by the utilization of various educational tools, both printed and digital. To carry out the class activities and to support complex projects, the use of free software – open code software is recommended. By deploying every available setting and tool, and by keeping track of technological progress regarding their field, the students will be able to be employed in corresponding jobs in the future. Students should be able to:

- Recognize the basic terms of World Wide Web (web standards)
- Recognize the basic principles of designing and organizing webpages
- Evaluate a website regarding its aesthetics and functionality
- Design simple webpages by using HTML
- Recognize and utilize Cascading Style Sheets (CSS) to share a webpage
- Use text, graphics, animation, video, sound on a webpage
- Modify and update the content of a webpage
- Incorporate to the HTML code, scenario language code to enrich a webpage with interactive elements
- Manage the installation, usage and modification of a Context Management System (CMS)
- Utilize modern technology and tools as regards design and management
- Report on and outline web-apps used by databases on the Internet
- Recognize the necessity of database use when it comes to particular applications and web-apps
- Detect security issues regarding database applications and web-apps
- Point out issues/problems that arise because of the interconnection of databases with web-apps
- Discern and select optimal strategies regarding the management of certain matters
- Create dynamic web-apps using PHP and MYSQL.

IV. BENEFITS FOR THE EDUCATIONAL PROCESS

The localized software installation on several school lab computers creates many issues on multiple levels. Especially since there is a need to install various types of software on computers that utilize different technologies, as is the case of school computers laboratories, the process can be very time-consuming and takes away from the versatility of the educational process. The use of XAMPP (https://www.apachefriends.org/index.html) constitutes a solution which however is deprived of the use of realistic function conditions of an online server. Officially, XAMPP designers designed software as a tool to develop and test websites locally on the computer without having to connect to the Internet. When XAMPP is installed on the local computer, it manages the local host as a remote node that connects to the FTP file transfer protocol. XAMPP designers could not predict the current conditions and the available nowadays possibilities for web interconnections [13].

V. SUGGESTIONS FOR ONLINE TOOLS’ EXPLOITATION

In the context of Informatics courses, students should develop a web application by utilizing proper methodologies and tools. The Development of Web applications’ software should be perceived as a tool whose resources can be managed by using the right software available online for free. For the development of web-applications one also needs project manager tools and specialized software. Some indicative candidates from the categories that are mentioned above could be the “Gannter software” (https://gantter.com), the Zoho Projects management tool, (https://www.zoho.com/projects/), and other projects management tools like Aceproject (http://www.aceproject.com/) or Wrike (https://www.wrike.com/tour/ #getstarted).

A. Management of Informatics Projects using Gannter

Gannter (Fig. 1) provides software products without any need to purchase install it since it is available through a web browser.

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Students can design anything from a complex informative system to a simple webpage and they can easily manage it thanks to its online platform. Through the main screen, the user can input all the necessary tasks, define which are the major and which are the minor tasks, set the beginning and ending dates for each project, state the resources (employees and materials) needed and outline the relations among different projects. The users can easily save their progress on google drive, dropbox or onedrive.

The basic functions of Gannter include first and foremost the definition of the term Project. The management of actions can also be performed and the user can create a Gantt scheduling diagram, which is depicted in a specially assigned area. Another feature is an input area, for project-related actions and their characteristics (e.g. duration), as well as a statement of resources (employees and materials) and a cost estimate. Additionally, risk management regarding projects or actions is also available, since it is possible to determine the possibility, lever of security, cause, and rank of priorities. Finally, the user can modify and personalize the calendar by choosing between three calendar options (Standard, 24-Hours, Night Shift). Last but not least, progress can be easily saved (google drive, dropbox or onedrive).

B. Drawio Designing Platform

In order to analyze and design applications, students should create the diagrams necessary to depict different functions as well as the system structure. Various tools can be utilized for system development. Such tools are dia (http://dia-installer.de/), Ms Visio, Text Processors, Google Docs, e-portfolio software as well as several software packages useful for multimedia material processing and the creation of presentations. To create the diagrams, students can use dia (http://dia-installer.de/), draw.io (https://www.draw.io/), online diagram and flowchart software «Cacoo» (https://cacoo.com) or flowchart software «gemmy model» (https://www.gemmy.model.com/flowchart-software).

Draw.io (Fig. 2) is an online tool that can be used to create diagrams and provides most of the commonly used shapes. It also offers the possibility of layout designing on mobile devices and many other interesting schematic representations. Draw.io allows users to save their progress on Google Drive, Dropbox, or on a localized device.

Fig. 2. Online designing platform Drawio

Draw.io is a diagram processor designed based on Google Drive, which focuses on providing high quality diagrams while maintaining a high level of flexibility, reliability, security, availability and privacy. All the application data are saved on Google Drive and the model-diagram is directly transmitted between the browser and Google Drive. Draw.io operates exclusively using https sectors, thus utilizing the industrial encryption model SSL. We can create diagrams fast, easily, without needing to install any program and simply save our progress on Google Drive or Dropbox. A vast variety of schematics is provided, from the simplest to the most complex, such as database designing, and software systems model (UML).

C. Turbo.net platform

Turbo.net (Fig. 3) is probably the fastest way to run programs without the need to install them. More than 1000 applications of different categories are available. Turbo.net applications run in the exact same manner as any other application of the system. The only difference is that they are isolated in their own safe setting. This particular function prevents the apps from pitting against other apps of our own system. At this point, we have to mention that the free version of Turbo.net allows us to use up to 10 GB of storage space for online apps.

Fig. 3. Turbo.net online platform

Thanks to the Turbo.net platform, it is possible to use application development settings such as eclipse, Asp.net, and Netbeans. NetBeans (Fig. 4) is a successful open source research project that includes a large amount of users, and a developing society with nearly 100 associates worldwide. Sun Microsystems is responsible for founding NetBeans in June 2000 and continues to be the main concessionaire. NetBeans is an IDE setting formulation – a tool that allows programmers to write, compile, debug and develop their programs. The programming language used is Java, but the platform can support every programming language. There are also a large number of modules which further aid the expansion of the NetBeans IDE functions. NetBeans IDE is a free product, without any restrictions when it comes to the location where it can be used and can meet most of our educational needs.

Fig. 4. Online system for project management

Fig. 1. Online system for project management

Fig. 2. Online designing platform Drawio

Fig. 3. Turbo.net online platform

Fig. 4. Online system for project management
Free online infrastructures for web-applications’ development:

When students complete their apps, it would be very useful to install them on real function settings, so that they can check their functionality. This need can be covered by the so-called online hosting areas that are provided for free by virtual online servers (Fig. 5) such as https://www.000webhost.com/ and http://www.freewebhostingarea.com/. By utilizing these hosting areas, the students can use a language of online apps like PHP and create databases with the help of MYSQL, use a widely used operating system to manage the resources of an online server such as a control panel, manage their own domain name, manage their own webpages through a content management system, utilize FTP functions, and become acquainted with web-apps’ security issues. All the aforementioned services are provided by an online platform and no software installation or customization is required.

The main benefits from using this kind of technology is that students are trained under realistic conditions regarding the development and control of their app, thus acting as managers of their own system. Trainees can also learn how to work in an environment that allows the development of online informative systems with the help of MYSQL and by using the PHP language. At the same time, students become accustomed to a widely-used operating system used to manage on line services such as cpanel. Furthermore, students have at their disposal a development setting which can be accessed and used anywhere at any time and not just within the walls of the lab, thus eradicating any likely time and space restrictions. All those features can be available to every student if they obtain their own domain by simply signing up for free. Finally, there are even more benefits to using online applications since educators and chiefs of laboratories do not need to install or have already installed any additional software on the lab computers, thus reducing the time that educators devote to install, upgrade and update software.

VI. CONCLUSIONS

In order to create online applications, which are obligatory in the context of students of Informatics training in Vocational Lyceums, it is necessary to use a variety of software, programming languages, databases, creative diagrams, and web and application servers. These software packages need to be installed on a large number of terminals in a school laboratory and, as a consequence, various teaching, technical and legal issues may arise. These issues can be dealt with if we utilize web-based software since no installation is required. In this particular paper, we presented certain online platforms which provide handy solutions that make the educational process easier and have many more benefits as a result. In this case, i.e. when all the functions are web-based (anytime, anywhere, anyone), a higher degree of functionality in the teaching methodology can be achieved. It is also very important for every school unit to be equipped with broadband Internet and up to date software as our proposal mentions. Nowadays, educational systems put a considerable effort in order to enhance their educational processes and more effectively transfer the knowledge to their students. In the last couple of decades, the explosive development of the Internet and of multimedia technologies brought vast possibilities to implement these new paradigms with an aim to improve the students’ learning and more easily augment their knowledge and prepare them to tackle any future issues that may arise.

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