



Supporting the Teaching and Learning for Subject of Computer Sciences

Ana Ktona¹(✉), Anila Paparisto¹, Alda Kika¹, Verina Çuka²,
Denada Çollaku (Xhaja)¹, and Jezuina Koroveshi¹

¹ Tirana University, Tirana, Albania
{ana.ktona, anila.paparisto, alda.kika, denada.xhaja,
jezuina.koroveshi}@fshn.edu.al

² Ibrahim Rugova High School, Kamëz/Tirana, Albania
verinacuka@gmail.com

Abstract. Obtaining good knowledge in computer science area before university education is considered a necessity in the most developed countries of the world. Decision makers in Albania have embraced this initiative. Currently, in Albania, ICT education starts from the fourth grade of primary school. But, what difficulties do institutions and interest groups currently face in teaching and learning the Computer Science' subject? Secondary and primary data were analyzed to find the actual situation of technology used in High Schools and challenges the pupils and teachers face during teaching and learning the subject of Computer Science. It was found that currently there are some difficulties in using ICT in schools. As a result, the teaching and learning of Computer Science' subject, is affected. Is there any appropriate emerging technology that could be alongside school infrastructure to support the teaching and learning process of Computer Science? Such technologies used in teaching and learning were identified through analysis of secondary data. By analyzing primary' data we found that "Bring Your Own Device" policies in combination with learning technologies would be feasible in Albania. A prototype is made, by implementing a LMS with lessons and quizzes in one of the Computer Science' Area. The prototype was tested in one of the High Schools of Tirana District. The pupils and the teacher participating in the test expressed a very positive attitude regarding the effectiveness of the prototype.

Keywords: Computing education · Bring Your Own Device · Learning Management System

1 Introduction

Technology is driving major changes in the way people interact, work, learn and access knowledge and information [1, 2]. And furthermore, this power has been seen as a major and sustainable source in the development contribution of economic activity in every country [3–6].

The development power of technology has been well understood by policy decision maker authorities in Albania and is strongly emphasized the extended use and

penetration of ICT in medium-term Pre-universities and Digital Agenda' document strategies [7, 8].

Information and communication technologies are seen by the Albanian Government, as essential to enhancing the opportunities of economic development across the country [9]. Effects and influence of ICT implementation is extended on all social and economic sectors of the country [8]. During 2008–2013, a series of laws were prepared and adopted in compliance with the European Union standards [8]. Actually, the Albanian government is offering a series of e-services to its citizens resulting in the improvement of the general index of readiness for the electronic governance [8]. While in the field of education there have been investments for building up computer laboratories, internet network installation in schools [8].

Albanian Government, via its document on the “Digital Agenda’s Strategy 2015–2020” points out the need for more investments and attention for the ICT in education in order to provide a society based on knowledge and to widely increase the skills of ICT utilization [8]. The strategy stresses, also, that Albanian society needs to be prepared for new challenges which emphasize the acquisition of trends in information technologies [8]. While the strategy for the Development of Pre-University Education emphasises the need for the integration of ICT in teaching and learning in order for the educational institutions to prepare students to live in “a knowledge society” and to enhance quality [7].

Obtaining good knowledge in computer science area before university education is considered a necessity in the most developed countries of the world [10–13]. Decision makers in Albania have embraced this initiative. Currently, in Albania, ICT education starts from the fourth grade of primary school [14]. But, what difficulties do institutions and interest groups currently face in teaching and learning the Computer Science subject? Is there any appropriate technology that supports the teaching and learning process of Computer Science?

2 Methodology

Technologies used in teaching and learning were identified through analysis of secondary data. Secondary and Primary data were analyzed to find the actual situation of technology used in High Schools and challenges the students and teachers face during teaching and learning the subject of Computer Science. Study reports, guidelines and strategy documents from different sources like Ministry of Education, Sport and Youth, Ministry of Innovation and Public Administration, UNESCO, World Bank etc. were analyzed. Two online questionnaires which were distributed in Tirana’ High Schools were created one for High School pupils and one for teachers. These questionnaires were filled out by 294 pupils and 57 teachers where only 17 were ICT teachers. Also, interviews were conducted with 95 Computer Science students who were from almost all of Albania’s districts. A prototype is made, by implementing a LMS with lessons and quizzes in one of the Computer Science’ Area. The prototype was tested in “Qemal Stafa” High School of Tirana’ District.

3 Findings and Results

3.1 Actual Situation of Technology Used in High Schools

Knowing the development power of technology in every area, including education, different actions are undertaken by Albania Government to include ICT into the teaching and learning process. E-School program was introduced in December 2005 by the government [15]. Considered as a core component of the major initiative that the government has embarked on to include Albania into the digital age, the program' main objective was to create an environment in which students, both rural and urban, can learn the use of Information Technologies and communication [15]. Under the E-School program was made possible equipment with computer labs to all high schools and a considered number of schools in primary education, the connection of these labs to internet, training of ICT' teachers and started the improvement of the ICT curricula in pre-university education [15]. Pre-University Education Development Strategy [7] emphasized the priority of government on curriculum reform, which is expected to lead to the equipment of schools with a secure and functional infrastructure that provides opportunities for the use of digital content in the learning process. Aiming the students being prepared for the labor markets is promoted the extensive introduction of ICT in the teaching process. In this context a contemporary Computer Science curriculum is developed, aiming at enabling students to comply with European standards. This will be accompanied by the improvement of technological infrastructure and the support for internet connections in schools that are not connected to [7].

One of the main priorities set it up in the Cross-cutting Strategy for the Information Society 2008–2013 [15] was the implementation of ICT in education and knowledge spread. According to different sources the ratio computer per pupils is improved significantly. In 2006 the ratio was one computer per 61 pupils [16], in 2008 the number of pupils for one computer was 45 [15], in 2009, the number of pupils for one computer was 25 [16] and in 2015 the ratio was one computer per 27 pupils [8]. Some of the computers distributed in pre-university education are not functional. Even in the major part of the schools have a dedicated broadband connection it remains only in computer labs [8]. The spread of broadband connection all over the school will facilitate the utilization of different information sources.

According to Pre-University Education Development Strategy [7], Digital Agenda [8] and National Strategy for Development and Integration [9] ICT in Education and curriculum development and reform still remains some of the top priorities for Albania. One of the main objectives set it up in Digital Agenda related to ICT in Education is: "Digitalization of the education system in order to increase the quality of education and contribute in the establishment of a society based on knowledge through the increase of access into digital curriculums and the facilitation of their internet connectivity up to 100%" [8 p. 32]. Integration of ICT utilization in a contemporary level in teaching and learning remains the main step for a gradual transition toward a knowledge based society, is emphasized in Digital Agenda [8 p. 32]. The guideline, "Learning with Examples, Constructivism and Technology" [17] prepared by the Institute of Educational Development, supports this objective. This guideline' aim is the use of technology and ICT to improve the learning process through the implementation of modern

methodologies. It emphasizes that using technology in the classroom makes the teaching process more effective and more attractive when developed according to appropriate teaching theory and methodologies. This guideline brings concrete examples of effective technology integration through the use of appropriate teaching/learning methodologies for different curriculum subjects.

Albania government, with the purpose of supporting the country's vision for educational reform in the context of its national, regional, and international aspirations, had initiated in 2015 the Education Policy Review [18]. This review seeks to identify relevant policy issues, to conduct in-depth analysis, and to formulate evidence-based recommendations within three key policy domains including information and communication technology (ICT) in education. One of the ICT in education policy issues found in EPR is: "The lack of a stable, responsive and widely available infrastructure and digital learning resources hinders the use of ICT in schools" [18 p. 60].

3.2 Technologies Used in Teaching and Learning

Every year started in 2009 till 2017 reports from New Media Consortium and Consortium for School Networking were created with the aim to examine emerging technologies for their potential impact on and use in teaching, learning, and creative inquiry in schools [19]. Key trends like Collaborative Learning Approaches and Redesigning Learning Spaces, challenges like Improving Digital Literacy and Integrating Technology in Teacher Education and important developments like digital strategies i.e. Bring Your Own Devices practices or learning technologies like learning analytics and mobile and online learning are very likely to impact changes in K-12 education across the world not beyond that the next five years [20–22]. New Media Consortium and Consortium for School Networking reports [19] show evidences about implementations of important developments that have direct implications for K-12 education settings.

3.3 Feasibility of Emerging Technologies in Albania

As the analysis of secondary data found actually there are difficulties in using ICT in schools in the process of teaching and learning. As a result, difficulties arise in the implementation of Computer Science curriculum. Is there any key trends or important developments that could be used alongside to school technology in teaching and learning? Introducing emerging technologies in teaching and learning is a challenge even to developed countries [23]. What about Albania? Is there any emerging technology suitable to be implemented here? With the drop in prices for desktops, laptops and mobile phones, learning technologies like mobile and online learning and digital strategies like Bring Your Own Device looks possible for Albania. There are evidences that implementing BYOD digital strategy alongside to school technology allows students to have better access to technology in the classroom, a greater range of learning activities involving technology, and more useful and meaningful peer and teacher feedback [24].

Two questionnaires were created to find out the feasibility of implementing learning technologies or digital strategies. One of them was intended to be filled out by pupils. Some of the questions in this questionnaire are:

- Do you have any digital devices in your home? (See Fig. 1 for the graphic of the answers)
- Do you have internet in your home?
- Could you bring any digital device in school from home? (See Fig. 2 for the graphic of the answers)
- Do you use technology to help you with homework/projects?

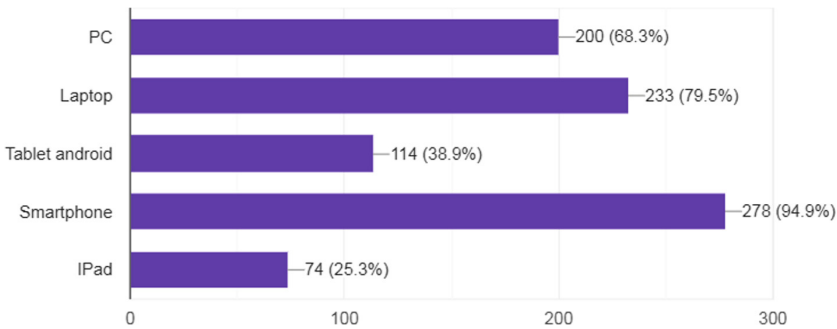


Fig. 1. Answers on the question: do you have any digital devices in your home?

Almost all the pupils answered they have internet in their home (97.3% of the pupils answered yes).

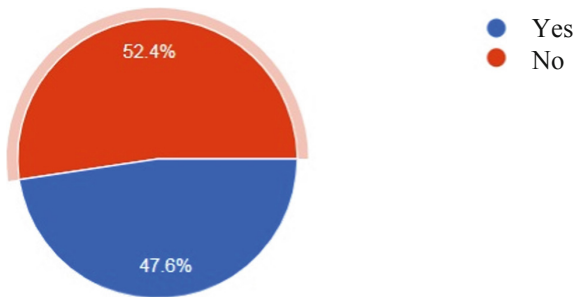


Fig. 2. Answers on the question: could you bring any digital device in school from home?

Almost all the pupils answered they use technology to help them with their homework/projects (99% of the pupils answered yes).

The other questionnaire was intended to be filled by the teachers. Some of the questions teachers answered were:

- How often do you integrate computer technologies into your teaching activities? (see Fig. 3 for the answers from ICT teachers)
- Please read the following descriptions of computer skill levels. Determine the level that best describes you. (see Fig. 4 for the answers from ICT teachers)
- Preferred Methodology of Teaching (see Fig. 5 for the answers from ICT teachers)

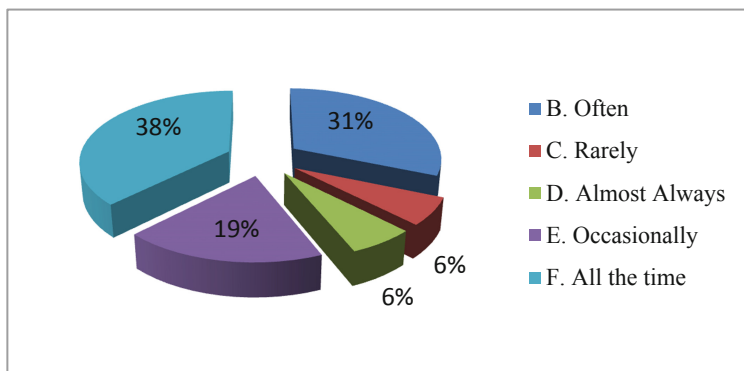


Fig. 3. Answers from ICT teachers: how often do you integrate computer technologies into your teaching activities?

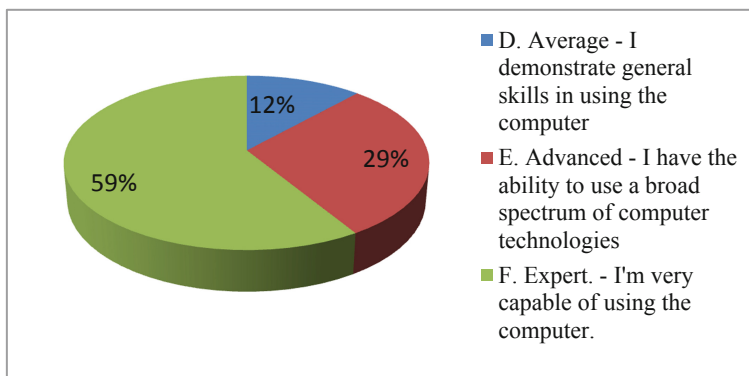


Fig. 4. Answers from ICT teachers: determine the level that best describes you.

The questionnaires were distributed in Tirana district. To get an overview of other districts in Albania 95 student that were from all over Albania’s Districts were interviewed.

Interviews were conducted by some of the authors with 95 Computer Science students, including students from study program Master of Science in Computer Science’ teacher, who were from almost all of Albania’s districts. The students were asked about their experience in High School on learning ICT subject. The objective of these

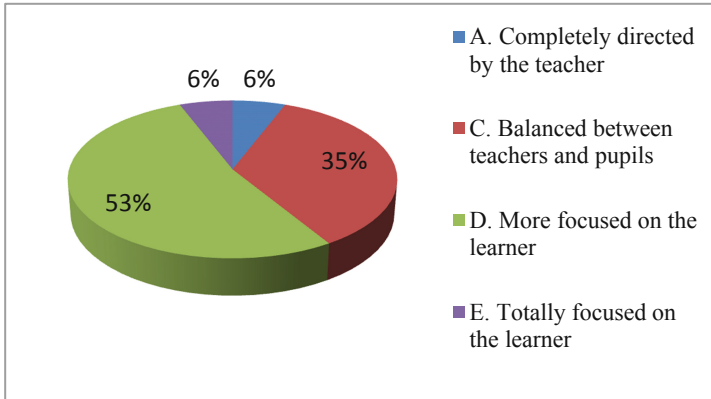


Fig. 5. Answers from ICT teachers: preferred methodology of teaching.

interviews was to get an information for all Albania's districts about technology used in High Schools and challenges the students and teachers face during teaching and learning the subject of Computer Science. Students from study program Master of Science in Computer Science' teacher were asked also about the situation they found, during their internship in the High Schools, about the actual situation of technology used in High Schools and challenges the students and teachers face during teaching and learning the subject of Computer Science. Their answers confirm the information we got from the analyze we made to secondary data and answers from questionnaires.

3.4 Solution

Pupils are familiar with technology and almost all of them have used it in the learning process. Although they have mobile devices (laptop, tablets smartphones) only 47.5% of them could bring their devices to school. A fully Bring Your Own Device strategy is not feasible but a combined solution BYOD strategy with mobile and online learning platforms it is because almost all the pupils have digital devices and internet access in their home. Teachers could upload the lesson that will be explained one day before in an online learning platform accessible by pupils. They could read the lesson and prepare for a discussion with a teacher. Pupils that could bring their devices access the lesson also in the class. The others can work with them in their devices, use the school technology or work in a traditional way in the class. To better manage the class we suggest allowing pupils to bring only a laptop in the Classroom. Other devices like smartphones or tablets could be used outside the class. As an online learning platform we propose a free Learning Management System. Lessons and quizzes prepared by Teachers uploaded in a Learning Management System, web-based systems that enable teachers and students to share materials [25], could be accessible from pupils via their devices or school devices. With such a system, teachers can create and integrate the course materials, assess and create personalized tests for pupils. LMS allows communication of learning objectives and organizes learning deadlines. Such systems distribute course contents directly to students and include both student progress and

assessment. Thus, pupils can see their progress in real time and instructors can monitor and communicate the learning effectiveness. Important for LMS is to try to create a simple communication between students and instructors. Such systems, in addition to facilitating online learning, tracking the progress of learning, providing digital learning tools and communication management, can be used to provide different communication functions. Introducing this solution for teaching and learning will modernize teaching methods [26].

A prototype is made, by implementing a LMS with lessons and quizzes in one of the Computer Science' Area. The pupils at any time and place can access and consult with the learning material. For any new material, added in the system, an email is sent. Materials can not only be viewed online but also downloaded directly from the site in order to have it stored in the device if there is no internet access. Most importantly, the tests are in the system and the result of the test is taken immediately as soon as it ends up seeing also the correct answers. The teacher also has many facilities, no worries as to whether or not the pupils have taken the teaching materials, and should not spend hours indefinitely manually correcting them. Teacher can look at the pupils' results in the system and through the reports that the system generates evidences the problems the students have and where the focus should be on their work.

The prototype is tested in "Qemal Stafa" High School in Tirana district. About 48 high school pupils from 10-th grade of the gymnasium "Qemal Stafa" participated in the testing. After creating the accounts for each of them they entered into the system to attend a one-hour class about the next topic they had in ICT subject. All the necessary materials, video (mp4) and power point materials related to the topic were uploaded in the system. By the end of the class-hour, students received a mini test with 5 questions on the topic, 100% of students reached the minimum target of the classroom.

The students and the teacher participating in the test expressed a very positive attitude regarding the effectiveness of the prototype and showed their commitment to involve them in this system.

4 Conclusion

Albania, as a lot of other countries, considers important to expose pupils to Computer Science knowledge since primary school and has developed a contemporary curriculum of Computer Science subject. Since 2005, different initiatives of Albania government, has improved the schools' ICT infrastructure in function of teaching and learning process. Although, currently there are some difficulties in using ICT during the teaching and learning process, which also affect the teaching and learning of Computer Science' subject. Important technological developments could be used alongside the school infrastructure to support the teaching and learning process. Bring Your Own Device strategy in combination with learning technologies was found appropriate for Albania. The prototype made, by implementing a LMS with lessons and quizzes in one of the Computer Science' Area, resulted interesting and productive. The use of appropriate technologies to support the teaching and learning process will introduce an innovative, more productive and more interesting way of learning and teaching. By combining these new technologies with teachers' pedagogical methods and tools, we

believe that the students' knowledge, attitudes, and skills will be increased. As a result, students and high school pupils will be more competent, as we are living in an information technology age and will gain lifelong learning skill.

5 Future Work

We will implement the prototype for three months in a High School of Tirana district to test it and improve it if necessary.

In the future, established incubators and cooperation with enterprises will support the use of Emerging Technologies in better teaching and learning by allowing investigation, acquisition, testing, prototyping, piloting, researching, and evaluation of emerging technologies that have the potential to transform education, enhance teaching, and increase student success and retention.

We strongly believe that on the long run time frame this will contribute on improvement on the labor skills of the Labor Market in Albania which in turn is fully in line with not only the Digital Agenda's Strategy of Albanian Government but the regional countries as well and even broader.

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