Engaging students in computer science with extracurricular projects – Oracle Academy Workshops in a Box use case

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Abstract - Today's students have been surrounded by information technologies since birth and most often have no patience to learn programming as it is commonly defined in the traditional curriculum. The modern Croatian Curriculum of Informatics in Elementary and Secondary School defines the learning outcomes and (with certain recommendations) is giving complete freedom and responsibility to the teacher in the design of teaching during which the students will achieve the anticipated learning outcomes. However, today's society and the national economy expect a growing number of educated professionals in the field of information technology, but it is unfortunately not happening. In addition to motivating students, different extracurricular activities can be provided by the teacher, as well as other stakeholders who may not specialize in teaching in cooperation with the school (parents, volunteers, sponsors ...). Taking into account the already implemented examples of good practice in Croatian schools, this paper lists examples of globally successful curriculum from Oracle Academy program, which are better known under the name Workshops in a Box. The paper also presents a short survey on the current implementation of computer science extracurricular programs in the Croatian schools.

Keywords - Extracurricular projects, Oracle Academy

I. INTRODUCTION

According to the definition [1] the extracurricular activity is related to officially or semiofficially approve and usually organized student activities (such as athletics) connected with school and usually carrying no academic credit. However, today's extracurricular activities in the area of European education include the most diverse areas of arts, science, entrepreneurship, civil society and citizenship education [2]. In addition, the European Union promotes and finances the cooperation of educational institutions and other stakeholders in the development of various extracurricular projects as well as the exchange of good practice examples through the Erasmus+ program. Key Action 2 [3].

The transformation of the global economy in the 21st century has had an impact on the additional demand for staff from the Science, Technology, Engineering and Mathematics (STEM) area, especially in the area of information and communication technologies (ICT), but most European school systems have not reacted immediately to such trends in the labor market. Such a problem is significantly indicated by the Royal Society report [4] which pointed to a number of problems in the existing curriculum for subject informatics in primary and secondary British schools. The conclusions of the report referred to the main problem of the current curriculum, which did not enable students to acquire key knowledge in the field of information technology. Similar problems existed in the educational systems of most European countries and large number of stakeholders from the industry began to develop and finance a variety of extracurricular projects that should interest a large number of students in the field of ICT.

The role of external stakeholders in addressing the identified problem has also been recognized by the European Union through the special strategy of the Digital Skills and Jobs Coalition [5], which brings together member states, companies, social partners, non-profit organizations and education providers, who take action to tackle the lack of digital skills in Europe.

Meanwhile, most European school systems have begun reforming existing school systems in the direction of changing the existing curriculum of informatics in the direction of stimulating computer thinking and problem-solving based approaches. Particularly interesting is the new Royal Society report of 2017. describing what such an approach has achieved in a five-year period in British schools [6]. The report specifically emphasizes the role of extracurricular projects in the progress achieved.

In line with these trends, the Croatian school system is being reformed, and the curriculum reform for the informatics subject has been highlighted as a priority by the Decision on Curriculum for Subject Informatics for Primary and General Secondary Education in the Republic of Croatia [7]. The Ministry of Science and Education (MZO) has recognized the importance of extracurricular projects in the reform processes, and as the first presented was ProMicro project for development of STEM skills [8].

II. ORACLE ACADEMY EXTRACURRICULAR PROGRAMS

Today, most global companies from the ICT industry invest in various forms of extracurricular programs to
improve the perception of informatics. One of the largest and globally recognizable initiatives is the Oracle Academy (OA) program founded by Oracle Corporation. Through the aforementioned program, an investment of $1.4 billion is planned through various supports to the European Union member states for the advancement of education in the field of computer science (CS) in the period 2016-2019. Special attention is given to vocational training of teachers in Java programming language and databases.

A good example of such activity is the collaboration between the OA and Croatian Education and Training Agency (ETTA) in the period 2016-2018 through which the improvement of the teaching competences in the field of Java programming and databases for more than 200 Croatian teachers of informatics was carried out [9]. In such trainings, teachers acquire competences for the education of students in secondary vocational schools and faculties on extracurricular activities of long duration (including 30 to 60 hours of lectures), some of which are aligned with Oracle professional certifications. For example, learning outcomes at the Java Foundations course are comparable to Oracle's professional certification Java Foundations Certified Junior Associate (Exam: Java Foundations - 1Z0-811) [10]. These courses are suitable for interested students who want to acquire competencies during their schooling that are in high demand in the labor market because after education they have competences for certain jobs (Java programmer, data scientist), which is very important to employers.

It can be said that the aforementioned courses have demanding learning outcomes and are not designed to make the first computer experience in an engaging and fun way. Therefore, it was necessary to shape the forms of learning that are using the best practices of the academic curriculum (project-based learning, computational thinking), while simultaneously engages students with computer science in a fun and interesting way through workshops, including other academic disciplines. That's why the Oracle Academy program has designed such courses which can also be run through extracurricular activities under a common name Oracle Academy Workshops in a Box [11].

III. ORACLE ACADEMY WORKSHOPS IN A BOX

The Oracle Academy Workshops in a Box program currently contains five workshops for various stakeholders motivated by the popularization of computer science and available at [11]. Initial interface for access to workshops is shown in Figure 1.

Getting Started with Java Using Alice workshop teaches basic Java programming concepts in the context of 3-D Animations in Alice 3 program environment created at Carnegie Mellon University [12]. It represents a good introduction to the next Oracle Academy Workshop - Creating Java Programs Using GreenFoot. GreenFoot [13] is a simple Java development environment (JDE), created at the University of Kent that provides advanced learning on object-oriented programming terminology and concepts while creating 2-D games. There is also an optional robotics workshop for the GreenFoot platform, named as Programming the Finch Robot in GreenFoot, which teaches the basics of Finch Robot (a small robot designed by BirdBrain Technologies [14]) programming in GreenFoot environment using its light, proximity, and temperature sensors. An advanced version of such a workshop is available under the title Programming the Finch Robot in Java. The latest workshop Solve It with SQL teaches the basics of SQL language in a fun way using cloud-based database development.

The learning outcomes of all workshops are tailored to student beginners who have no knowledge of programming and databases. All listed workshops contain up to 16 hours of lectures, designed in such a way that they can be conducted by persons who are not trained teachers in the field of computing. Although workshops have a slightly shorter duration compared to school subjects, these courses have a full curriculum, preparation checklist, facilitators guide, tutorials and solutions that teacher can use in the preparation and implementation of lectures.

IV. COMPUTER SCIENCE EXTRACURRICULAR PROJECTS AND CROATIAN TEACHERS OF INFORMATICS

In the preparation of this paper, a short survey was carried out on computer science extracurricular projects in Croatian schools. According to a statement of MZO [15] from November 2017., the Croatian education systems was employed 481 full-time teachers of informatics in primary and secondary schools in school year 2017./2018. In the same time, 766 teachers lectured informatics with some other course to full teaching load. A total of 131 Croatian teachers of informatics answered the questionnaire, of which 64 were employed in primary education schools and 67 in secondary school.

The term of extracurricular project mentioned in this survey implies any form of extracurricular project carried out in cooperation with an external stakeholder for the purpose of popularizing computer science (e.g., computer programming workshops, robotics etc.). The main purpose of this survey was to find out how many such projects actually took place in Croatian primary and secondary education for the last two school years (2016./2017. and 2017./2018.). According to the responses received, 62% of schools held at least two such activities for their students in that period, which is a good result.

It was also important to find out whether the teachers themselves participated in such activities outside the school. According to the responses received, only 4% of teachers have confirmed their participation on one or more extracurricular workshops which were held outside the
school in the observed period. This result is not so good and it can be said that higher participation of teachers is expected in such educations.

Motivation of teachers was also examined with the question of whether they want to volunteer for such projects organized as workshops outside the school. Even 61% of respondents answered the question positively and it is an excellent result. If this result is compared with the answers to the previous question, the reason for the inactivity of teachers in out-of-school workshops is clearly not a question of their motivation.

Teachers were also asked whether they used some of the content of extracurricular projects in the regular teaching for subject informatics. On this question, 76% of respondents gave a positive answer which indicates a good quality of such projects in Croatian schools.

When asked whether they have heard about Oracle Workshop in Box extracurricular programs, 66% of respondents gave a positive answer. This result is somewhat expected on the basis of the activities that the OA program has carried out in the last three years in cooperation with ETTA [9].

V. CONCLUSION

Extracurricular projects are a significant global driver of the popularization of computer science and consequently participate in the reform processes of existing school systems. It can be said that the representation of extracurricular content in Croatian schools is satisfactory in the last two years. This was certainly contributed to activities resulting from the national reforms in Croatian school education. However, it is necessary to involve teachers more actively in computer science extracurricular projects which take place outside the school because they have the knowledge and motivation for their successful implementation.

REFERENCES


