Work in Progress - IEEEXtreme: From a Student Competition to the Promotion of Real-world Programming Education

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Abstract - **IEEEXtreme is an IEEE Student Activities Committee initiative to create a worldwide programming contest for IEEE Student Branches.**
The success of the past editions and the way IEEEXtreme is evolving, suggests that it will become the only worldwide competition capable of promoting the computer programming skills of collegiate students within a global software engineering approach of real-world programming problems.
Real-world problems that require programming skills are invariably framed within a software engineering approach, where code writing is just the visible dimension of the global effort. Professionals are increasingly compelled to work in multidisciplinary contexts where soft skills are as important as technical ones. This reality should be expressly considered when educational courses are planned to teach programming techniques at undergraduate level.
This paper discusses the positive impact that worldwide events like IEEEXtreme might have on the adoption of Problem Based Learning approaches in programming education at undergraduate computing degree programs.

Index Terms - Programming competitions, Programming education, Project based learning, Real-world programming problems.

IEEEXtreme EVENTS

IEEEXtreme[1] events take the competitive software developers spirit of TopCoder[2] and deploy one worldwide 24-hour contest, where teams of IEEE university students solve a set of real-world programming problems.

The first edition of IEEEXtreme took place on 2 December 2006 (from 0:00 GMT 0 to 23:59 GMT) organized by the IEEE Student Activities Committee (SAC). The IEEE Computer Society Chapters Activities Board (CAB) joined the organisation efforts for the second edition, which took place on 8 March 2008. Both editions had three problem booklets containing stimulating real-world programming problems. The first booklet was released at midnight (GMT) starting the contest. The second and the third problem booklets were releases eight hours after the previous one. In the first edition, the competing teams were also asked to compose and "coding song" during the last 6 hours of the contest, to add a social component to the competition.

While more teams registered, a total of 44 teams joined for the first edition and 130 teams participated in the second edition of contest. The participating teams were located throughout the world (33 countries in the second edition). The teams were uploading solutions throughout the 24-hour competition period.

The 24 hours of the contest were very intense for the participants as well as the organising team and the judges. Judges, being a part competition themselves, were communicating with the teams throughout the contest. Questions asked by the competing teams were broadcasted to all participants and interactively answered on the competition server in real-time.

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Real-world problems that require programming skills are invariably framed within a software engineering approach, where code writing is just the visible dimension of the global effort [1]. Professionals are increasingly compelled to work in multidisciplinary contexts where soft skills are as important as the technical ones. This reality should be expressly considered when educational courses are planned to teach programming techniques at undergraduate level.

Topics such as requirements engineering, project management, and quality are typically not seen as important, in first-level academic degrees in computing, because early-career software development professionals are essentially technology-driven [2]. IEEEXtreme events have been showing that it is possible to address the traditional problems of getting students involved into learning computer programming if real-world problems are adopted and if programming skills appear in a context where soft skills are also determinant for the success of the programming task.

In IEEEXtreme events, during the 24-hour contest, student teams are asked not only to solve typical IOI[3] and

[1] http://www.ieee.org/web/membership/students/scholarshipsawardscontests/ieeextreme.html
[2] http://www.topcoder.com/
[3] http://www.ioinformatics.org/

ICPC[4] programming problems (typically, solved by input-output batch programs), but also to deal with more complex problems usually found in the daily-life of real software developers, like doing some reverse engineering to get original requirements prior to the forward construction of the software solution, like learning on-the fly a new special-purpose language to deploy a domain-specific program solution, document and formalize some piece of code with standard design notations to justify architectural decisions of the developed solution. This *programming-for-the-real-world* approach of the IEEEXtreme events is succeeding in motivation students for the real-world usage of programming skills because the PBL (Problem Based Learning) principles are embedded in the way the IEEEXtreme competitions have been organized.

PROGRAMMING EDUCATION

Teaching programming is not just about students learning a programming language and programming is only a part of problem solving [3]. Lessons on how to program should also promote good programming habits, teach the students how to learn on their own and instil positive qualities, useful to students' programming related careers.

With collaborative learning, studying programming becomes more engaging, interactive, and fun. Competitions promote problem-solving skills. They are an attractive form of learning and motive to improve programming skills [4], [5], [6].

In general, problem-based learning facilitates generic skills such as group work, planning, problem solving, independent learning, research skills, time management, writing and oral presentation. It also has the advantage of virtually eliminating plagiarism [7]. However, the total teaching effort can be greater when compared with more traditional approaches.

Team-based projects are a well-known mechanism to motivate students by giving them the chance to participate in the type of work and environment that can be found in a software house [8], [9]. When such learning mechanism is adopted, it is reported that students can learn more about "real" software engineering than with less ambitious frameworks [10], [11]. However, the usage of a format that resembles the context of a software house is more difficult to implement, which unfortunately makes it quite uncommon in computing education.

This forms an important part of ensuring that students tackle modern industrial problems, strengthening the ties between students and their potential future employers. This also solves, at least partially, the fact that educators rarely have the time required to manage real software projects in addition to their normal duties. In fact, an important part of education in an academic setting is the practical application of concepts. The application of computer programming in the academic environment is currently quite different from computer programming in a professional context. We believe, it is the task of teachers to provide realistic experiences to better prepare students for work in their future profession. Students can work in small teams to complete a project that must develop not only their technical competency, but also planning and management experience, which are crucial skills in the real world.

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[4] http://acmicpc.org/