Introducing Students to Computer Science With Programmes That Don't Emphasise Programming

Tim Bell
Computer Science and Software Engineering
University of Canterbury
Christchurch, NZ
+64 3 364-2987
tim.bell@canterbury.ac.nz

Paul Curzon
School of Electronic Engineering and Computer Science
Queen Mary University of London
London, E1 4NS, UK
+44 (0)20 7882 5212
paul.curzon@eecs.qmul.ac.uk

Quintin Cutts
School of Computing Science
University of Glasgow
Glasgow, G12 8RZ, Scotland
+44 (0)141 330 5619
quintin.cutts@glasgow.ac.uk

Valentina Dagiene
Vilnius University
Vilnius, LT-08663 Lithuania
+370 698 05448
valentina.dagiene@mii.vu.lt

Bruria Haberman
Computer Science Department,
Holon Institute of Technology, Holon, Israel,
and Davidson Inst. of Science Education,
Weizmann Inst. of Science,
Rehovot 76100, Israel
bruria.haberman@weizmann.ac.il

ABSTRACT

We examine five outreach programmes that introduce school students to Computer Science. All downplay programming as a pre-requisite skill for engaging with Computer Science, yet they use a wide variety of formats for reaching students, including contests, shows, magazine articles, and resources for teachers. We classify these different approaches, identifying the different ways they have been adapted to their target audience, and drawing out the common elements to provide guidance for similar initiatives.

Categories and Subject Descriptors

K.3.2 [**Computer and Information Science Education**]: Computer Science Education

General Terms

Human factors

Keywords

K-12 outreach, computational thinking.

1. OUTREACH PROGRAMMES

We compare five outreach approaches with the common goal of attracting students to study Computer Science (CS). The approaches enable students to engage with concepts from CS without having to first learn how to program and present practical ways to engage students in Computational Thinking [5]:

(a) The Bebras competition, which is based around CS concepts [4]. Students who enter this annual competition are challenged to solve a variety of tasks from a broad range of computing areas without using programming. An additional area on ICT and Society gets them to think about the wider issues of computing;

(b) CS Unplugged, a series of activities originally designed as an outreach resource for engaging students with meaningful games, magic tricks and challenges that involve a broad range of concepts from CS without using a computer at all [1];

(c) The cs4fn (CS for Fun) project presents shows in schools and at science festivals, and produces free magazines, online articles and books [2]. Its aim is to present advanced CS topics and research in offbeat ways to high school students to enthuse them about interdisciplinary CS, science and engineering;

(d) The CS Inside project, a series of lessons primarily aimed at teachers, providing engaging ideas for introducing CS concepts in

the classroom situation [3]. The activities are intended to bring out some of the CS to be found inside the technology that is part of students' everyday lives.

(e) The CS, Academia and Industry programme is intended to bridge the gap between school and the "real world" of computing by enabling students to meet with experts from academia and industry [6]. It includes enrichment meetings, field trips and software development projects under the supervision of experts.

Our aim is to suggest a classification tool for: (a) evaluating existing approaches of this kind, examining how they can be adapted to a target population, and (b) suggesting new approaches aiming at attracting specific target populations to study computer science in a novel way. Drawing out the common features and themes of these successful programmes provides guidelines for the design of future initiatives. The tool may enable those designing outreach to evaluate approaches, to choose the most suitable approach for their students, and to adapt the approaches to the target population and context. The approaches described here have all had widespread adoption and influence. We conclude that programmes that downplay or avoid programming provides an effective and scalable way to introduce CS.

2. REFERENCES

[1] Bell, T Alexander, J., Freeman, I. and Grimley, M. 2009. Computer Science Unplugged: School Students Doing Real Computing Without Computers. In *The New Zealand Journal of Applied Computing and Information Technology*, 13(1), 20-29.

[2] Curzon, P. and McOwan P.W. 2008. Engaging with Computer Science through Magic Shows, *ACM SIGCSE Bulletin*, 40 (3), 179-183.

[3] Cutts, Q., Brown, M., Kemp, L. and Matheson, C. 2007. Enthusing and informing potential computer science students and their teachers. *ACM SIGCSE Bulletin*, 39(3), 196-200.

[4] Dagienė V. 2006. Information technology contests– introduction to computer science in an attractive way. *Informatics in Education*, 5 (1), 37-46.

[5] Wing, J.M. 2006. Computational thinking. *Communications of the ACM*, 49(3), 33-35.

[6] Yehezkel, C., and Haberman, B. 2006. Bridging the gap between school computing and the "real world". *Lecture Notes in Computer Science*, 4226, 38-47.