Computers, Making, Music, and Design

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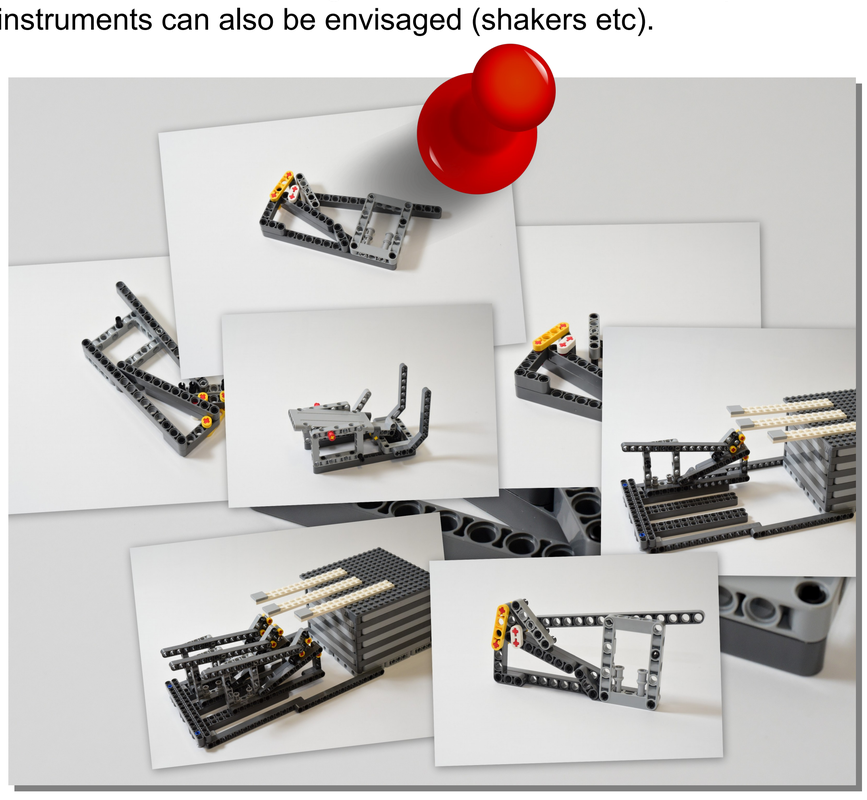
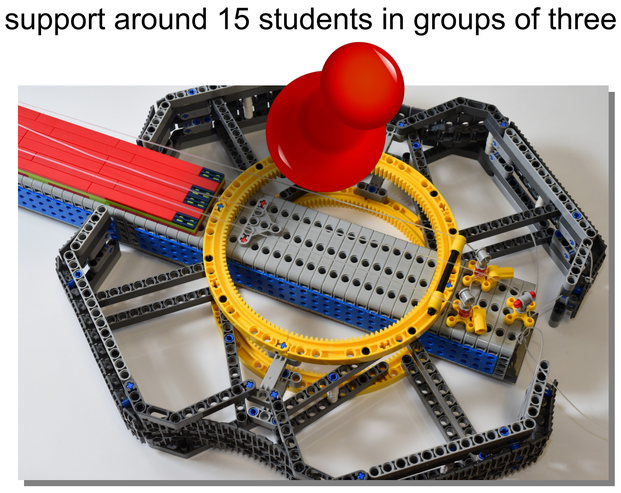
Purpose of research
In recent years, there has been an increasing emphasis on coding in the school curriculum and in extra-curricular activities. The kind of small-scale programming this involves is a great way to encourage school students to get involved with computing and to help them understand what's involved in making computers work for people. However, it does not always help develop the kind of larger-scale systems-level thinking that is needed for professional software engineering later on, or that can be used in many areas of problem-solving, engineering, and design. We are exploring ways to help develop these skills, in particular: modularisation, abstraction (determining which details to pay attention to, and which to ignore or summarise), interfacing, information hiding (separating the 'what' and 'how' of system components), inter-communication, design, and trade-offs.

Rather than doing this directly with software, our aim is to exploit the inherent fun and playfulness of making with LEGO® bricks, of creating music and musical instruments, and linking these to music synthesisers running on Raspberry Pi (using the freely-available SonicPi system). We have developed proof of concept instrument designs including a simplified guitar, thumb 'piano', and triggered 'piano' (all physical LEGO® models), and a combination physical/electronic triggered 'piano'. These capture different aspects of the skills we are aiming to develop in students. Simpler instruments can also be envisaged (shakers etc).



Research design
We are going to undertake pilot fieldwork as a piece of small-scale action research. The intention is to test the effectiveness of the proposed approach through voluntary extra-curricular 'workshops' with year seven students (and their teachers). These are envisaged as a series of three afterschool sessions. The first workshop would involve students constructing their own instruments using the bricks available, the second would involve following a plan to create a particular instrument, and the third would develop those instruments into electronic controllers for the music synthesiser. Our aim is to understand something of what students are learning through discussion and feedback with them and their teachers to inform our future work, publications, and funding.

We have already received an informal expression of interest from a school in the UK to host these workshops and anticipate being able to support around 15 students in groups of three at each event.



This project was funded by the UCL Department of Computer Science Strategic Research Fund.

The fieldwork described here has been approved by the UCL Institute of Education Ethics Committee under approval number REC 1235.

Main research objectives

- To test the effectiveness of using interdisciplinary approaches in conveying concepts needed for large-scale technical development.
- To understand the practical aspects of delivering such material in this way to inform future larger-scale studies.

Data collection
In line with action research methodology, the following means of data collection are planned:
- Researchers' self-reflective notes and journals
- Anonymous quotes from participating pupils and teachers jotted down during sessions
- Photos and video evidence gathered during the observation of the participants' practical work
- Further qualitative, textual data gathered through plenary focus groups and/or brief questionnaires for pupils and staff

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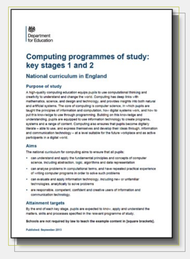
What's happening with Computing in English Schools?



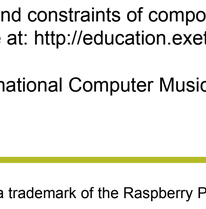
In September 2014, the English National Curriculum introduced major requirements in the teaching of computer programming. At Key Stage 1 (ages 5-7) pupils are now taught how to create and debug simple programs, whilst at Key Stage 2 (ages 7-11), their code must achieve specific goals, including controlling or simulating physical systems and solve problems by decomposing them into smaller parts. At Key Stage 3 (ages 11-14) pupils are taught to use information technology to create more complex programs, larger systems and a wider range of digital content.

The requirements have led to considerable professional development demands within schools over the past five years, not to mention new resources.

These changes were introduced following the publication of an influential report by the Royal Society in January 2012.

This report suggested that much Information and Communication Technology (ICT) teaching in schools was unsatisfactory. Although there was technically nothing to stop teachers introducing programming skills into lessons, many young people only gained basic digital literacy skills such as how to use a word-processor or a database. This was at a time when the UK economy was in great need of programming expertise, something covered extensively in the press at the time.

The organisation Computing At Schools was set up under the auspices of the British Computer Society and the National Association of Advisors for Computers in Education to offer training and teaching resources to schools.



All of these developments have led to increasing emphasis on coding in both the English school curriculum and in extra-curricular activities.

Related Literature

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