MAMIC: a visual programming library for amalgamating Mathematics and Coding through Music

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The role of computing within the National Curriculum framework has changed dramatically in recent times. Traditionally, the computing curriculum in schools focussed on software competency and proficiency in common but basic tasks such as word processing, delivered through the subject of Information Communication Technology (ICT). In other words, students became perfunctory but perhaps uninspired end users, closely tied to ubiquitous commercial packages such as Microsoft Office. However, in September 2014, then Education Secretary Michael Gove made significant changes to the National Curriculum that affected both primary and secondary education in the UK. This has consisted in essence of an enforced shift from the prior ICT model to one that, at least in theory, embraces coding as a fundamental tenet of computing (i.e. active creation rather than end use, closely related to Rushkoff's notion of "programmed or be programmed" [7]) and promotes computational thinking more broadly [1]. For instance, Key Stage 1 now asks that students actively consider program structure and sequential design as well as demonstrate core competency [2]. The inclusion of computational thinking seems particularly prescient and important: if the ability to cheaply outsource the drudgery of basic software development (particularly to the far east) may mean that the ability to code is, in and of itself, becoming less important from a UK labour perspective, it could be argued that students able to adopt a computational mindset, may be better prepared to apply computing principles to a range of scenarios [8].

While this curriculum shift has been received positively by leading technology institutions such as the British Computer Society Chartered Institute for IT and Stone Group [3], some educators and unions have raised their concerns. For example, Andrews [1] highlights many factors that inhibit the appropriate implementation of the new computing approach across the multiple key stages of the national curriculum. This primarily relates is a lack of specialist programming skills within the current ICT teaching population. Training and support for current teachers (specialist and nonspecialist) is also seen as inadequate. For instance, in July 2014, a YouGov survey commissioned by Nesta and the TES found that over 60% of ICT teachers did not feel confident about teaching the new computing curriculum from September 2014, and over half the surveyed teachers admitted to not being adequately prepared for the forthcoming coding curriculum bias. Furthermore, 67% of teachers surveyed stated that despite recent Government initiatives, teachers still did not feel that they had adequate support and guidance that would aid their subject knowledge and/or skills gaps [4].

The Music And Mathematics In Collaboration (MAMIC) library, introduced in this paper, tries to help bridge this gap between educational ideal and delivery. Specifically, MAMIC is an ongoing multi-disciplinary library for the Pure Data visual programming environment. Aimed at primary schools, it can be seen to support emerging interdisciplinary pedagogical approaches regarding the delivery of the new Computing curriculum in primary schools. In particular, the MAMIC library a) amalgamates the previously distinct subjects of mathematics and coding, and b) teaches this synthesis through music analysis and creation. It therefore tries to address the current lack of interdisciplinarity in Music Technology in primary school settings, and in turn proposes an original interdisciplinary teaching methodology that may be useful going forward [6]. More broadly, this use of music as the host for this mathematics-coding parasite can be related to numerous studies highlighting the use of music as a potent vehicle for the transfer of extra-disciplinary skills within an educational setting. Examples include;

perceptual processing of sound to activities such as the development of algorithmic relationships; concepts between written materials and sound and the memorisation of advanced information adopting music and written text as the mechanisms to instigate these desirable cognitive qualities [5].

[1] Andrews, S. (2014) *What's Changing in the Computing Curriculum?* [online]. [Accessed 14 March 2015]. Available at: <http://www.pcpro.co.uk/features/389875/whats-changing-in-the-computing-curriculum>.

[2] Curtis, S. (2013) Teaching our Children to Code: a Quiet Revolution [online]. [Accessed 14 March 2015]. Available at: <http://www.telegraph.co.uk/technology/news/10410036/Teaching-our-children-to-code-a-quiet-revolution.html>.

[3] Nguyen, A. (2013) *IT industry welcomes new computing curriculum.* [online]. [Accessed 14 March 2015]. Available at: <http://www.computerworlduk.com/news/careers/it-industry-welcomes-new-computing-curriculum-3469136/>.

[4] John, M. (2014) *More than Half Teachers 'not confident in Computing*.' [online]. [Accessed 10 April 2015]. Available at: <http://www.agent4change.net/policy/curriculum/2264-more-than-half-teachers-not-confident-in-computing.html>.

[5] Hallam, S. (2010) The Power of Music: its Impact on the Intellectual, Social and Personal Development of Children and Young People [online]. [Accessed 10 April 2015]. Available at: <http://www.mia.org.uk/assets/docs/general/the_power_of_music.pdf>.

[6] John, M. (2011) *Kids use ICT for music everywhere. Why not schools?* [online]. [Accessed 10 April 2015]. Available at: <http://www.agent4change.net/policy/curriculum/1254-kids-use-ict-for-music-everywhere-why-not-schools.html>.

[7] Rushkoff,D. (2010) *Program or be Programmed; Ten Commands for the Digital Age*, New York, OR Books.

[8] Shapiro, J. (2015) *Five Technology Fundamentals That All Kids Need To Learn Now*. [online]. [Accessed 05 November 2015]. Available at: <http://www.forbes.com/sites/jordanshapiro/2015/10/31/five-technology-fundamentals-that-all-kids-need-to-learn-now/>.