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Towards an effective freeware resource for music composition in the primary classroom

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Abstract

This paper presents an ongoing project to develop a freeware resource for music composition in the primary classroom. The national curriculum for music at Key Stages 1 and 2 calls for students to 'compose music for a range of purposes using the inter-related dimensions of music', a challenging aim that demands significant guidance, support and resources. With cuts to school funding and prioritization of core subjects, teachers and researchers are faced with finding solutions to ensure the provision of a quality music education. As part of a wider research project funded by the Arts and Humanities Research Council, Graphick Score has been continuously developed and used for music composition lessons in primary schools throughout the north-west of England. This paper examines the present effectiveness, potential and limitations of this resource, as well as the further need for research and technological solutions to make a creative and meaningful music education a part of the school life of all children.

Keywords: composition; creativity; curriculum; music; software

Creativity and curriculum

The new national curriculum for the study of music at Key Stages 1 and 2 introduced in 2014 was considerably less detailed than its 1999 predecessor, consolidating skills and knowledge, breadth of study and attainment targets into a few short bullet points. The entire music curriculum across all key stages now covers four pages – by contrast, the curriculum from 1992, when music was first added to the national curriculum, had 77 (DES, 1992). Despite this conciseness, the subject is presented as having the utmost educational importance, being 'a universal language that embodies one of the highest forms of creativity', and that has the potential to impart 'self-confidence, creativity and sense of achievement' (DfE, 2013: 1). Adopting a similar rhetoric, the National Plan for Music Education opens with a quotation from Aristotle: 'Music has a power of forming the character and should therefore be introduced into the education of the young' (DfE and DCMS, 2011: 2).

In the original 1992 curriculum, music was presented as a practical subject with composition as a central activity (Swanwick, 1992: 162–3). However, the 2014 curriculum lacks specific guidance about appropriate compositional approaches, stating instead that students should 'improvise and compose music for a range of purposes using the inter-related dimensions of music' (DfE, 2013: 2). Similarly, while the 1999 curriculum offers some guidance about how students can use technology to make music (DfEE, 1999: 18–19), the only direction in the 2014

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version is that it should be used 'appropriately' (DfE, 2013: 1), an inexplicably vague response to 'insufficient improvements in the quality of learning through the use of technology' (Ofsted, 2012: 54). The new curriculum also dispenses with subjective language regarding 'mood', 'feelings' and 'intention' (DfEE, 1999: 16–19), placing greater emphasis on musical information: developing an understanding of the history of music and great composers through listening and appraising, and being able to 'use and understand staff and other musical notations' (DfE, 2013: 2). The latter target, in particular, has hitherto not been seen earlier than Key Stage 3. Previous curricula have always placed greater emphasis on alternative notations, while the staff system has in the past proved too daunting a prospect for many teachers (Mills, 1994: 194). It is therefore not an aim to be introduced without substantial reasoning and support.

The differences between these successive curricula suggest a preoccupation in 2014 with non-practical aspects of music (such as theory and history) that are auxiliary to the central practice of composition outlined in the 1992 curriculum. These non-practical elements are akin to the lower-order skills of Bloom's taxonomy – storing and recalling facts – often conceived as steps leading to the higher-order skills of creative expression (Krathwohl, 2002). The notion that knowledge is received in the abstract and fashioned into something creative, rather than extracted from a meaningful creative process, is a position that has long been critiqued within the constructivist school of thought:

> According to this logic, only after the pyramid of processing has been completed, should students expect to achieve the less talked about (and rather more nebulous) goal of improvising, to have conscious or unconscious experiences of a truly musical kind.
>
> (Borgo, 2007: 76)

Considering that Ofsted found 'too much use … of verbal communication and non-musical activities' in the classroom (Ofsted, 2012: 4), the 2014 curriculum seems to indicate a programme of study moving in the wrong direction by placing less emphasis on active experimentation with new ideas and musical experiences. These kinds of activity may be the most effective precursor to synthesis of knowledge and further creative exploration, an approach wholly consistent with the supported theory that children learn best through discovery and reflection (Bruner, 1961) and succinctly illustrated by simply turning Bloom's taxonomy upside down (referred to as 'Bloom's 21') and starting with the goal activity (Wright, 2012; see Figure 1). The role of the teacher, then, is ensuring that students arrive at knowledge-based outcomes through direction and questioning. Ofsted make this a central argument of their follow-up to the 2012 report, declaring that 'performance and enjoyment are not enough' if music is to be upheld as a 'rigorous, academic subject for all' (Ofsted, 2013: 9).

The Bloom's 21 model promotes an experiential learning process that allows students to arrive at learning outcomes independently, or with the guidance of teachers and peers. This learning structure resonates with the recommendations of Ofsted: 'Survey evidence showed, very clearly, that pupils made the most musical progress when they were taught in music, rather than about music' (2012: 46).

While creative and practical activities can be more easily directed by teachers with specialist musical training, this does not, by itself, lead to high-quality learning. Ofsted found that the best music lessons were conducted by trained full-time teachers with a musical specialism (2012: 20), but that specialist music teachers also accounted for a large proportion of inadequate lessons where a lack of classroom management or teaching skills were observed (2012: 19). Generalist teachers, accounting for two-thirds of music lessons, demonstrated questioning and management skills but made less use of musical activities, and therefore showed a greater degree of consistency in terms of quality of teaching (Ofsted, 2012: 18–19). We can conclude from these findings that practical music activities only lead to outstanding lessons when coupled

with the teaching skills necessary to guide students beyond the 'create' stage of the Bloom's 21 model. It is therefore vital to have a qualified teacher overseeing music lessons. Generalist teachers, or teachers with limited musical experience, have shown a greater capability to deliver a quality music education than, say, music specialists with limited teaching experience (Ofsted, 2012: 18–19), although studies continually address issues about confidence in teaching the subject (Mills, 1989; Hennessy, 2000; Seddon and Biasutti, 2008; Hallam *et al.*, 2009; Russell-Bowie, 2009; Biasutti, 2010; Garvis, 2013; de Vries, 2013; Biasutti *et al.*, 2015). Furthermore, the teaching of composition is a reported source of uncertainty for specialist as well as generalist teachers (Winters, 2012).

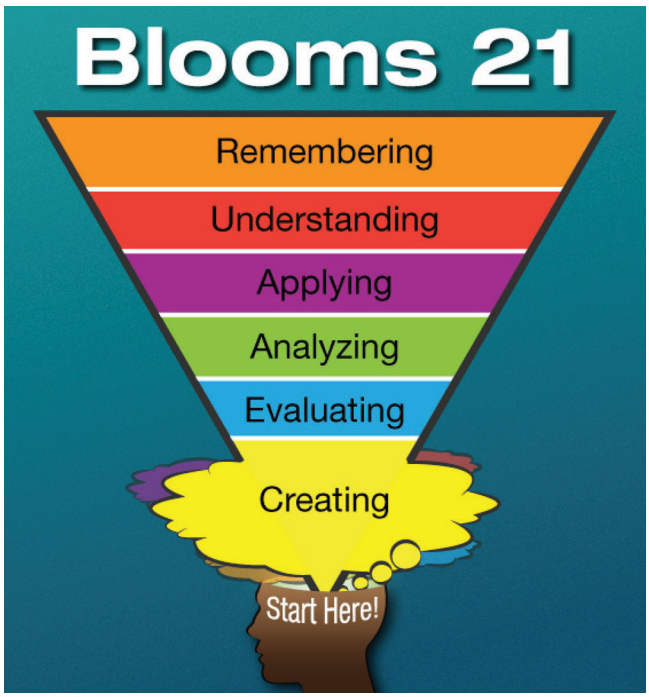

Figure 1: Bloom's taxonomy flipped (Wright, 2012)

If we are to have a curriculum that is both creative and coherent, we must ensure that sufficient resources and guidance are in place to support the classroom teacher as well as the student, in terms of both making music and defining clear outcomes. It is evident from the reports of Ofsted that many teachers do a good job of helping students to achieve a level of musical understanding without the means to deliver creative lessons, while others can engage with practical activities and struggle to help their students reconcile this with musical knowledge. This disparity is further compounded by the fact that the curriculum has been reduced in length, and in terms of its emphasis on creativity, while the importance of music is undermined by budget cuts that hit non-core subjects hardest. Therefore, accessibility of resources and effective learning structures must be a priority in maintaining a creative music curriculum.

Software resources for classroom composition

Software resources are particularly useful for facilitating music composition as they allow us to save our work and return to it as many times as we wish. Prior to this, systems such as staff notation had to be understood before students could record their music on paper. Even with early commercial composing software packages, modelled on staff notation, an advanced level of musical understanding was required. Now, of course, we can use software packages and applications that represent musical material in a multitude of imaginative and accessible ways, and with more recent advances in mode of input, such as the touchscreen tablet, we can find more intuitive ways of interacting with musical materials. Due to this enhanced capacity for interactivity and expression, making music with a computer has become something much more like playing a musical instrument (Williams, 2014), while different modes of representation can be employed that make this a more accessible activity for the musically inexperienced. This is highly relevant to the generalist teacher, as it presents further opportunities for more practical learning in music lessons.

Figure 2: A composing interface in Charanga

Charanga Music School is one of the most effective and popular software resources currently used in primary school music classes. Launched at the same time as the new music curriculum, it is a suite of tools employing pedagogical approaches to music theory, history and composition (see Figure 2). Charanga offers a great deal of support to the generalist teacher, offering structured schemes of work with clear outcomes. There is a need for more resources such as this, which encourage creative exploration within a pedagogical framework and present clear musical outcomes. It is also important to ensure that pupils are able to develop and apply

creative skills in a range of readily available and open-ended composing environments, to ensure 'deep learning', or that which 'develops the learning, creating and "doing" dispositions that young people need to thrive now and in their futures' (Fullan and Langworthy, 2014: i).

While there are many music applications aimed at the very young, there are far fewer music-making programs specifically designed for school-age children. It is likely that the reason why we have seen an insufficient impact of technology on music education is because there is not enough music software designed specifically to support curriculum learning, or to assist less musically experienced students and teachers. My own background is principally in secondary school education, where I have found that each school tends to have a subscription to a commercial composing software package, such as Logic or Cubase, which is then used for all ICT-related music activities. Because these programs are not aimed at children, new students face a difficult task in learning how they work, and such lessons often focus disproportionately on the operation of the program rather than the wider relevance of the music activity. This is perhaps an explanation for the ineffective applications of technology that Ofsted (2012) criticized:

> While they were kept engaged by the tasks and enjoyed working with the sounds, most found it difficult to explain the reasoning behind their choices. Opportunities were missed to develop understanding of the musical syntax, form or the sampling processes that underlay the creation of the pre-composed loops and riffs that the students were using. Even where pupils were creating their own musical ideas in step-time or in real-time, limited evidence was seen of them going beyond the initial inputting of notes to shape the dynamics, articulation or subtleties of tempo for their ideas.
>
> (Ofsted, 2012: 54)

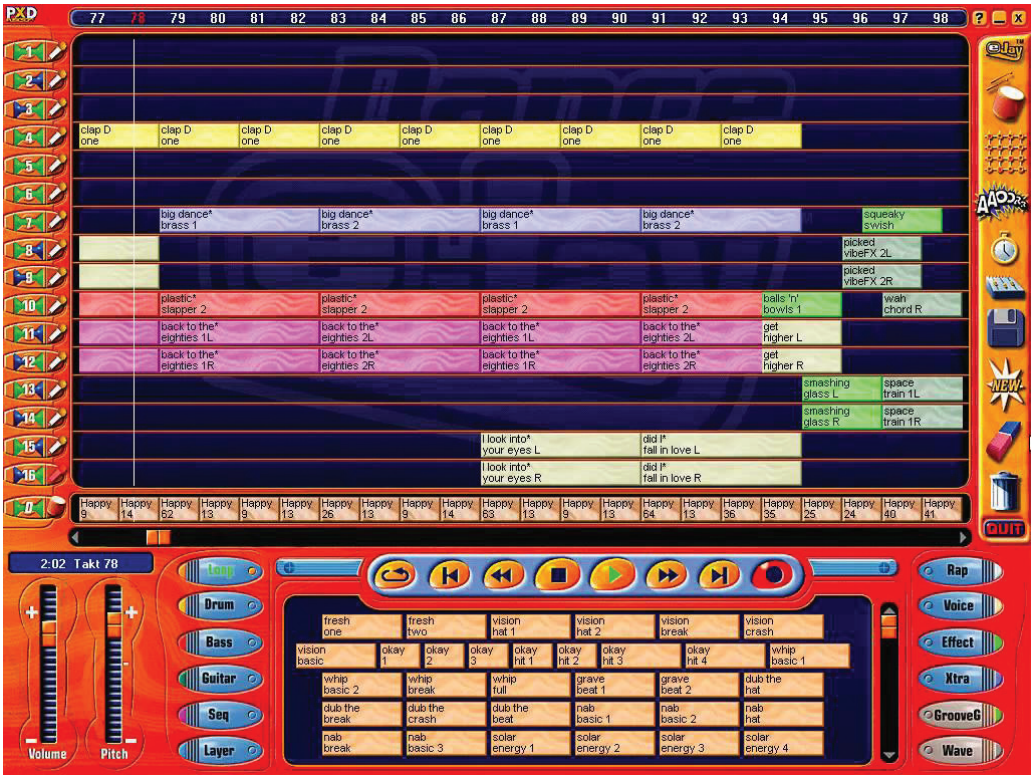

Figure 3: The user interface of eJay

The arrangement of 'pre-composed loops' can provide an accessible means to 'select and combine sounds' (DfE, 2013: 2) that produces a coherent musical result. However, to move beyond this rudimentary Key Stage 1 skill, we must explore how the approach functions at different levels. We might 'zoom out' and ask, 'How do these building blocks form a verse, a chorus, an overall song structure?' Conversely, we might 'zoom in' and ask, 'What are these building blocks made of, and can we alter them for some intended purpose? What are these sounds? Can we cut them up into smaller blocks?' Such an approach is employed in the sequencing software eJay, an accessible environment for exploring form, structure, style and texture (see Figure 3). Several studies have focused on the effectiveness of eJay in promoting considerations of these musical dimensions in young learners (Dillon, 2003; Gall and Breeze, 2008; Mellor, 2008). To paraphrase the new curriculum, these examples can be thought of as 'other musical notations' through which the 'inter-related dimensions of music' (DfE, 2013: 2) may be made apparent, or may become interactively attainable, providing that there are opportunities for students to further explore the shape and subtleties of musical materials.

There are several well-established examples of composition using larger, meaningful structures that are later broken down into constituent components. Notably, rhythm is traditionally introduced using word-rhythms that allow children to easily conceive and memorize rhythmic groupings. Drink names are typically used: tea (one crotchet), coffee (two quavers), lemonade (two semiquavers and a quaver) and so on. Simple rhythmic compositions are then easily represented. For example, the first line of 'Pat-a-cake, pat-a-cake, baker's man' can be notated as 'lemonade, lemonade, coffee, tea', using a sequence of words or corresponding symbols. Once a system of rhythmic patterns has been established through musical activity, the concept of duration has some context of relevance to the children, and the groupings can be further broken down into smaller durational components. This approach relates to a learning theory proposed by Bamberger, advocating composition using meaningful structures (Bamberger, 1996), or 'tuneblocks' (Bamberger and Hernandez, 2000):

> We are asking students to begin with what we believe are the simplest kinds of elements, but which for them may be the most difficult. In doing so, I think we are confusing smallest elements – in music, isolated, de-contextualized pitch and duration values – with what we assume are also the simplest elements.
>
> (Bamberger, 1996: 34)

The composing software Impromptu, which Bamberger co-developed, breaks recognizable tunes such as nursery rhymes and folk songs into fragments, which are then arranged by the user to recreate the piece or form a new composition (see Figure 4). For the purposes of early years music education, a familiar musical phrase, as a structure of multiple notes and durational values, is simpler than the first note in isolation, because the child has a context for understanding the phrase as a whole. They can recognize it, replicate it in a variety of possible ways, and possibly modify it for creative and expressive purposes. In this way, the musical language derived from culture becomes the starting point, the knowledge that children bring to the learning process. These kinds of software offer creative frameworks within which students can explore musical ideas with a degree of freedom. Because musical outcomes are so intertwined with the modes of interaction and representation employed in these programs, and generally easy to comprehend for both student and teacher, they are effective resources for the Bloom's 21 model of learning.

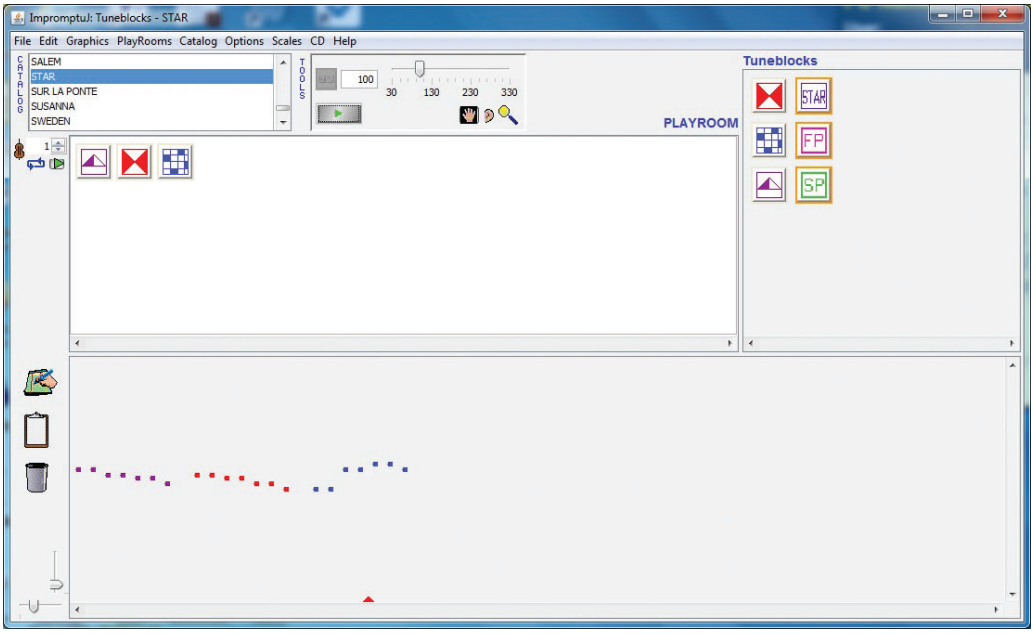

Figure 4: Impromptu, showing the mixed-up 'tuneblocks' of 'Twinkle, twinkle, little star'

Graphick Score

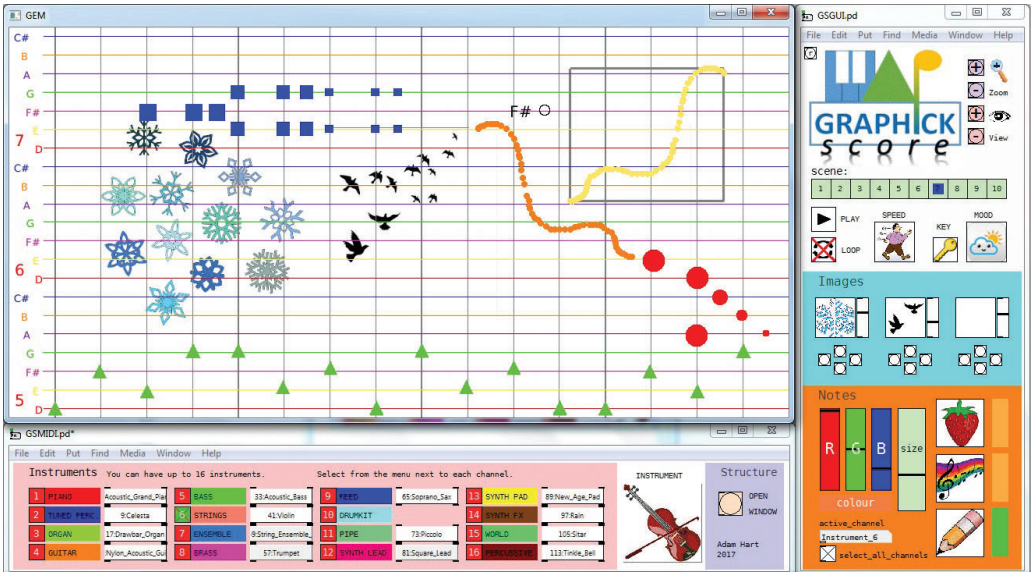

Figure 5: Graphick Score, as of November 2016

Other artistic subjects have a very 'hands-on' approach to composition: we can sketch, splash and sculpt. The original idea behind Graphick Score (see Figure 5) was to find a way of bringing this sense of kinaesthetic exploration to music composition through the development of a freeware resource, something novice composers could delve into, but with which there was the possibility for progression and synthesis of musical knowledge. This would be a 'sandbox' environment – an open-ended resource offering creative freedom, but clarity in terms of musical outcomes, and therefore well-suited to the Bloom's 21 learning structure. Graphick Score is built using the object-oriented programming language Pure Data, with external libraries such as the GEM graphics environment. Variations have been tested in music lessons throughout the north-west of England, and the eventual goal is to consolidate the most effective design features as a free application that can be used both in and out of the classroom.

The originality of Graphick Score stems from the representation of musical dimensions as interactive graphical notations, allowing the user to explore how these properties function in relation to one another. Users 'draw' or 'stamp' their musical ideas on to a blank canvas, and then arrange these 'scenes' into a larger composition. Playback is continuous, so users can hear the piece unfold while composing. It is therefore easy for users to use the program immediately, and to perceive relationships between the music they are hearing and the graphics they are seeing. Other layers of musical meaning are communicated through accessible analogues – for example, the screen is divided into a series of colour-coded steps, corresponding to a scale of musical notes. When the image of a smiling sun is selected, this scale of notes will make the music sound happy, and when the rain cloud is selected, the music will sound sad. While this allows tonality to be explored at a very simple level, the note names of the chosen scale can be displayed, allowing this level of meaning to be translated into a more formal musical knowledge. Another example is the system for representing tempo, or the speed of the music, given as a menu of animals from tortoise to cheetah.

Figure 6: Fruit-rhythms in Graphick Score

There are various options for defining the kind of musical material generated. A pictorial menu of general MIDI instruments is provided, and a sample is heard when one is selected, to give the user an idea of their chosen sound. Rhythmic structures are grouped using the concept of word-rhythms, although types of fruit were used instead of drinks, as these were easier to represent using graphical symbols (see Figure 6). This allows the user to create patterns easily from sequences of these rhythmic clusters. Earlier versions used 'tuneblocks' in the same manner as Impromptu, fragments of recognizable melody that can be arranged to form original compositions. A musical fragment can be placed anywhere on the screen other than the suggested line, which is always highlighted. By starting on a different line, students can hear how the melody retains its shape but has a different mood. Fragments can also be selected, copied,

moved, flipped and rotated to generate variations that take it further away from the original melody. This means there is a kinaesthetic, jigsaw puzzle-like mode of interaction that befits creative exploration.

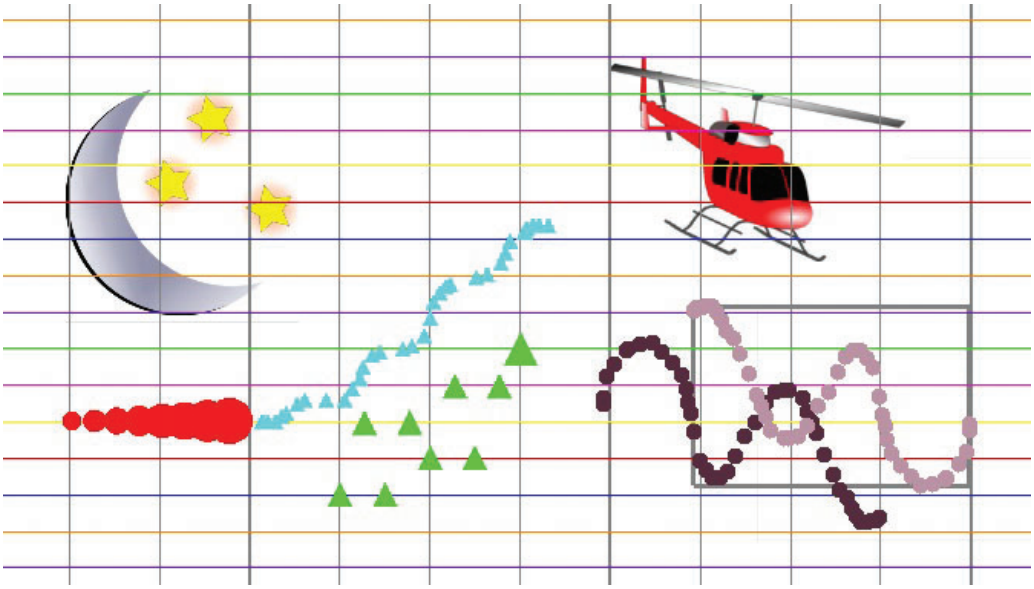

Figure 7: A sequence of musical gestures and audio clips; the selected gesture has been rotated to create a 'spiralling' pattern, befitting the accompanying helicopter sample

In recent versions, a menu of musical gestures relating to kinaesthetic actions has been added – 'crunch', 'tumble', 'float' and so on (see Video 1: Demonstration and Figure 7 for stills from the video). Users also have the option to draw and copy their own gestures. This encourages students to employ a kinaesthetic language in their musical responses, which research suggests is a tendency in children of primary school age (Kerchner, 2000). Through this approach, we have a common and accessible musical vocabulary that also promotes reflection and reasoning, as students seek to build meaning in their pieces through a sequence of musical 'actions'. To augment this storyboard-like approach, a menu of clip-art images with corresponding real-world audio clips has been added. For example, users might add a picture of an aeroplane to hear a jet taking off as part of their composition. Multiple images and sounds can be added to each scene, and the volume can be altered by resizing the images, as with the other musical materials. Later versions, especially those developed for tablet, will include the possibility to record new sounds using the built-in microphone, and pair these with downloaded images, or perhaps images taken using the camera. In this way, students will be able to build a multimedia composition within a virtual environment, but one that draws from their real-world environment. Where students can explore this link between music and meaning, and not only provide justifications for their musical choices but pursue these outcomes within a meaningful context, we can say that this is creative expression.

Outcomes

Current research with Graphick Score has focused on individual and group composition tasks within Key Stage 2 music classes. These lessons have followed the Bloom's 21 model of starting

with a creative task and leading into the consolidation of learning outcomes and establishing new musical information. Students may be asked to make a composition that tells a story of some kind. This narrative is then used to explore how musical gestures and dimensions communicate meaning, leading to a greater understanding of these abstract ideas as well as, in some cases, more formal musical knowledge, such as staff notation. High levels of engagement have been seen across all sessions, with students keen to delve into the program. In some cases, students have struggled to access the wider range of functions, and this is something that requires further clarification or prompting within the user interface, especially since the program is most often used with minimal demonstration. However, students have generally made the most progress when new functions or musical ideas are raised as they become pertinent to the unfolding composition, rather than at the start of the lesson. This has been seen in other research involving composition through ICT: 'Pupils achieved the highest standards when they were given musical and technological information as they needed it' (Pitts and Kwami, 2002: 69).

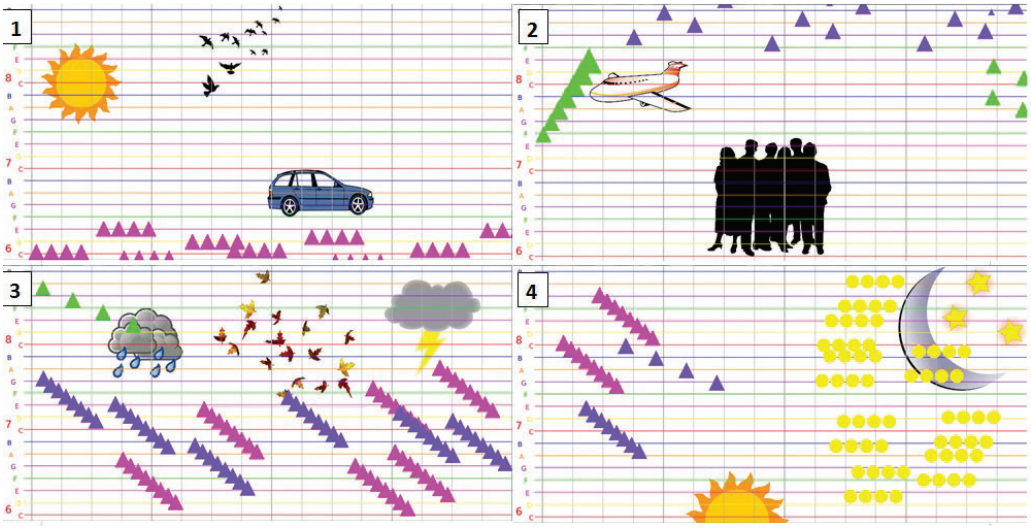

Figure 8: Four scenes from a story of a holiday by two Year 5 students

Video 2: Holiday (see Figure 8 for video stills) is an example of a storyboard composition by two Year 5 students. Although the number of musical gestures is limited, the piece tells a clear story with appropriate use of musical dimensions, which the students explained:

- Scene 1 – *Getting to the airport*
  Samples – *Traffic and birdsong*
  Music – *A clutter of brass instruments (car horns) at a low pitch (on the ground) moving across the screen (traffic)*
- Scene 2 – *On the flight*
  Samples – *Aeroplane taking off, chatter of a crowd*
  Music – *A rising sequence of notes of increasing volume (take-off) and a high-pitched happy melody (flying)*
- Scene 3 – *Arriving to bad weather*
  Samples – *Rain, wind and thunder*
  Music – *A descending sequence of notes (aeroplane landing) and descending patterns played on xylophone and glockenspiel sounds (rainfall)*

- Scene 4 – *Night-time*
  Samples – *Owl noises, crickets*
  Music – *Descending patterns cease (rain stops, sun goes down) then twinkling bell-like sounds (stars).*

In this example, the students wanted to tell a humorous story of going on holiday on a sunny day and arriving to a storm. They started with the images and samples, and then found a musical representation for each part of the story. The class teacher, not a music specialist, was able to prompt the students with appropriate questions relating to musical dimensions. This teacher was shown the basic functions of the program in only a few minutes, and was confident in assisting the students throughout the lesson, although they did have to ask occasional questions of me regarding operation. When all of the groups had finished their pieces in this lesson, the teacher organized a game where the compositions were played in turn, as well as being shown on the interactive whiteboard. Other groups were asked to say what they thought the story was, as well as identifying how musical dimensions had been used. In this way, the teacher was able to consolidate knowledge about 'inter-related dimensions of music' (DfE, 2013: 2) at the end of the lesson.

In all lessons, students showed high levels of engagement, and were keen to explain their stories with reference to musical ideas:

Imogen: … a rabbit being chased by something …

Kody: You could have the piano for running fast, going down, then, like, one drum (*makes action of something going down a hole with arm*).

Imogen: I did a rabbit trying to run up a hill … so he got up but then it rained (*the tonality switches to the minor key*). So he had to go back down but then there was a cheetah at the bottom because I saw that (*indicating the tempo control; the tempo becomes fast here*). Then he had to run back up, and he got away from the cheetah. Then he finds his family so he's happy (*a cheerful melody plays at the end*).

This example of dialogue shows children reflecting on the reasons for their compositional decisions. In Imogen's case, this mostly involves changes in tonality and tempo as the rabbit of her storyboard encounters various imagined situations. During reflection, other students often suggested additions, such as Kody's suggestion that a single drum hit could represent the rabbit jumping into its hole. This representation of actions and emotions from chosen timbres and gestures occurred in other examples:

Karla: This is where he's falling (*crashing noises, drums*), this is where he's upset (*sad sounding melody, low in pitch*) and then he tries to get up again (*tinkling sounds, glockenspiel, high in pitch*) and then he's celebrating (*synthesizer, fanfare-like*).

Such examples were followed by questions to draw out reasoning for these musical decisions, such as 'why might we use a low [pitch] sound for a sad moment?' The children were then able to further substantiate their reasoning, often relating this to cultural language, for example 'feeling down' and 'feeling low'.

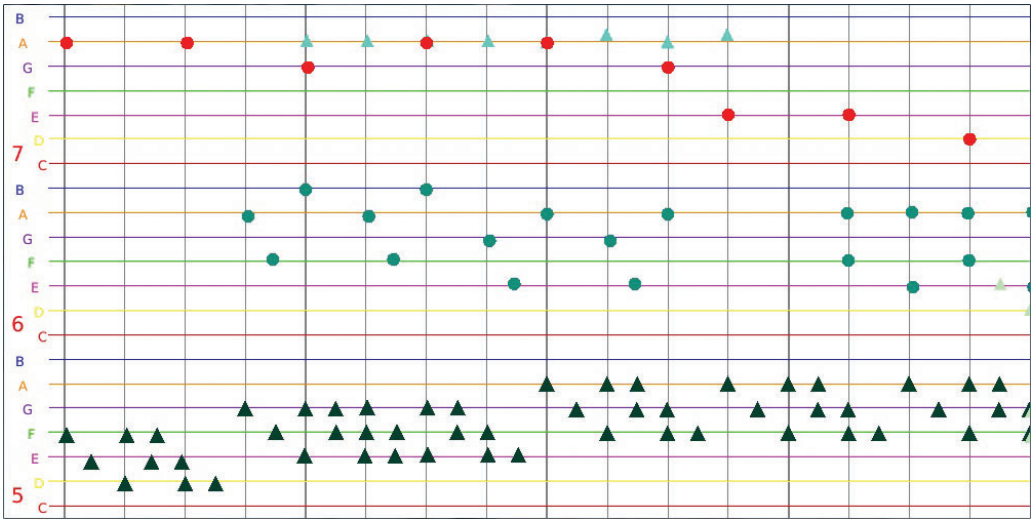

Figure 9: Anna

Another recurring feature was the way in which participants engaged with each other, showing their ideas and asking questions such as 'what instrument is that?' and 'how did you make that?' In such instances, references to the functions of the program were commonly used, as in the following dialogue describing Anna's piece (see Video 3: Anna and Figure 9 for video still):

Anna: Mine's about, like … this is waiting in a queue … it went … (*imitating pattern with up and down finger movement, like a rollercoaster*) … mine was … it was in Gulliver's World. And we're waiting in a queue, then going on a ride, then waiting in a queue …

Teacher: So how did you represent the ride?

Anna: I went, like … I put, like, four notes, like, 1, 2, 3, 4, with …

Tom: … with, like, strawberry?

Anna: Yeah … and then with, like, pear … I did 1, 2, 3, 4; 1, 2, 3, 4 …

Teacher: Right, OK.

Anna: And then I did the same … and I did, erm, apple, and I did the upside-down ride, the hoop thing, where you go up, then you spin.

In this example, the fruit-rhythm 'strawberry' is repeated to represent the train-like motion of the rollercoaster, as correctly identified by Tom, with gaps to represent the queuing between rides. The up-and-down motion of the rollercoaster was represented with rising and falling pitch, and the example also contains a particularly interesting use of the rotation function to describe the 'upside-down ride'. This suggests that a frame of reference had been established that enabled the participants to describe their ideas, as well as to pursue new ideas. Participants very quickly built confidence in this setting, wanting to show their compositions, and being keen to show others how they had utilized a function. This does suggest, however, that the functions of the program require further clarification to ensure that it can be used properly with little guidance.

Many results were built upon very simple representations of motion and movement, but showed evidence of musical dimensions upon reflection. An example is Aisha's 'Owl' composition (see Video 4: Aisha, 'Owl' and Figure 10 for video stills):

> Aisha: I've done … this is, like, an owl … then it flies over, and it drops, then that's it in its nest.

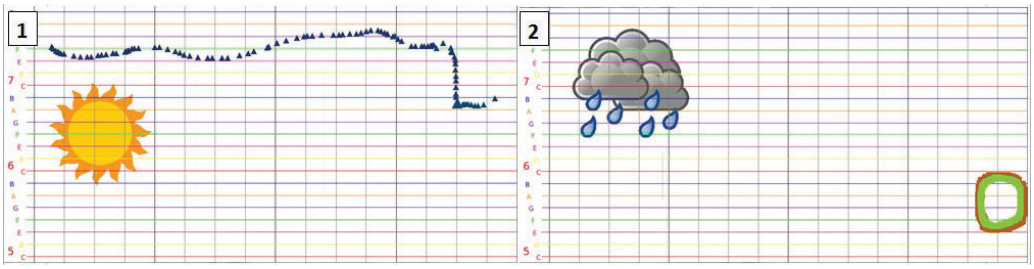

Figure 10: Aisha, 'Owl'

Although straightforward, the score tells a clear story in which there is a musical element. The owl, flying through the air, lands with a drop in pitch. Its sedentary position in the next scene is represented by the circular 'nest' at one end of the window, as it waits out the rain. Structure and timbre has been used in a simple but effective manner to tell the story. Similarly, Ronan's 'Humpty Dumpty' depicts the motion of the egg falling off the wall with a dropping pitch, and the visual and audible mess as it hits the ground (see Video 5: Ronan, 'Humpty Dumpty' and Figure 11 for video still).

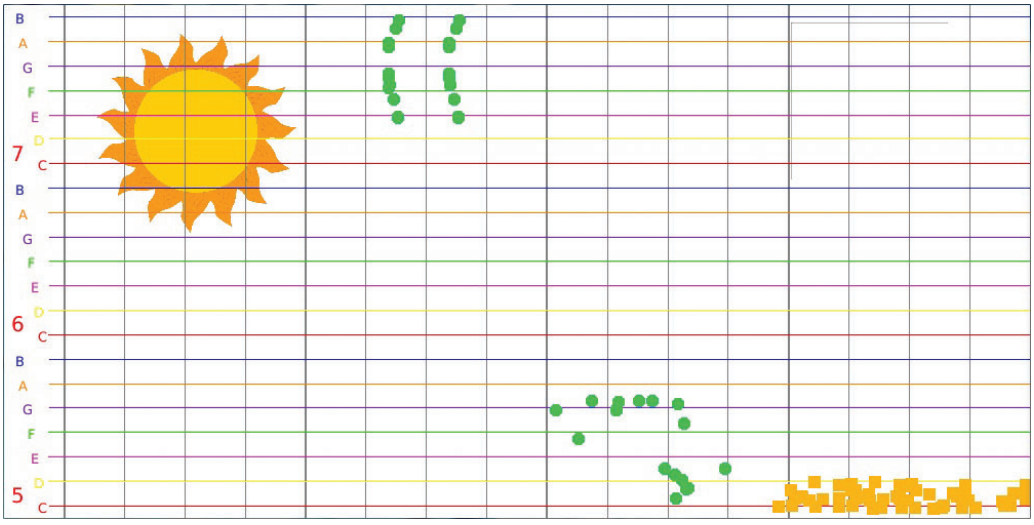

Figure 11: Ronan, 'Humpty Dumpty'

In this lesson, the social influence to tell a story and the accessible visual representation of musical ideas led to instances of creative expression, as the children looked for visual characterizations of sounds, or sonic representations of actions and emotions. Such ideas, when 'discovered' by the participants, were isolated and reinforced through discussion and reflection. Activities such

as this, with no prerequisite skill or knowledge, can provide a valuable opportunity for novice learners to access and engage with the 'inter-related dimensions' of music, to present creative ideas and develop a musical vocabulary.

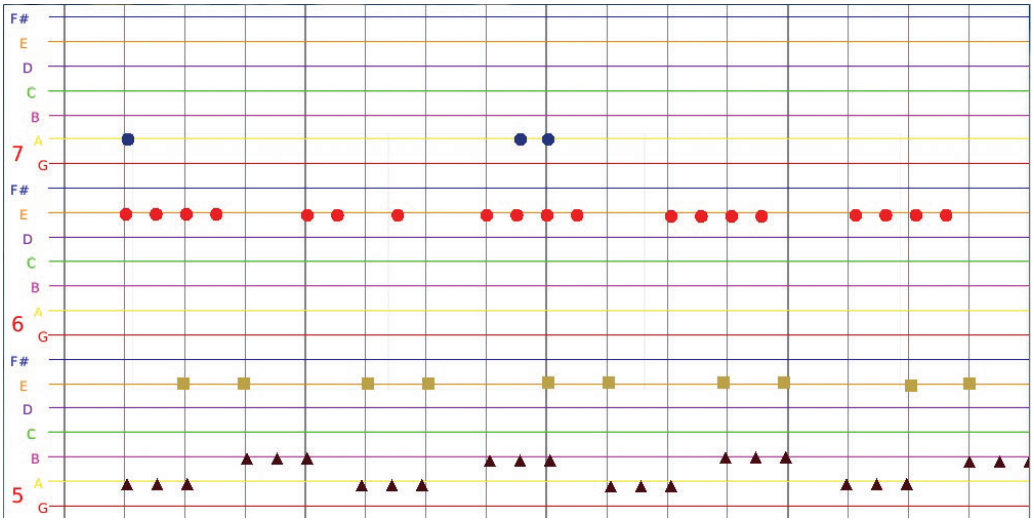

Figure 12: Natasha

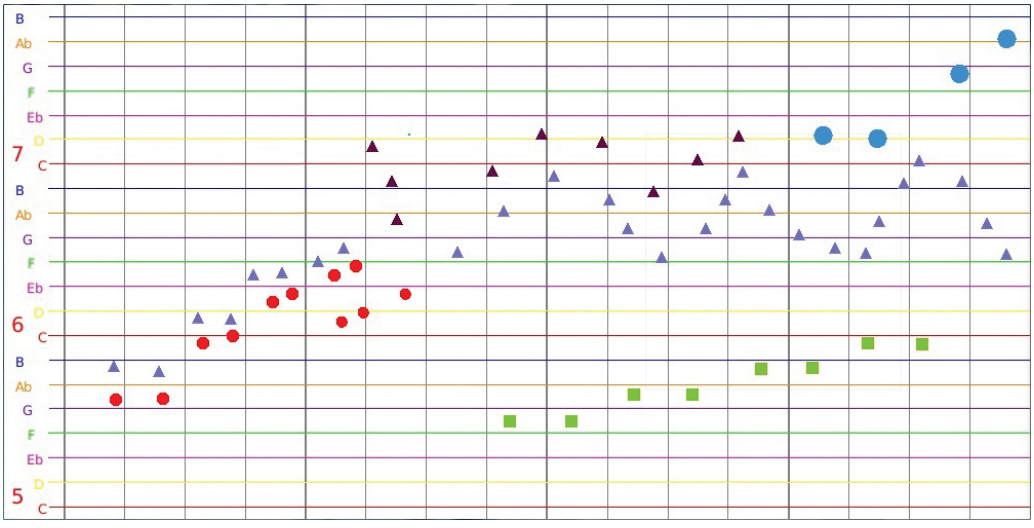

Figure 13: Rickie

One early application of Graphick Score was in a lesson by a specialist music teacher with a mixed group of Year 5 and 6 students. The lesson focused on the creation of rhythmic and melodic variation, something that the students could easily explore using the program, by moving and rotating different musical fragments. This led to a greater understanding of intervallic and rhythmic relationships, so the lesson could be considered a scaffolding activity for staff notation. Several scenes contain repeating cross-rhythms (see Video 6: Natasha and Figure 12 for video

still), while others showed a fairly advanced attention to melody and harmony. The example by Rickie contains several conjunct melodic patterns that are partially harmonized and imitated by other voices (see Video 7: Rickie and Figure 13 for video still). Notice how the contour of the first melody is copied a step down, and then harmonized a third above by another voice.

Other compositions showed evidence of more advanced polyphonic texture. Sam's example is particularly interesting, as it contains a number of repeating rhythms and melodies spaced apart to form a consonant harmony, and decorated by harp glissandos and flourishes (see Video 8: Sam and Figure 14 for video still). Similar evidence of harmonic and melodic creativity could be found in many other examples.

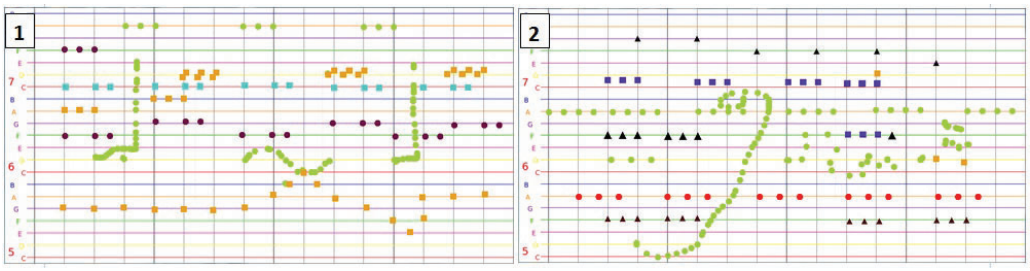

Figure 14: Sam

Throughout the development and testing of Graphick Score, the program has assisted both generalist and specialist teachers in delivering creative and practical composition lessons leading to clear learning outcomes. Following the Bloom's 21 structure, the program was useful in facilitating immediate creative exploration and promoting a meaningful musical vocabulary between students and teacher, and thus enabling progress. However, there are limitations that still need to be addressed. Currently, users cannot record directly into the program using acoustic instruments, although recordings can be added as audio samples. However, I feel that the program could be used to supplement live performance with percussion or other instrumentation, by adding other musical patterns.

There is room for more versatility in terms of how musical dimensions are represented and interacted with. For example, note duration has yet to be incorporated, and the freehand drawing function could be applied to a range of other uses besides the inputting of notes, such as changing dynamics and tempo. This would resolve some of the limitations presented by composing in 'scenes', where each has a fixed tempo, tonality and length. On several occasions, students have asked if it is possible to play part of a scene, or change the speed part way through. Clearly, such possibilities still need to be explored. There is also a need to make these functions apparent while simplifying the user interface, to ensure that both the student and the generalist teacher can approach it with confidence and clarity. The eventual goal for this interface is to develop it as a touchscreen tablet application, along with some online guidance about how it might be used to assist in the delivery of a creative music curriculum.

Conclusion

This paper has argued for the importance of composition in the primary music curriculum, examined some of the barriers, and presented one developing solution as to how it might be delivered. It is clear that primary school children are seldom afforded the opportunity to create their own music in class, whether due to lack of appropriate resources, guidelines or

confidence in the subject. Although more research is required at this stage, the compositional activities described in this paper have yielded some promising results in terms of creativity and reflection, leading to concrete learning outcomes, and have suggested that resources such as Graphick Score can be valuable in providing access to real music-making experiences, as well as in clarifying musical dimensions. Future studies will continue to build upon this progress, and to apply these ideas to compositional activities at earlier stages of education. However, this research only addresses a small part of the issues presented by a changing curriculum and the challenges of current policy. There are many wider questions to be answered with regard to what the curriculum should include, and how to continue to ensure a meaningful music education for all.

The study of music can help children develop confidence, identity and the ability for personal creative expression. As indicated in the work of Bamberger (1996; 2000) children respond to musical ideas when they become accessible and tangible, and possess a context of relevance. My aim with Graphick Score and other resources is to explore new ways for children to take hold of these ideas, shape them and make them into something with personal relevance. Such activities are needed for children to explore and comprehend the dimensions of music, or to develop their own musical 'grammar', for this is something that is forged not on paper but in practice. There is a need for more resources of this nature, which may help to make practical and creative activities a more prevalent component of the curriculum, as well as to ensure that technology continues to have an impact on the development of music education.

Notes on the contributor

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