Reconstructing music education through ICT

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New technologies are transforming approaches to teaching and learning in primary and secondary schools. Their adoption as part of teaching and learning processes is part of a much larger social and cultural change driven by the arrival of digital technologies (Somekh, 2000; Selwyn, 2002). It is hard to overestimate this change. Prensky puts it like this:

> Today's students have not just changed *incrementally* from those of the past, nor simply changed their slang, clothes, body adornments, or styles, as has happened between generations previously. A really big *discontinuity* has taken place. One might even call it a *singularity*, an event which changes things so fundamentally that there is absolutely no going back. This so-called *singularity* is the arrival and rapid dissemination of digital technology in the last decades of the twentieth century. [Prensky, 2001, p. 1, his italics]

Prensky draws a useful comparison between those who are 'natives' of this digital revolution and those who are 'immigrants' (Prensky, 2001, pp. 2–3). Digital natives are 'native speakers of the digital language of computers, video games and the Internet', whilst digital immigrants have been 'fascinated by and adopted many or most aspects of the new technology but always retain, to some degree, their "accent", that is, their foot in the past' (Prensky, 2001, pp. 1–2). Whilst these distinctions are contentious and have been debated amongst educators (Owen, 2006), for the purposes of this research the hypothesis was that 'digital natives' are working with new technologies in ways far beyond the experience of many 'digital immigrants' who dominate the teaching profession at the current time.

Evidence of the rapid arrival and dissemination of digital technologies is perhaps most visible when ones looks at how new technologies have revolutionised the ways in which people perform, compose, share and purchase music. The power of the Internet allows users immediate access to and purchase of music from many genres, styles and traditions. Similarly, producers of music exploit the immediate and communicative potential of the Internet to artistically shape their output. Paul Korda, in an interview with Kroeker (2004), stated that:

> File-sharing's effect on music for me, as an artist, is currency. If I record a song today about a current subject, people can hear it tomorrow, given the wide-reaching effects of the Internet. It's the richness of the here and now, bringing new ideas to life, producing them and releasing them to the people. Currency is what technology is all about, and you either move into the future with the here and now, or you live in the past. [Kroeker, 2004]

The price of technologies that allow users to create, perform and share music has fallen so greatly that it is now possible to produce music of extremely high technical quality in the home environment with a modestly equipped personal computer. Indeed, many powerful musical tools that were previously housed within the realm of the professional recording studio are now available freely over the Internet. Théberge (1997) has discussed the domestication of the recording studio and indicates that the home studio is essentially a private space both physically (often in a bedroom or basement) and acoustically, with headphones being used as an 'instrument of isolation' (Théberge, 1997, p. 234).

These developments continue to move on apace. Yet the consequences of young people developing their musical skills in this private and isolated world of technologically mediated musical activity for the shared and public world of classroom music making demand to be examined in more detail.

The educational framework

Katz points out that technological revolutions of this type do not occur in isolation:

> Any broadly used technology is intimately connected to another existing technology, system, or activity. Essentially, then, the impact of any new technology, whether the 'horseless carriage' or sound recording, arises from the differences between it and that which it supersedes, improves upon, or extends and—crucially—the way users respond to those differences. [Katz, 2004, p. 1]

The connections between wider technological changes in musical production and consumption and their impact on educational practice have seldom been explored. But, drawing on analysis of the literature as it stands, two main themes began to emerge.

First, it became clear that technologies were being used by teachers for the teaching of music particularly at Key Stage 2 onwards. This is something that is expected and prescribed by the National Curriculum (DfEE, 1999). The range of technology being used was surveyed by Mills and Murray (2000) and confirmed in a report by OfStEd (2005).

Second, there was a noted anticipation in the literature that new technologies would begin to change the nature of particular subject disciplines, but in stages. For instance, the ImpaCT2 project (DfES, 2002) stated that:

During stage one the main focus is on the provision of equipment, infra-structure and support; stage two focuses on teaching ICT skills, often in specialist ICT lessons; stage three moves to the integration of ICT with curriculum subjects, including numeracy and literacy. [DfES, 2002, p. 3]

At the time of writing, only a few schools seemed to have moved effectively into what had been defined as 'stage three'. In a later part of the report reasons are given as to why many schools have been unable to make this final transition:

For many schools the main focus of activity following installation of net-worked ICT infrastructure was on teaching ICT skills. Cross-curricular use of ICT is difficult for secondary schools to achieve because ICT has tradi-tionally been a specialist subject for GCSE. *A major shift in culture and established practice is involved in the introduction of ICT within subject teaching.* [DfES, 2002, p. 19, my italics]

Specifically within the field of music education there have been anticipated changes. As Cain points out:

These practical changes [the introduction of new technologies] are very considerable, and, what is perhaps even more important, they have brought into question some of the most basic conceptual frameworks that have underpinned music teaching. [Cain, 2004, p. 217]

This final sentence summed up precisely what the investigations of this research sought to uncover. The Mills and Murray (2000) review established that there was a substantial amount of new technology available to music teachers. But our textual analysis of this document showed that practices were limited and often related to the underpinning of traditional values associated with musical performance and composition. Musical uses of technologies within schools that challenged established and traditional musical practices were rare. The research hypothesised that to truly embrace the potential of ICT would require a major shift in music education's culture and established practices.

The research questions and method

The main aim of the research was to document and analyse the use of new technologies in formal music education. This aim broke down into three specific research questions:

1 How do pupils learn about music in the classroom setting, using new technologies?
2 How does the introduction of new technologies change a teacher's peda-gogical approach?
3 What relationships are there between the uses of new technologies in formal music education compared with musical practices adopted by 'digital natives'?

A number of schools ($n = 18$) and artists ($n = 3$) were identified and asked to participate in the research project. Schools were chosen from within three major partnerships associated with universities providing initial teacher education (those at Manchester Metropolitan University, the University of Central England and the Open University). All music departments participating in the research were considered good or excellent in their practice through first-hand experience of their work by university tutors or postgraduate students. Artists were selected by prior knowledge of their work through their involvement in previous research projects.

In order to address the research questions a simple qualitative research design was constructed, consisting of an initial questionnaire for all participants, followed by researcher visits to schools and the carrying out of formal interviews with selected teachers. Follow-up visits were made to a number of departments ($n = 5$) to address particular themes. Copies of the questionnaires, visit notes and interview forms can all be downloaded from the project web site (www.ucan.tv/tda). Artists were interviewed as a separate part of the process and documents relating to their musical practice with new technologies can be viewed on the above web site.

Key issues

The analysis of questionnaire data and interview transcripts revealed a number of key areas. These will be briefly explored before moving into a deeper analysis of these issues within a context of the wider technological use observed from the artists' work.

Schemes of work

The data showed a range of time (30 per cent) being spent on ICT activities within the music curriculum. Departments were evenly split in terms of using ICT in a general sense to support music teaching and learning across all schemes of work or having a particular scheme of work through which ICT skills would be taught.

Hardware

There were a number of identified issues relating to pieces of hardware, which included personal computers and more specific pieces of music technology such as music keyboards, recording devices and other specialist equipment.

First, most departments (88 per cent) had difficulty using networked computers for musical activities. The most common reason for this was the imposition of policies relating to software content, networking of computers, sharing and management of files, etc., put in place by ICT managers. For this reason there was little evidence of music teachers using the general

computer resources for any musical teaching or learning (beyond basic internet searches). But there were many teachers who complained about the lack of computers in their subject teaching areas (66 per cent).

The most commonly used pieces of technology observed were music keyboards. If the music department had access to computers specifically for music work it was almost entirely the case that these computers had a music keyboard attached (94 per cent).

Two of the visited departments (11 per cent) had a dedicated recording studio within their facilities, including a 'live' room. Teachers in both these schools realised the considerable potential that such a resource could offer pupils but were working hard to tailor the music curriculum to ensure that all pupils developed the necessary skills to exploit this resource when appropriate.

Software

Teachers used a small range of software in their music teaching. These included Sibelius (a musical score-writing piece of software; 94 per cent) and Cubase (a musical sequencer that allows the user to record different tracks of sound and play them back together; 77 per cent). There was a notable lack of freeware and shareware in departments. Of the pieces observed, Audacity (an audio editor and processor; 22 per cent) was the most common.

The perceived benefits of using music technology

All teachers interviewed stated the positive benefits of using music technology at Key Stages 3 and 4. Themes drawn from the interview data included:

1   Boys getting more involved in music.
2   Pupils exhibiting an increase in pride, enthusiasm and motivation about their own work and taking greater responsibility for their own learning process.
3   Changing the music curriculum to make it more stimulating and relevant.
4   The ease with which pupils approach pieces of technology compared with the learning of traditional instruments.
5   New approaches to composition, with technology facilitating pupils who lack traditional instrumental skills.
6   An increasing interest in GCSE music and other music technology options post-16.
7   A general raising of standards and enhancement of pupils' abilities across the Key Stage 3 curriculum.
8   Being able to give an accurate representation of current issues and creative processes in the music industry.

The problems with using music technology

Alongside the perceived benefits of using new technologies, teachers talked about a number of associated problems. These included:

1 Practical and technical difficulties of sourcing, implementing and maintaining music technology within a busy classroom environment.
2 A noticeable loss of conventional musical skills in some cases.
3 Decreasing confidence from pupils in respect of musical performance.
4 Decreasing peer-to-peer relations, interactions between pupils and group work, with too much computer-based musical work.
5 Difficulty ensuring equal opportunities, particularly with limited resources.
6 Varying pupil responses to using ICT, particularly from pupils who had traditional instrumental skills.
7 Pupils not being able to judge quality of work from quantity of work, particularly within compositional tasks. 'It's easy to create a lot with not much in it!'

Pedagogy and ICT

Teachers described how thorough planning, including the setting of key learning objectives and associated learning outcomes, was just as important when using new technologies. It was considered vital that each lesson had a musical learning objective that could be used to structure and focus each of the teaching activities within the lesson and that the selection of pieces of new technology should be made after this had been considered.

The majority of teachers (94 per cent) were agreed that extensive uses of ICT in music teaching required new approaches to classroom management. Some teachers (33 per cent) found classroom management easier with the use of ICT. (Oft-mentioned benefits included paired work at keyboards with headphones or sequencing activities). Some teachers (50 per cent) found the management of the classroom more difficult, with too many demands being made on them for their being able to teach effectively. One teacher said she felt more like 'a technician than a music teacher' and another struggled to keep his pupils on task within a particular piece of software because his pupils found 'more interesting things to do within the technology'.

Many teachers were conscious of their shortcomings in the area of music and ICT. A number (39 per cent) spoke of their pupils knowing more than they did about a particular piece of technology. This did not threaten the majority of the teachers (57 per cent of this 39 per cent), who saw it as a positive opportunity to encourage pupils to move towards a greater degree of independence in their learning. They described this shift from teacher-dependence to learner-independence as accompanying a shift in their teaching role from instructor to facilitator.

Finally, the organisation of teaching spaces was an on-going concern for the majority of our teachers (88 per cent). Few of the departments visited

had specifically designed music suites and the imposition of large amounts of ICT made considerable demands in respect of health and safety issues as well as good pedagogical practice.

Analysis

An analysis of these issues against the wider observation of artists' work with new technologies was conducted. Each of the three research questions will be briefly considered.

Challenging conservatism: how do pupils learn about music in the classroom setting, using new technologies?

This research shows that, despite wide and significant cultural changes, music education in the classroom is still predominantly technologically conservative. Five years on from the research of Mills and Murray (2000) it seems that the main uses of ICT in music education have not developed in line with technological developments exhibited in the work of other artists. Many basic uses of ICT for music sequencing and score writing dominated teachers' work.

Recent OfStEd data concluded that teachers are far more successful (in their terms) with music technologies in Key Stage 4 and on post-16 courses than with younger pupils, and there is a need to extend good practice into Key Stage 3 (OfStEd, 2005). This was reinforced in our data, for example:

> At Key Stage 3 we use Cubasis [a simple software music recorder] for sound pictures and collages, but at KS4 there is a need for pupils to develop melody and harmony in order to get good grades at GCSE. [Teacher, in interview]

This teacher, and OfStEd, seem more able to judge 'success' with music technology when it reinforces a traditional approach to music education. The 'sound pictures and collages' to which the teacher refers are valuable only as a precursor to the 'real' compositional activity of melodic, rhythmic and harmonic construction and variation dictated in examination specifications. When asked about this issue, teachers cited a range of possible explanations. Top among them were the 'overbearing' and 'rigid' structures of GCSE specifications that, they felt, actively discriminate against the creative use of new technologies. During interview one teacher made the following comment:

> Performing can be very hard to mark properly. Pupils who have instrumental tuition are always going to have the upper hand over the pupils who don't—especially at KS4. [Teacher, in interview]

Given the extensive range of musical performance practices witnessed, it seemed remarkable that musical performance with ICT was so poorly

represented in our sample of schools. An investigation into the requirements for musical performance in each of the major examination boards for 2006 has shed some light on this issue (see appendix).

Only one of the examination boards could be said to be genuinely inclusive in respect of encouraging the use of ICT as means of musical performance. The other two examination boards discuss the use of ICT as means of 'enhancing' the musical performance of an instrumentalist or vocalist (but do not consider its influence as worthy of any assessment process or credit) or allow pupils to include ICT as part of their musical performance but insist on there being a live element to the performance as well. There are also some very strange prohibitions on what counts as performing skills, stating clearly that DJ-ing does not contain the necessary elements of musical performance to allow an accurate assessment to be made and is therefore not permitted. The examination boards' prescription sends strong conservative messages to pupils and teachers as to what is permitted as authentic musical performance.

All this contrasts greatly with the methods of music production in studio settings, live performance venues and the collaborative opportunities presented by the internet, where composers, sound designers and other artists use a plethora of hardware and software for their creative ends. Unrestricted from the arbitrary and paralysing effect of curriculum specifications, particularly at Key Stage 4, musicians and artists can develop and extend their use of music technologies for musical performance and composition.

Challenging pedagogy: how does the introduction of new technologies change a teacher's pedagogical approach?

The data collected clearly show that teaching music with ICT is in some senses broadly similar to and in other senses quite different from teaching music without ICT. There are a number of possible explanations for this.

First, music teachers are used to working interactively in a teaching environment that is dependent on resources. A typical music classroom will contain a range of instruments and other equipment. Teachers are used to selecting and organising resources in a range of spaces. In this context the adoption of new pieces of technology is just another tool in a long list of potential resources that have to be integrated and managed appropriately. However, one of our teachers commented that:

> My teaching has become a lot more interactive. Using a smaller room with computers is very different to sitting at desk in a larger room. I do a lot more demonstrations and hands-on teaching than I would do in a traditional classroom. [Teacher, in interview]

Second, as considered above, ICT can legitimately be used to support and extend traditional approaches to music education. Teachers can easily assimilate minor differences in subject knowledge and presentation as new technologies are incorporated into their existing schemes of work.

Third, music lessons will typically contain different arrangements of pupils, including individual, paired and group activities. Most music teachers are used to managing this range of group work and giving pupils a degree of independence. When computers and other technologies become available these models of working are easily transferable for most teachers.

Differences began to appear when the extent or the use of technology became more extreme. For example, two of our schools had recently acquired recording studios with a range of specialist equipment and an associated 'live' room. Both departments were thinking long and hard about how to incorporate this new resource into their schemes of work at Key Stages 3 and 4. It would have been easy for these teachers to just limit access to this expensive resource to older pupils or those with an explicitly expressed interest in music (perhaps those who had opted for further study). But, to their credit, the teachers were grappling with the issues of equal opportunities that such a rich technological resource had thrown at them. It seemed inevitable that the teacher's role in supporting pupils' learning in these studio settings would change significantly. Even without the luxury of this resource, the issues associated with classroom management did pose major questions for the teachers interviewed:

> Classroom management has changed hugely! One has to consider the health and safety issues, the positioning of new equipment, where do you want to stand? You have to actively manage the space. But actual management of pupils hasn't changed that much. Music has always been a subject where you have to take a very active lead throughout. [Teacher, in interview]

Challenging music: what relationship is there between the use of new technologies in formal music education compared with musical practices adopted by 'digital natives'?

There can be little doubt that the use of technology in music has had a profound impact on musicians and their conceptualisation of musical practice. But changes in the wider musical world have not been reflected by substantial changes in the music classroom. Part of this is explicable by considering precisely what it is that many of these new technologies allow a musician to do.

Music technologies enable musicians to engage with the 'micro-phenomena of musical sound itself' (Théberge, 1997, p. 186). Evidence of this is found in a number of the case studies presented in the online materials (www.ucan.tv/tda). Working closely with sound itself can lead to a change in musical priorities as a performer or composer. ICT can facilitate a shift of emphasis away from the traditional issues such as melody, rhythm or harmony to an increasing focus on dealing with the sound itself, thinking about its intrinsic value and place in a wider musical structure (Théberge, 1997, p. 186).

One of the reasons that wider changes in musical practice with ICT evident in the work of contemporary artists is not generally reflected in music education at Key Stages 3 and 4 is that the musical priorities facilitated

through pieces of technology are not valued as highly by teachers as those traditional priorities that form part of Western classical traditions. Green (1988) reflects on a time when popular musical traditions were not a significant part of the music curriculum. Her study of how popular musicians learn (Green, 2001) challenged music educators to think about how they teach instrumental performance. A significant cultural change is needed to move music education into the twenty-first century. This will be achieved as more teachers recognise the potential of new technologies to teach new musical content in new ways.

Our music education system to this point in history has been rooted in traditional beliefs and values towards the production of musical sounds linked with musical instruments and the skill to play them well (Lamont, 2002). Learning to play a musical instrument is a long process towards mastery of that instrument and the controlling of its sound to match the prescriptions of a musical score or the constraints of a particular musical genre. The majority of teachers interviewed were anxious to maintain this dimension of music education.

Conclusion

In the wider world, digital technologies have transformed the ways in which music is accessed and owned. 'Digital natives' embrace a new world of musical performance and composition, empowered by new instruments, both physical and virtual, that democratise performance and compositional processes in ways unimaginable ten years ago.

These changes are slowly filtering through to the conservative musical practices in our classrooms. There have been similar transformations in relation to matters of effective teaching and pedagogy with ICT (Somekh, 1997; Somekh and Davis, 1997; Somekh, 2000; Selwyn, 1999, 2002). Teachers too need to broaden their understanding of what constitutes musical compositional and performance activity in the light of the changing practices that ICT is bringing to music in its various genres. They will need to recognise that using ICT in music education has the potential to transform the nature of the subject itself as well as how it could be taught. But teachers within Key Stages 3–5 have been slow to adopt new uses of music technologies, and typical uses of music technology lean towards underpinning traditional approaches to music education rather than revolutionising them.

Observations of musical practices outside the classroom have led to a consideration of how new technologies can facilitate and enable a closer analysis of the micro-phenomena of sound in order to construct new approaches to performance and compositional activity. There is evidence that the use of ICT in this new way can quickly empower pupils to get to the very core of sonic material and begin manipulating its structure through simple interfaces. These pockets of exemplary practice in some of our identified schools could be usefully explored and disseminated in more detail. One of the problems faced by small-scale innovations of this sort is the huge

bureaucracy of National Curriculum assessment frameworks, GCSE and GCE specifications and other conservative influences that can make it very difficult for teachers who want to reconstruct music education through imaginative applications of ICT. Subject associations, the networks of schools associated with each university's initial teacher training and databases of materials such as the Teacher Training Resource Bank (www.ttrb.ac.uk) all have an important part to play here in challenging conservative practices and allowing innovative accounts of educational practice to be disseminated more widely.

Ultimately, music teachers and those undertaking initial teacher training in music have to develop a clear understanding of what constitutes effective music teaching with ICT. If educators fail to grasp this major cultural shift, music as a curriculum subject will become increasingly alienated from young people's lives and they will find their music education elsewhere.

Appendix

Comparison of the GCSE performance criteria (for examination in 2006)

Criterion	AQA	Edexcel	OCR
Solo performance	One solo piece (12.5%)	One solo piece (15%)	One solo piece (10%)
Ensemble Performance/ Performance during the course	One ensemble piece (12) (There is also a performance/ realisation dimension of the integrated assignment)	Perform/direct two pieces (including Composition 1 = 15%)	Two further pieces of which one must be an ensemble (20%)
Solo performance definition	Instrument or voice (see note about ICT below)	Play, sing or sequence (minimum of three simultaneous tracks or timbres)	Instrument or voice
Ensemble performance/ Performance during the course definition	Instrument or voice allowing genuine ensemble skills to be demonstrated. Solo performance accompanied by a piano or guitar does not equal an ensemble for the soloist, but may be considered an ensemble for the accompanist	Performing an undoubled part within an ensemble or group. This can include: • Directing an ensemble • Solo performance using a sequencer • Improvising as part of an ensemble • Ensemble performance using music technology	Significant individual part in an ensemble

Appendix   (continued)

Criterion	AQA	Edexcel	OCR
ICT inclusive or exclusive	ICT exclusive 'Performances **incorporating** the use of multi-track recordings and other forms of ICT are also eligible as solo performances. **There must be a live performance** of at least one part at the point of assessment. Performing skills must be demonstrated and, as such, **DJ'ing is not an eligible activity**'	ICT inclusive	ICT exclusive 'If candidates **enhance** their performing using ICT, credit is available for the musical enhancement shown in the outcome, **not for the understanding of ICT**'
Marking	• /8 for accuracy of pitch and rhythm • /8 for interpretative qualities • /8 for expressive qualities • /6 for demand For ensemble pieces the second and third are combined and an additional mark for ensemble is included (marked /8)	/10 for accuracy /15 for interpretation (and ensemble in the case of Performing during the course)	/10 for musicality (and ensemble when appropriate) /5 for difficulty

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