Videoconferencing and learning in the classroom: the effects of being an Orphan Technology?

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Abstract

Drawing on a decade of evaluation research into videoconferencing in English schools, this paper explores the relative lack of pedagogical innovation in the educational application of videoconferencing. Initial surveys on the frequency and patterns of use of videoconferencing provided baseline data for selected case studies involving in-depth interviews with key personnel involved in the deployment of videoconferencing and observations of lessons in which videoconferencing was being used. Data analysis reveals that the main models of videoconferencing use were either ‘substitution’ (videoconferencing replacing face-to-face curriculum delivery) or ‘enhancement’ (whereby videoconferencing augments traditional pedagogical practices). Examples of ‘adaptive’ use (exploring the innovative potential of videoconferencing) were relatively rare. This apparent conservatism, at odds with the emergence of shifting pedagogies with other ICT tools, was allied to videoconferencing being positioned as an ‘orphan’ technology, whereby interested teachers were offered quasi-autonomy – that is, power to innovate was limited by highly localised policy and curricular systems. The authors conclude that for videoconferencing to enter the mainstream of school ICT provision, wider learning benefits need to be demonstrated to a broader audience, so that videoconferencing can reach its transformative potential. Ways to achieve this are presented.

Keywords: Technologies in Learning, Technology Mediated Learning, Videoconferencing, School Education

Introduction

At an educational technology event in London in February 2013 (the British Education and Training Technology exhibition: BETT), a day-long seminar involving contributions from teachers, policymakers, researchers and commercial organisations in the UK served to demonstrate the wide range of learning benefits facilitated by videoconferencing. There was, however, an undercurrent to these positive messages; that unlike other forms of educational technology, the integration of videoconferencing in UK schools was neither uniform nor widespread.

The relative lack of ‘spread’ of videoconferencing, despite its proven educational value and alongside the almost exponential growth of school ICT more generally – is the issue/conundrum considered in the present paper. The paper draws upon the findings of a number of evaluations of videoconferencing in schools in England conducted by the authors over a span of approximately eight years (2003-2011).

This evaluation work was sponsored variously by the government education department of the UK, the (now defunct) British Educational and Communications Technology Agency (Becta) and a commercial provider of Advanced Level courses in a variety of subjects (taken in England at ages 17-18) via the medium of videoconferencing. Altogether these investigations resulted in detailed case studies of more than 40 schools, each involving interviews with a range of teaching, managerial and technical personnel, students, as well as classroom observations of videoconferencing-supported learning. The main focus of these projects was to uncover – across a range of contexts - the learning potential of videoconferencing and the factors which were associated with its pedagogically effective use. The present paper represents a retrospective analysis on the outcomes of these studies in an attempt to throw some light on the conundrum identified above.
Learning benefits of videoconferencing

Some of the first educational uses of videoconferencing were to be found in higher education (Carter et al. 1996), where the capacity of the technology for transmitting live lectures to a wider audience, either located locally (for example to accommodate large student numbers) or further afield, enabled students at a distance to participate synchronously (Bollom et al. 1989; Schiller and Mitchell 1993; Storck and Sproull 1995). While these initial trials represented a transmission model of pedagogy and learning (Boldt 1998) in that the technology enabled the ‘delivery’ of the traditional face-to-face lecture to a remote audience, the technology was also to prove effective in facilitating less didactic features of higher education teaching, such as the tutorial or small group seminar (Pitcher et al. 2000; Andrews and Kleece 2002).

While there are examples of using videoconferencing for ‘distance education’ at a school level (for example in the provision of education to pupils in remote or rural locations (Husu 2000) where access to expertise in particular subjects may be limited (Pritchard et al. 2010), or for students who are unable to physically attend school for reasons such as prolonged illness (Wilkie 2011), the curricular and pedagogical context of most schools meant that many of the initial forays into videoconferencing documented in the 1990s tended to focus on its capacity to access expertise from beyond the school walls, rather than broadcast outwards. A number of UK institutions and organisations, as part of their educational remit, offered educational input via videoconferencing. Chief among these were national museums and galleries (Arnold and Cayley 2008) alongside some commercial organisations and university departments (Li et al. 2009; Anderson 2008), providing a range of enhanced learning opportunities, many of which were tailored to the UK national curriculum. An extension of this model is the ‘virtual tour’ or field trip (Barber 2010; Pachnowski 2002), whereby learners have (often guided) access to sites which would otherwise be inaccessible, for example for security issues (such as a nuclear facility) or for reasons of organisation (e.g. transporting a class of children to the location) or cost. As the demand for this kind of provision grew, the need for a structured approach to connecting schools to providers was met by mediating organisations such as Global Leap – a ‘one stop shop’ which offered a menu of learning opportunities, as well as technical support and guidance (Arnold and Cayley 2008).

Because of the organisational facilitators that have grown up around this approach, it represents a relatively easy – and popular - ‘first step’ into videoconferencing for schools, a stage that Comber et al. (2004a, 25) refer to as ‘familiarisation’. Less common – mainly because it has relied on schools independently locating willing partners – is school-to-school collaboration mediated by videoconferencing, an example of ‘enhancement’ in Comber et al.’s terminology (ibid.). A typical example of enhancement is in language learning (Jaurgi and Bañados 2008; Macrory et al. 2009; Harris 2002), where a class in the UK learning – say – French, communicates directly with a group of French peers learning English. In other subject areas (e.g. science, mathematics) students can experience different environments remotely, exchange information, and discuss outcomes, both through school-to-school initiative and participation in an organised project. For example Gage’s (2003) project involved students in different schools collaborating on maths tasks, an approach which has been shown to facilitate increased student autonomy (Newman et al. 2005), with teachers in each school acting mainly as scaffolders of pupil learning (Smyth 2004; Vygotsky 1978). For the learner, such events are exciting and highly motivating, leading to improved student engagement both during and after the conference (Eales et al. 1999), especially where its inclusion is part of sequence of topic-focused activities.

This kind of learning environment creates the opportunity for pupils to interact, face to face and synchronously, with same-age peers in different geographic and socio-cultural settings, which in turn leads to increased cultural understanding (Cifuentes and Murphy 2000). The potential afforded by videoconferencing to reduce the transactional distance - ‘the psychological and communication space between the learner and the teacher’ (Moore 1993, 22) – has also been found to give confidence to otherwise reluctant public speakers, improving social and communications skills (Anastasiades et al. 2010; Husu 2000; Heath and Holznagel 2002) in particular increasing pupils’ self-confidence (Wu et al. 2011) or supporting those with special educational needs (Thorpe 1998; Martin 2005).

The conundrum

All of the above examples describe learning experiences that represent valuable additions to and enhancement of regular classroom learning. The real-time, face-to-face nature of videoconferencing means that learning activities of this kind have a degree of immediacy and authenticity which is often absent from asynchronous modes of interaction (Comber et al. 2004a; Martin 2008; O’Rourke and Martin 2011). These learning benefits are wide ranging and have been internationally recognised for many years (Lave and Wenger 1991).

Despite this wealth of evidence, videoconferencing is far from being universally adopted in UK schools. For example in 2008, fewer than one in ten UK schools were registered with the JANET Videoconferencing Service (JVCS), a key organisation for the coordination of educational videoconferencing (Videoconferencing Insight
2008). This represents something of a conundrum, especially given the wholesale adoption and integration of educational technologies more generally, even though debates about the pedagogical value of such technologies persist (Livingstone 2012). In the present paper we draw upon our research to explore and explain this conundrum, before offering some potential ways to push forward learning by videoconferencing.

**Methods**

The current paper therefore draws on data from a number of evaluations of videoconferencing use in English schools conducted by the authors over a period of eight years (2003-2011). Each investigation followed a similar research protocol, which comprised three stages. *Stage one* involved a survey, administered to each participating school, of the key institutional characteristics (size, location etc.), the nature and location of videoconferencing equipment used and patterns of use (frequency, subject areas). The survey also sought to identify key managerial, teaching and technical personnel involved in videoconferencing. Analyses of these data contributed to sample selection and the development of interview and observation schedules for use in *Stage two*.

*Stage two* comprised intensive case study visits to each school, typically conducted over one or two days. These involved individual semi-structured interviews with the ‘lead teacher’ (the person with main responsibility for the curricular coordination of videoconferencing), one or more ‘teacher users’ (teachers who regularly used videoconferencing in their teaching), the ICT coordinator and a member of the senior management team. Where available, further interviews were conducted with technical staff. Group interviews were conducted with students involved in videoconferencing learning activities. Observations of classroom practice where videoconferencing was being used were also conducted, which also involved an additional pre-and post-lesson interview with teachers and students. In addition, policy and curricular documentation relevant to the implementation of videoconferencing were collected for later analysis. Together these varying methods provided a comprehensive picture of the range, nature and impact of learning through videoconferencing in the respective schools. Finally, in *stage three*, follow-up telephone interviews were conducted with selected school personnel where issues emerging from initial data analysis were explored further and/or verified.

Data were analyzed using a thematic analysis approach (Boyatzis 1998). Following the identification of initial themes representing ‘clusters of meaning’ (Creswell 1998), more specific sub-themes were developed within each overarching theme. Transcripts were reviewed using a constant-comparison method (Strauss and Corbin 1994; Boeije 2010) until the point of data saturation ‘at which no new insights are obtained, no new themes are identified’ was obtained (Bowen 2008, 140).

**Discussion (a) Identifying the nature of the problem**

In 2003, the authors, in collaboration with colleagues at the University of Cambridge, were commissioned jointly by the then Department for Education and Skills (DfES) and the British educational and communications agency (Becta), to evaluate the ‘Videoconferencing in Schools’ (ViC) initiative, a government-supported trial of videoconferencing use in English schools. The project involved linked case studies of some 29 schools, both primary and secondary, including those for children with special educational needs. The outcome of this evaluation was published in the form of two reports (Comber at al. 2004a; 2004b) which indicated a broadly similar set of learning benefits as those presented in the literature review in this paper. In addition, a range of factors associated with an ‘educationally effective’ videoconference - that is, an event which was able to meet fully clearly articulated learning and curriculum objectives – were identified. These included structural factors such as the pattern of interaction (e.g. one-to-one, one-to-many, many-to-many), organisational factors (e.g. the role of teacher(s)/other adults participating in the conference), curricular factors (e.g. the place of the conference within the subject curriculum) and technical factors (e.g. the speed of data transmission; visual and auditory quality). In addition, four broad categories of videoconferencing usage were identified, providing a typology of use which included familiarisation (first steps in the videoconferencing process), substitution (videoconferencing replacing face-to-face curriculum delivery), enhancement (whereby videoconferencing augments traditional teaching and learning practices) and adaptation (exploring the potential of the technology to go beyond traditional pedagogies).

This analysis provided a diagnostic framework, through which it was possible to evaluate videoconferencing activities in a systematic way. This framework was deployed in a subsequent set of 6 case studies in UK schools identified as representing ‘cutting edge’ practice with videoconferencing. The summary report of this series of evaluations (Lawson and Comber 2005), also on behalf the DfES/Becta, provided further evidence of the pedagogical and institutional characteristics which underpinned the innovative use of videoconferencing for learning.
Given the positive outcomes of these various studies, at a time when the provision of ICT for schools was firmly on the agenda of UK government, it was reasonable to assume that videoconferencing would become an integral element in a technology-mediated educational policy – both nationally and locally. However while ICT more generally became steadily integrated into curricular planning and practice in schools, videoconferencing appeared to remain something of a ‘fringe’ activity by comparison, embraced enthusiastically by some teachers in some schools, but never becoming a ‘mainstream’ technology. This led the authors to re-visit, in 2010/11, five of the six ‘cutting edge’ schools which participated in the 2004 evaluation, with a view to identifying what developments in videoconferencing practice had taken place in the interim. The initial rationale for this follow-up study was to capture key characteristics of sustained innovation and development, which might in turn offer schools clear guidance on the educational advantages of videoconferencing in an age of rapidly developing technology, including the emergence of social media tools. However, it quickly became clear that, far from finding expanded use, we encountered in four of these formerly ‘flagship’ schools ‘a much more dramatic picture of decline and retrenchment’ (Comber and Lawson 2012, 6).

Taking together indicators of individual, technological, pedagogical and organisational developments (Birch and Burnett 2009), we constructed a typology to describe the different patterns of videoconferencing developments in the five schools. Of the two where videoconferencing still flourished, one demonstrated clear evidence of progression in these areas, indicated by an expansion of videoconferencing activity both within and between subjects, including a renewed commitment to international exchanges with other schools, while the second had largely consolidated existing practice, that is, while videoconferencing was still a key element of its curriculum offering, this mainly involved access to ‘remote expertise’, as had been the case at the time of the first visit. Two of remaining three schools were in a state of contraction whereby videoconferencing had become confined to use by ‘enthusiasts’ in one or two curriculum areas, while the fifth school was in decline, that is, not only had videoconferencing contracted, but there were signs that without intervention it would cease altogether.

Our analysis offers some insight into the relative failure of school videoconferencing to become more mainstream.

**Outcomes of the follow-up study**

We identified five key factors which were critical to the development and sustainability of videoconferencing, three of which particularly relevant to the present discussion.

The first of these is ‘policy frameworks’, which include both those external to the school (for example government policy, investment in technology and so on) and those which operate within (the place of videoconferencing in the school ‘vision’, curriculum planning etc.). Despite the positive learning outcomes associated with the Videoconferencing in the Classroom project (Comber et al. 2004a), the Education Department shifted its priorities away from videoconferencing and towards other forms of educational technology, such as interactive whiteboards (Higgins et al. 2007). It would seem reasonable to conclude that the almost ubiquitous integration of the latter in UK schools, and the patchy distribution of the former, is at least the partial outcome of this policy position.

Externally determined education policy is of course mediated at the level of the school, in which the school leadership’s decisions on whether or not to incorporate (non-statutory) educational strategies or tools, such as videoconferencing are central. As found elsewhere for ICT in general (Comber and Lawson 2003; Anderson and Dexter 2005; Comber 2007), sustained use of videoconferencing was strongly associated with a school leader who demonstrated support for and understanding of the educational potential of videoconferencing. This in turn led to investment in technology, in relevant professional development opportunities for their teachers and an ethos of learning innovation, exemplified in curriculum documentation. In particular, the validation by management of videoconferencing as one of a range of key educational technologies, and the recognition of the key role of the personnel responsible for its use in learning activities were found to be crucial determinants of its curricular integration. This approach was most evident in the one school where a progressive strategy was being followed, and to a lesser extent in the school where practice was adjudged to have been consolidated. Managerial support for videoconferencing was much less overt in the other three schools, where its use was either in contraction or decline. In one, this process was traceable to the arrival of a new leader for whom videoconferencing was no longer ‘on the agenda’, along with the recruitment of a number of young teachers who perceived videoconferencing to be ‘old’ technology. Its use thereafter was marginalised, sustained only by a single enthusiastic teacher in a single curriculum area using existing technology.

This situation links directly to the second key factor, what we have referred to elsewhere as the ‘key personnel syndrome’ (Comber et al. 2002, 21), whereby the success of an initiative is heavily dependent on one or two innovation ‘champions’. Where knowledge of and enthusiasm for a technology is confined in this way, the loss of such personnel often signals the beginning of a downward trajectory. Thus the main reason for
"orphan" technology. Without her to encourage and support others, the technology remained largely unused until her return a year later, when revitalising its use was a case of ‘starting all over again’. In another school, a similar situation prompted a period of planning prior to the teacher’s departure, to ensure that her role was undertaken by another, thus avoiding the breakdown in continuity which beset the first school (see also Gunn 2010).

The final factor relates the positioning of videoconferencing to other educational technologies. In the three schools where videoconferencing was in retrenchment, this role of ‘videoconferencing coordinator’ was associated with a particular curriculum area such as languages, so that videoconferencing was primarily seen within the school as a subject-specific technology, necessarily limiting opportunities to spread its use into other areas of the curriculum. In the two schools which demonstrated progression or consolidation respectively, the videoconferencing coordinator had a school-wide remit, with videoconferencing regarded as a particular – but important – pedagogical tool. Moreover both were given (by the management) the freedom and encouragement to innovate, as well as a commitment to funding new initiatives. What is especially telling here, is that in all five schools the role of the person mainly responsible for the coordination of videoconferencing activity was quite distinct from that of ICT coordinator. This in turn meant that videoconferencing itself was not seen as part of ICT more generally, nor (with one exception) was it part of the school ICT policy or development plan. In other words, videoconferencing was not perceived as part of the ‘ICT family’, and in this regard, can be conceptualised as an ‘orphan’ technology.

What distinguished schools where effective, integrated use of videoconferencing was evident, and those where it was seen to have ‘withered on the vine’, was therefore a combination of the above factors: in political terms, the extent to which the learning benefits of videoconferencing are recognised and incorporated within policy frameworks (both national and local); in managerial terms, the degree of the knowledge about and commitment to the pedagogically effective deployment of videoconferencing and finally, in terms of the perceived educational potential of the technology itself, the extent to which videoconferencing is perceived as central to learning as other ICTs and, by association, the status of those charged with promoting its use within the school.

Discussion (b) Solving the problem?

A third study, conducted in 2006, and sponsored by a commercial organisation, evaluated a particular model of videoconferencing, that is, the remote provision of ‘Advanced Level’ courses (the examination in the UK taken at ages 17 and 18), typically to schools (250 of them in 2006) where there was a minority demand for a given subject and/or where there was no relevant teacher expertise. This research provided a new set of insights into potential solutions to the conundrum of the absence of mainstreaming of a technology with proven learning benefits. The delivery of these courses through videoconferencing adopted a fairly traditional approach to pedagogy and learning, in which an hour of mainly teacher-directed learning was supplemented by individual students working through a course booklet, with readings, questions and activities, in preparation for the following week’s videoconference session. While both students and teachers in receiving schools held mainly positive views of the programme offered, the major benefit was seen as giving students access to subjects that would otherwise not be able to be offered within the school. The technology was thus seen as only a delivery mechanism and not as having potential for ICT-mediated learning of a different type to the traditional mode on offer. In other words, videoconferencing was perceived as a non-ICT specialist technology deployed to solve a very limited palette of learning challenges.

In prompting the authors to explore the learning dimension of videoconferencing more closely, this study helped to frame ideas about the conundrum we encountered. In terms of learning strategies, videoconferencing has been mainly conceptualised by teacher-users in schools as useful for a traditional approach to learning, which in Higher Education terms would be seen as a ‘lecture-at-a-distance’ mode. Even when remote experts were brought into a classroom through videoconferencing, the main delivery was through a lecture type format, with interesting artefacts and question-and-answer elements used to break up the ‘talking head’ dominant segments. In most of the schools in this research, the ‘critical mass’ necessary for the development of a learning community generated round videoconferencing did not exist. Without this, the opportunity to explore the wider learning potential of the technology and demonstrate to the wider school audience different learning advantages that can be accrued from engaging with it was lost. This is not to say that there was no innovative use for learning purposes observed in our research, but rather that these examples were often isolated from the mainstream school or were not disseminated in any systematic way or suffered from the loss of key personnel at crucial moments in the development of more innovative learning.
Moving forward to the mainstream?

In examining ways in which videoconferencing could be used for different learning strategies and in a more learner-centred way (Hannum and McCombs 2008), we draw upon two examples from the recommendations of our study into the Advanced level provision. The first is to deploy additional technologies that, by being added onto the videoconference facility, should encourage a different mode of learning (Saw et al. 2008). For example, the provision of a virtual whiteboard, with shared access for both far and near ends, has the potential to be used to generate co-knowledge, in which, say, teacher and student share ideas and build models of understanding together rather than being transmitted from the teacher/expert to the student. By saving the products of such joint enterprise, it would also privilege the activities of the student as well as the teacher/expert in preparing materials for revision. The second example offers a different way of learning that is beneficial to deep understanding of material. We suggest that students should be linked with remote students on the same course to form ‘v-buddy’ pairings, in which the couple would have dedicated videoconference time each week to work together on course materials or pursue their own learning agendas in the context of the examination they were preparing for. This could either be done formally, developing materials to reflect the new learning arrangements, or informally by the students themselves determining their own learning plans together, with support by the facilitator teacher when required. This would have the effect of shifting the responsibility for learning towards the students and moving towards independent study as the main way in which videoconferencing was deployed and contributing to the development of student self-efficacy (Knight and Yorke 2004). It would also give each student access to a different viewpoint or expertise beyond the limitation of their own school context. The main obstacle to the use of v-buddies as a new form of learning was the worry that such pairings would be largely unsupervised, even with the capacity to record exchanges, and therefore open to abuse or exploitation. This in itself raises interesting questions about trust when developing peer-to-peer models of learning remotely.

In seeking to implement our ideas about how to use videoconferencing in more innovative learning ways, we devised a project with some American colleagues, in which participating schools would set up a number of v-buddy arrangements around a curriculum task of mutual interest. We alighted on Citizenship as the area where both American and British students could gain equally, both in terms of qualifications and in the knowledge co-produced. V-buddies would have regular contact (always recorded) through videoconferencing combined with peripheral technologies and would organise and deliver a Citizenship Project of their mutual choosing. The key principle operating in this project would be that teachers would not interfere at all in their deliberations unless help was requested by the v-buddies themselves. Any support given would be minimal. However, we could not attract the necessary funding to set up and manage the project and so test out our hypothesis, perhaps providing an all too real demonstration of the low priority of videoconferencing in government funding decisions.

Conclusion

To summarise, in our view, the way to mainstream videoconferencing in schools is by demonstrating a much wider range of learning benefits to the broader audience of students and teachers in schools which would have the effect of bringing videoconferencing in from the cold. Drawing on social constructivist (Vygotsky 1978) and transformative (Mezirow 1991) learning theories and our own research demonstrating that some of the most productive learning came from peer-to-peer use of videoconferencing, we would argue that a more interactive, co-learning approach to knowledge construction and acquisition is facilitated by a coming together of synchronous and asynchronous technologies, with videoconferencing offering an opportunity for student-centred learning at a distance.

By integrating additional technologies into the routine practices of videoconferencing and creating a dense web of v-buddies throughout schools, we believe that this would have the effect of increasing independent learning amongst the students (and incidentally, we believe it would also increase their grade scores), but just as importantly it would lead to the utilisation of videoconferencing normatively rather than the equipment only being brought out for special occasions. When the potential of videoconferencing for delivering learning in more innovative ways is recognised amongst a broader audience of students and schools, the effect would be to draw in videoconferencing as one of a range of technological gateways to learning and remedy its current position as an orphan technology.

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