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Research Question Cluster Five:

- *In what ways has the use of digital technologies (including CAD/CAM) helped to raise pupils' aspirations?*
- *What other consequences are there of using digital technologies in D&T?*

1 Introduction

It makes interesting reading to revisit, after just over a decade, the edited text of Hutchby and Moran-Ellis (2001). Here, in the realm of *technocultures* can be found discussions of how notions of childhood and childhood transition are formulated and have changed. Where once childhood was seen in terms of something 'natural', something pure and an entity to be nurtured it can now be seen as *technologised* and, some would argue, is thus somehow prone to compromise or corruption. The age of *technochildhood* is with us.

The text discusses how, in its sense of transition, childhood is about both dependence and independence – and each of these can each be understood interpersonally and technologically. Lee (2001:166) notes '...that technologies have played a significant role in the production of children's independence' and he argues that technologies (including spectacles and inhalers) can be '...extensions of childhood', contributing to the development of agency, identity and autonomy. Clearly, these last three concepts are valued components of any good education and engagement with them must inform D&T practice.

In weighing matters of appropriate balances of technological exposure for pupils, several considerations arise. No technology (software or hardware) is neutral and, as will be seen in what follows, maintaining a critical disposition is key to good educational practice. While the digital world frequently sets off alarm bells around such issues as cyber-bullying, surveillance and privacy, no technology is innocent. Thus, when teachers, parents or pupils decide to use any new technology – no matter how seemingly benign – the issues of uncritical socialization and enculturation (towards the new), approval and, even, promotion and dependence can go unchallenged. In times of high connectivity, 'reaching out' and accessing become normal – but these only ever build, in the constructivist sense, on that which is already personal and the local.

Thus, as an empowering educational extension, whether a digital technology is in the form of a specific device or software package or it is a globally connected system, it is at once both asset and liability to good practice. As with all technologies, they can manifest as (seemingly) simple and unproblematic tools of enablement or – as with proper education – they can themselves be the focus of the kind of critical questioning that underpins all learning.

2 What are aspirations?

An aspiration is a goal to be achieved, a dream to be realized or a target to be reached. Aspirations are as idiosyncratic as those who hold them and the belief that something of value can be achieved, is what inspires individuals to gain and apply knowledge and skills in order to turn their aspiration into reality. The human act of aspiring to attain, gain, or contain things of value is evidenced throughout history by anthropological artifacts that demonstrate the construction of edifices, the recording of hieroglyphs and the adornment of corpses. We can determine the existence of aspiration in cultures across time and across the globe through analysing this evidence. We can also determine that what people aspired to, in the main, was the best of what was available at the time; it was desirable. Some aspired to possess the most precious metals and finest cloth and it was these that were buried with monarchs rather than the less desirable dented tin and coarse cotton. We can, therefore, with some assurance assume that what most young people today aspire to includes the best of what is available; it is desirable.

The advent of digital technologies brought about since the Digital Revolution in the early 1980s has seen sweeping changes in how we create, store and share information. Many people, young and older, aspire not only to *owning* the physical artifact that enables them to engage in such processes but also to *possess the knowledge* that enables them to do so. Therefore, particular assumptions are often made about the changes in pupils' aspirations influenced by the advent of digital technologies in schools and particularly in Design and Technology education.

3 What digital technologies contribute to influencing the way students interact with learning?

Pupils entering Secondary School today were born at the turn of the Century. These young people have only known a world that has been populated by digital technologies given that the revolution started during their parents' teenage years. How they interact socially, politically, occupationally, communally, commercially and administratively will involve, at some level, digital technologies. The processes, interfaces, and software their parents use *now* will most likely be obsolete and superseded by systems we can't now imagine by the time these pupils are young adults. Who will provide the

foundation of skills, knowledge and, most importantly, criticality that will be essential for their productive participation in the future using digital technologies of their time?

Already pupil-to-pupil tutoring is a sound pedagogical approach adopted by most educators who value the guide-on-the-side manifesto of Vygotskian theory (1978). Pupils who are techno-savvy can teach other pupils quickly how to navigate the touch screens of iPads™ and SmartPhones™. The reality of having the neighbour's ten-year-old tune your television has moved into modern orthodoxy.

Conventionalism can be at a variance in formal education. Tensions may exist where teachers perceive the motivational bubble that surrounds the novelty of digital technologies overwhelming the more traditional modes of learning embedded in the curriculum (Davies, Hayward and Lukman 2006). But, developing the productive learning environments that enable pupils to deploy digital technologies as artifacts and processes of learning requires more than a tokenistic inclusion of one or two interactions per subject per term. Pupils' aspirations would be best guided by an organised, critical approach to the contribution to life that digital technologies are likely to make for future world citizens and that as resources these technologies are capable of altering how we interact with knowledge (Hague and Williamson 2009). They are a reality. Ensuring pupils develop an evaluative approach to the use of digital technologies is possible if pupils are exposed to and engaged with such rigorous analysis in school. We propose that D&T offers the only significant opportunity for pupils to be educated holistically in the use and consequence of use of digital technologies.

4 What is the evidence that demonstrates the influence that using digital technologies has on students' aspirations?

4a Participation

A report by Hague and Williamson (2009) found that when young people engaged with digital technologies they were participating in a 'popular culture experience' (2009:11) that enabled them to access and generate information. Politics and consumerism are populating these platforms more and more in order to deliver motivational, manipulative or persuasive narratives that may influence beliefs and actions of the populace. The greater the participation rate of young people in this popular 'life-space', then the more they are exposed to the values and subsequent exploitation of the deliverer. The intensity of the bombardment of information through Twitter™, Facebook™, and Blackberry™ style soapboxes demands that the audience have the ability to critically analyse the narrative. In 2001 Prensky believed that, while young people were beginning to process information in different ways due to their exposure to digital technologies, they were also seen as having limited understanding of those technologies or the cultures they represent (Prensky 2001). So participation requires pupils to be engaging in learning with and through digital technologies and in learning about them, which requires

critical thinking skills (Burn and Durran 2007). Hague and Williamson (2009) propose that formal education needs to emphasise digital literacy as part of the core curriculum.

'Digital Britain', a report published in 2009 by the Departments for Culture, Media and Sport (DCMS) and Business, Innovation and Skills (DBIS), (DCMS/DBIS, 2009) includes a plan to reach a secured position for Britain economically through increasing digital participation. It is a skills-based plan focusing on providing British citizens with the skills, motivation and confidence they need to ensure that the UK becomes one of the world's leading digital knowledge economies. Other reviews and reports such as the Morris Independent Review of ICT User Skills (2009) and the Byron Review (2008) have had remits that focus on the development of digital life skills or digital literacy and the entitlement that all children have to gain such knowledge. Such reports demonstrate the popular belief that maximizing knowledge and understanding of digital technologies will best prepare future populations for productive lives. Such beliefs have implications for what happens in formal education and how curricular and classroom strategies are going to deliver the skills, knowledge and critical understanding required to make this happen.

4b Integration

The challenge of integrating into practice digital skills across the curriculum in schools is beyond the remit of individual teachers (Hague and Williamson 2009). What is interesting is that a digital version of Bloom's 1956 Taxonomy has been created (Churches, 2008) and attempts to investigate possibilities for learning. Some of the 'verbs' that are included in this 'new' taxonomy mirror D&T's contribution to pupils' learning through designing, planning, producing, inventing, devising, constructing, making, broadcasting and animating. Collaborative activities are also included with verbs such as questioning, commenting, networking, contributing, conferencing, reviewing, debating and posting. This modern application of theory suggests that the integration of worthwhile engagement is possible if the curriculum is reshaped with a focus less on subject domains and more on integrated learning.

The Becta Report (2009) highlighted that where digital skills were integrated across the curriculum a wider range of positive outcomes were possible for pupils. D&T can play a large part in delivering digital technology skills in a challenging environment that encompasses many 'subject' areas in the current curriculum. In a consideration of secondary education the report found four key outcomes emerged for students who were exposed to a greater use of digital technologies in formal education including: students gained an additional term of progress; students' overall grades improved; students' performance improved and was maintained after a year; and, where students had a computer at home at Key Stage Three they demonstrated significant improvements in their overall Key Stage Four test scores.

Access to home computing seems to be an important element for progress in learning and Hague and Williamson (2009) highlight that this access to digital media is not just a one-off act of buying into technological products but a social process where updating, upgrading and modifying existing hardware and software accentuates the socio-demographic inequalities. This may not be reflected in the figures used by Becta (2009) that show while 75% of young people have access to broadband at home only 60% of these use it every day but 80% use it to do their schoolwork. The platforms being used at home may not replicate those being used at school and it could be debatable as to where the 'latest' technology is to be found, school or home. However, it is undeniable that schools do have a responsibility to remove some of the inequalities that exist due to social demographics.

Ito et al. (2008) confirmed that participation in digital life is more than simply accessing online popular culture. Formal education communities do not characterize the type of experimentation and exploration that young people engage in during their participation in social digital activity. There appears to be a 'think carefully' divide that distinguishes traditional educational activity from youthful civic and social life (Ito et al, 2008). The implication here is that educational practice, as suggested through D&T activity, can engage pupils in innovative and creative explorations of materials and systems that mobilize pupil thinking and contribute holistically to a useful education for the future. However, students' aspirations for the future will be enhanced through critical thinking and challenging, authentic experiences as well as social learning. The blend must be well managed.

4c Communities

We move in different communities and where once the boundaries of these collectives were distinguishable by space, the advent of digital space has blurred the peripheries and created sodalities of like-minded individuals. The Digital Technology Guidelines (DTG) from New Zealand provide an approach to teaching and learning digital technologies in the secondary school to support pedagogical practice, develop links to the national curriculum, provide a useable framework for teachers, create a platform to enhance industry relationships and to encourage self-reliant life-long learners. It incorporates a flexible planning environment that encourages teachers to design and deliver programmes of work to secondary pupils through strands such as Electronics and Control, Programming and Software, Digital Media and Digital Society. Since 2007 the project has identified that it is not only the school community that is benefiting from the development of this method of exploring digital communities. By integrating within the local communities, schools are exposing the possibilities of personal growth for pupils and members of the wider community through the development of digital skills, knowledge and understanding.

Light and Luckin (2008) look at technology-enhanced learning and two aspects of relevance to the social justice agenda which address how technology can be used to address all people's needs and differences and how it can be used to enable more people to communicate, socialize, debate and participate in society. An interesting intersection between the idea of social justice and personal aspiration is reflected in Milne's (2005) work which addresses the problem that if everyone aspired to have the same thing then designing society would be straightforward. When we factor in choice (aspirations and desires) and difference (physical, intellectual, social, demographic) then we have a more complex design problem – and design diversity.

5 What are the consequences of using digital technologies in D&T?

5a Personalised approaches?

An International PISA (2009) report that probed students' attitudes to digital technologies looked at the learning potential of students where digital technologies had been integrated into their school lives and also their homes. Similar results to previous reports mentioned in this paper were found. Where there was a combination of access to ICT and technologies at home as well as at school students demonstrated gains in their own learning. The PISA report emphasized that the use of a digital learning platform was significant for students to gain a personalised approach to their learning. Design and Technology uses a whole-part approach to engage and develop design thinking yet what is emerging from the literature is that a personalised approach accessing technology both inside and outside school is what makes a difference.

Using Computer Aided Design (CAD) in schools can lead to the 'white elephant syndrome' where the school is not always able to keep up to date with the latest versions of the software (or hardware) for their specific area. Students may be using 'old technologies' for a modern curriculum. The accessibility of open-source software, particularly in the home environment, may lead to an 'I can do better outside of school' attitude that diminishes the value and contribution of formal pedagogical practice. Computer Aided Manufacture (CAM) is the process of manufacturing where the design has been created using specific CAD software and exported to a 'carrier' such as a 3D printing machine where the artifact is manufactured.

Students are not often participants in this process; more often they take a spectator's role. Their participation may only be engaged in applying finishing techniques or processes to refine the final product. This particular digital process has changed the key element of the Design and Make Process that had previously been the domain of the student. As such processes enter the domain of the teacher or technician so individualised approaches using such technologies become marginalised. CAM does allow students to have access to free software outside of school and the software gives them the opportunity to explore and examine one aspect of virtual design. However the translation of such

investigation into a final artifact is problematic without the appropriate equipment either at home or at school. This lack of translation into a physical product is symptomatic of the onset of digital cultures and practices (perhaps epitomised in the numbers of photographs now taken that are never printed).

5b Physical space versus virtual space

There is a discernible gap in the experience, expectations and technical expertise between young pupils and their teachers and technicians (Light and Luckin, 2008). There is another discernible gap between design space and development space. Students may be asked to design and make, but are not always able to move from simulated or virtual space in the design phase to physical space for making due to costs of materials or lack of access to hardware. Sener (2007) says that having learners motivated to engage is not enough if there is no imperative to improve the quality (or actuality) of the content being generated. Good ideas are not sufficient so a move to co-innovation and co-production with the commercial community may be a way forward. However, professional ethical matters arise here as particular pupil-teacher-school-industry relationships must be interrogated for whose interests are being served.

6 Conclusion

If aspirations are largely about desire and not all in the world of digital technologies is seen to be desirable to students, then an age-old educational challenge remains. That is, it falls to educators to overcome the challenge of the less-palatable and to whet pupils' appetites. This cannot be done by individual teachers let alone individual D&T teachers. If the D&T department and the school's ethos is one of little more than skilling, is uncritical of technologies, and doesn't value the triad of agency, identity and autonomy then, to draw on Postman (2000), schools and teachers are little more than promotional channels for particular (marketed) technical products. The result is apathy towards and ignorance of rich knowledge and learning.

Once more, the matter of digital technology engagement is one for both a subject and for whole-school, cross-curricular approaches. Design and Technology is the best-placed subject and the teachers themselves will need to be aware of, and educated in, the issues involved in feeding digital aspirations. This would call for the development of school and classroom cultures that are active-critical towards digital technologies and their potential (for both good and ill) rather than cultures which are passive-uncritical towards them. Done well, D&T education in, for and about digital technologies will thus further pupils' aspirations and would (hopefully) enhance the subject's status amongst pupils, colleagues, parents and community alike.

References

- Becta (British Educational Communications and Technology Agency), (2009). *Enabling Next Generation Learning: Enhancing learning through technology – a guide for those who work with schools*. Becta. URL: <http://www.becta.co.uk/Guidance%20Docs/Becta%20Files/Publications/5.%20Enabling%20Next%20Generation%20Learning%20Enhancing%20learning%20through%20technology.pdf>
- Burn, A. and Durran, J. (2007). *Media Literacy in Schools: Practice, production and progression*, London: Paul Chapman.
- Byron Review (2008). *Safer children in a digital world: The Report of The Byron Review*, Department for Children, Schools and Families, and the Department for Culture, Media and Sport, DCSE Publications, Nottingham. URL: <http://media.education.gov.uk/assets/files/pdf/s/safer%20children%20in%20a%20digital%20world%20the%202008%20byron%20review.pdf>
- Churches, A. (2008). *Bloom's Digital Taxonomy*. URL: <http://edorigami.wikispaces.com/Bloom%27s+Digital+Taxonomy>
- Davies, C., Hayward, G., and Lukman, L. (2006). *14-19 and Digital Technologies: A review of research and projects*. Bristol: Futurelab.
- DCMS/DBIS (Department for Culture, Media and Sport and Department for Business, Innovation and Skills), (2009), *Digital Britain: The final report*, DCMS/DBIS, London. URL: <http://webarchive.nationalarchives.gov.uk/+/interactive.bis.gov.uk/digitalbritain/report/>
- Hague, C. and Williamson, B. (2009). *Digital participation, digital literacy and school subjects: A review of the policies, literature and evidence*. Bristol: Futurelab.
- Ito, M., Horst, H., Bittanti, M., boyd, d., Herr-Stephenson, B., Lange, P.G., Pascoe, C.J., and Robinson, L. with Baumer, S., Cody, R., Mahendran, D., Martínez, K., Perkel, D., Sims, C., and Tripp, L. (2008) *Living and Learning with New Media: Summary of Findings from the Digital Youth Project*, The John D. and Catherine T. MacArthur Foundation Reports on Digital Media and Learning, Chicago, November 2008
URL: <http://digitalyouth.ischool.berkeley.edu/files/report/digitalyouth-WhitePaper.pdf>
- Lee, N., (2001), 'The extensions of childhood: Technologies, children and independence' in Hutchby, I. & Moran-Ellis, J., (Eds.), (2001), *Children, Technology and Culture: The impacts of technologies in children's everyday lives*, pp.153-169, RoutledgeFalmer, London.
- Leitch, S (2006). Leitch Review of Skills: Prosperity for all in the global economy - world class skills. HM Treasury. Department for Culture, Media and Sport [DCMS] and Department for Business, Innovation and Skills [BIS] (2009). Digital Britain: Final report. The Stationery Office.
- Light, A. and Luckin, R. (2008). *Designing for social justice: People, technology, learning*. Bristol: Futurelab.
- Milne, S. (2005). User X – 'Design for Each'. Published 15 November 2005, Digital Media Access Group. Accessed 27 October 2011 from www.dmag.org.uk/resources/design_articles/designforeach.asp
- Morris, E., (2009), *Independent Review of ICT User Skills*, Department for Business, Innovation and Skills, London.
URL: <http://www.dius.gov.uk/%7E/media/3F79A51589404CFDB62F3DA0DEBA69A1.ashx>

Organisation for Economic Cooperation and Development (OECD), (2009)
PISA 2009 Results: Students On Line: Digital Technologies and Performance (Volume VI), OECD,
Paris. URL:
<http://www.oecd.org/pisa/pisaproducts/pisa2009/pisa2009resultsstudentsonlinedigitaltechnologiesandperformancevolumevi.htm>

Postman, N., (2000), *Building a Bridge to the Eighteenth Century: How the past can improve our future*, Scribe Publications, Carlton North, Vic.

Prensky, M. (2001). Digital Natives Digital Immigrants, Part II: Do they really think differently. *On the Horizon*, Vol.9 No.6, NCB University Press.

Sener, J. (2007). In search of student-generated content in online education. *E-mentor* Vol 21, No. 4.
URL: <http://www.e-mentor.edu.pl/eng/magazine/table-of-contents/number/21>

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