9Towards a new theory of Mind

The surveys of student computer use undertaken over more than five years of the study showed students using Information Technology tools to undertake tasks across the whole of their education. Key Skills has been embedded in the post-16 curriculum and in vocational training. The principles of the Literacy Hour and the Numeracy Hour have moved from the primary school into the secondary school. These Key Skills by any other name are likely to by joined by ICT. When that happens they will form the core curriculum for all students.

Surveys of teacher competence in the use and application of ICT during the same period have highlighted a growing disparity between students and their teachers. Where teaching in ICT takes place much of it is skills-based. It focuses on exercises, which are assessed on the basis of how well the student has fulfilled the expectations of the teacher and the assignment. The outcome is often a set of imperfectly-learned routines with limited transfer possibilities. This is particularly the case where schools have decided to allocate an hour a week to ICT as a taught subject, in order that National Curriculum responsibilities be met. The intention may be that ICT is to be taught as a tool, but because resources are often inadequate students rarely have the opportunity to use it as a tool except in tightly controlled circumstances.

Interviews with students, however, indicate that their starting points for work are what they already know, and what is available for their use. The conventional instructional paradigm holds that the learner is introduced to a new program, practises the skills and then applies them in a relevant task. However, this is not that which students apply to their own Information Technology use.

Tasks which students undertake represent the unknown: they try to solve problems and complete work at the same time. The old paradigm of learning, practice and application has little relevance to tasks which they undertake. The constant updating of hardware and software means that few schools have the

resources or the time to ensure that students learn, practise and apply their ICT skills. What is happening is that students apply the programs they have to the task in hand, and try to learn the routines as they go along. The use of the tool becomes shaped by the outcome, and the skills develop through use. The practice becomes one of 'do-it-yourself', in which items are taken 'off the shelf' and used in whatever way the constructor sees fit.

The French term for this is 'bricolage' - whether for a do-it-yourself store, a builders' merchant or the act of constructing an artefact in this way. In 'The Savage Mind' (1962) Levi Strauss used the term 'Bricolage' to describe the way in which the non-literate, non-technical Mind of 'primitive' man responds to the world around him. The process involves a 'science of the concrete' which is carefully and precisely ordered, classified and structured by means of its own logic. The structures are 'made up', and are ad-hoc responses to an environment. They establish homologies and analogies between the ordering of nature and that of society, and 'explain' the world and make it able to be lived in. The bricoleur constructs the 'messages' whereby 'nature' and 'culture' are caused to mirror each other. Levi Strauss saw bricolage as a way in which pre-scientific societies construct a belief system which explained their world.

Papert (1980) used the concept of bricolage in relation to the concept of 'chunking' (Miller, 1956), a process in which knowledge is broken into 'Mind-size bites', which enables new knowledge and understanding to be constructed from it. His thesis was that the use of previously learned strategies - specifically LOGO routines - could be used as a tool by children in concept formation.

Levi Strauss' explanation of bricolage and the bricoleur offers an insight that is, perhaps, more applicable to our students.

> …a bricoleur is someone who works with his hands and uses devious means compared to those of a craftsman…(he) has nothing else at (his) disposal. … The bricoleur is adept at performing a large number of diverse tasks…the rules of his game are always to make do with 'whatever is at hand'. (p.17)

The process used by students, then, is one of working from the specific (the assignment or task that must be completed) to the general (learning from that experience to apply to future experiences). The signs by which they work are those of the Graphical User Interface, with its buttons, toolbars, the ability to undo errors and print preview work in progress. The 'devious means' which

they use involve templates and wizards, making do with 'whatever is at hand'. Their work gives an account of their lives in a world where allusion, reference and quotation seem the only possibility.

> We have already noticed the connection between…the activities of the…bricoleur and the modus operandi of the jazz musician. …This art, - an art of signifiers, not signifieds, can be said to be truly modern…
>
> (Hawkes, 1977 p.121.)

If the analogy of 'do-it-yourself' is developed, then one needs to examine the tools and materials that a bricoleur can find to hand.

The toolbox

The toolboxes with which students work can be found at home, amongst their peers, and in educational establishments. The ubiquitous personal computer with a 3.5-inch disk drive can be used to achieve at least part of whatever task is in progress. A collection of floppy disks will store all of the parts that have been fabricated: the artefact will be assembled in whatever space offers the best facilities. A CD-writer extends the range of possibilities, whilst online storage resources can be accessed by students from whatever location for whatever purpose, be it individual or collaborative.

The diversity of information technology provision in educational institutions is a by-product of the speed of technical change and of the continuous consumption predicated by built-in obsolescence. The same pattern can be found amongst individuals: what was state-of-the art six months previously is no longer marketed. The cutting edge of technology slices the market into as many segments as there are owners, many of whom imagined that their purchases would have the same life span as other consumer items such as video recorders or washing machines.

Students learn to use a range of tools in whatever way they can. Old 286 machines can be used to create and edit text and data: a 386 will be used for that, and more. Computers with a 486 processor serve as workhorses, whilst the serious work is done on the newest, fastest machines with the largest memory and the biggest hard drives. Scanners and digital cameras will grab all the images that are needed. Institutional Internet access, with greater

bandwidth and faster connection speeds than at home will provide serendipitous information sources.

The Tools

> …the engineer works by means of concepts and the 'bricoleur' by means of signs.
>
> (Levi-Strauss, 1962; 1972 p. 20.)

Throughout the research it has been noted that students work with whatever software tools are to hand. These tools range from the basic integrated Works packages installed on educational networks, through those, like Lotus SmartSuite or Corel WordPerfect Suite, which are bundled (for market share) with machines sold into the domestic market, to the latest incarnation of Microsoft's Office. The more enterprising students download freeware or beta versions of programs from the Internet. DTP programs, publishing packages and presentation software are all available, to be picked up and used when they are needed. The CD-ROM cover disks that are given away with computer magazines are passed around if they contain games, programs or useful utilities. Oracle's Think.com links students to world-wide collaborative communities and provides a forum for publishing.

Students work with Wizards in order to short-cut the learning curve. Wizards provide a way in which users can approach a task for the first time and be guided through a range of options. Auto-content and templates provide ideas and suggestions: choices are provided which users can accept or reject at will; preview possibilities and choose the one most appropriate to their needs. They offer a framework for learning in which the learner is in charge.

Success with one piece of work encourages further experimentation: the main skill that is learned is the speed with which things can be learned.

What remains to be done by the student is to knit together all of the work created by these tools. Students learn how to save and import in various file formats. Having done so, they pass that knowledge on to others. Work is copied from one application and pasted into another. All these are done in the teeth of rapidly approaching deadlines: writing, creating and editing are simultaneous. As each part of the edifice is put into place it is saved: if it does not look right, or if the structure topples, then the UNDO command restores the status quo. In this way, numbers of pieces can be tried out, considered and modified before the deadline arrives and the work is submitted. The process is

one of intuitive navigation through a series of mid-course corrections. Students have often referred to this as 'tweaking' or 'tinkering'.

The Materials

> …he 'speaks' not only with things…but also through the medium of things: giving an account of his personality and life by the choices he makes between the limited possibilities.
>
> (Levi-Strauss, 1962; 1972 p. 21.)

This Do-it-Yourself approach affords equality to all materials. Student-generated text is no more privileged a discourse than text downloaded from the Internet, saved from a CD-ROM or scanned from other text sources. Images taken from clip art collections are modified at will and used in conjunction with others scanned from books, magazines and photographs or grabbed by video capture. The Web is seen as an infinite resource of images and code as well as information. These materials, then, are seemingly endless: the needs of the task, the tools to hand, the knowledge pool and the time available are the only constraints.

The Artefacts

An artefact that illustrates the dilemma which this poses to educational institutions was produced in response to a Year 9 Geography assignment which was set at Boston Spa Comprehensive School. This required students to research and write a paper on earthquakes. Responses varied from handwritten explanations drawn from a range of textbooks with appropriate hand-drawn coloured diagrams, through bald summaries of lesson notes, to work resourced from, and produced through, ICT. The most imaginative example of the latter category was produced by a student who utilised diagrams from Encarta entries, saved a sequence of images from the video clips as individual frames and chose text samples to illustrate the process. These were then copied and pasted into a document and presented as his own work. His (original) written contribution was a series of headings and an explanatory commentary.

This assignment elicited a number of responses from teachers. Many thought that the report somehow short-changed the educational process. The student admitted that the report had been completed in half an hour. Many students had spent weeks on their reports, struggling to share library books and

produce neat work. Nevertheless, in terms of both cognition and outcome the student with a home PC and Encarta had achieved what the assignment intended.

Presentation software provides enhanced opportunities for students to embed headings and explanatory commentary in a format that uses images and effects to communicate. These postmodern collagistes cut and paste images into the presentation framework and thread their message through the medium. The information is carried both visually and textually.

In an early (1996) example of PowerPoint by a Year 12 GNVQ Business (Advanced) student, images and text were combined to illustrate a talk on employment and the law. As with many such presentations the student incorporated text from the report into the slide show. The result was that effect of the image is minimised. The amount of text meant that the value of the image was more decorative than semiotic. By the following year students were adapting their style to match the presentation. Standard layouts and images from PowerPoint were still used, but the quantity of text had reduced.

Year 11 students in a GCSE Geography project the same year (1997) collaborated to produce a report of their field trip. The majority of the images were drawn from the clip art library, but a map had been scanned and inserted into the presentation. Student annotated the images with points from their study. By the following year students undertaking the same project were thinking in terms of digital cameras and scanners. An increasing number of computers targeted at the consumer market were bundled with these peripherals. Three of the images in their sequence were digitised photographs. The fourth image had been scanned from an existing picture.

As students gained increased access to computers in school and at home, the level of complexity of their work increased. Their slides demonstrated complex editing, with a range of images and techniques incorporated into the final product. When a Geography teacher set homework, one Year 9 student simply inserted images and selected text from the multimedia encyclopaedia Encarta into PowerPoint templates. These were then printed out and used as coursework. In later examples images were downloaded from the Web and incorporated into a presentation templates.

Web pages produced by students used a similar design approach: page design was often based on that produced by others: source code for images and effects copied and pasted into the students' own sites. Indeed, hosts such as GeoCities distribute free utilities to encourage web site construction.

The Problems

The post-modern positioning and conditioning of students, accessing, copying and swapping a range of media, extends to the work that they do. They regard the artefact they produce for assessment as their product: they have designed and created it. In essence, it is a post-copyright product. In their world, what are the ethics of ownership? What are intellectual property rights in the Information Age? What is plagiarism?

A presentation made by a Year 12 GNVQ (Intermediate) student to report on his work experience integrated word processing, PagePlus (a DTP program) and stock clip art from PowerPoint. The student also used the Print Screen facility to save screen shots which illustrated the tasks he undertook on work experience. These were then integrated with the rest of his work. The main signifiers on the slides were the images: the text simply supplied the detail. The student had started to move away from a dependency on text. Whilst undertaking work on a database during his work experience the student selected the 'Print Screen' option and saved the image to his floppy disk. On his return to school the image was imported into a DTP program, text superimposed, then copied and pasted into the PowerPoint file.

In an ideal world there would be time, resources and expertise enough to ensure that the educational process empowered all of our students equally. What we see, however, is that in this Information Age, those with access to the economic and cultural capital which computers represent are privileged.

> I got my first computer when I was five. I've had lots since then. I always use them.
>
> (Year 12 GNVQ Student.)

These students envisage any tasks which they are set in terms of the resources and routines which they will use. The proportion of their week in which computers are used is considerably greater than most of their teachers. Apart from access during timetabled lessons, students have access before school, at break, during lunch-times and after school. When they go home to work many of them switch on their computer. (Year 7: 47% Year 10: 62%; Year 12/13: 72%). It is only to be expected that their proficiency should be more extensive.

When the starting position of many students is compared with that of their teachers it becomes clear that it is critical to develop a range of strategies to

cope with the ways in which many school students work. The first imperative is that information seeking and handling skills should be taught as an integral part of the curriculum from the earliest age. The second imperative is that schools and teachers address the issue of those students who do not have access to a home PC. A policy of positive discrimination may be needed. It may be necessary to re-define our expectations of coursework in order that no group of students is disadvantaged: neither those from non-digital households, nor those who are electronic magpies, plucking glittering items from whatever source they find and constructing their artefacts.

A key issue is that students be taught the attribution and ethical use of materials. Plagiarism of a textbook is easier for a teacher to identify than that of a plethora of electronic information. Those students who have CD-ROMs and an Internet connection at home have access to an unlimited source of information which teachers cannot control, or indeed identify.

The progress of these cyborgs from the classroom into higher education inevitably raises questions about the nature of authenticity and originality of their work. The issues raised are ones that are of direct concern to teachers. If they are not addressed at an early enough stage in the educational process there may well be two inevitable consequences:

- more ammunition will be handed to those critics of the expansion of higher education, who would argue that true learning is the province of the few, rather than the resource of the many;
- those students whose understanding and use of computers is limited by their lack of access will be further marginalised.

A new (autonomous) way of working?

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which resists both privileged readings and traditional narratives, suggests an outlook very different to a Hegelian sense of thesis, antithesis and synthesis.

What do you do when you have to learn and those who should teach you don't know?

The background of many teachers in the past thirty years has been based on the concept of developmental stages in learning (Piaget, 1958). This posits three main stages through which the learner must pass - sensori-motor, concrete and iconic - before anything of significance can be produced. Much of the pedagogical culture of schools (and teacher ideology) is loosely based on a conflation of these stages and 'developmental readiness'. Teacher input, student practice and application (or transfer) are often assumed to be the appropriate model for student learning. The education system itself, with its primary - secondary - tertiary divides, and the ways in which educational resources are allocated, provides the material base for this superstructure.

Learners with access to computers have established a different material base. The speed and capability of machines, with their 'Point and Click' ostensiveness, templates and wizards, have usurped their teachers' paradigm. Learners practise the skills and concepts whilst applying them: where input or explanation is necessary the task will be suspended. The Help facility, a magazine article or a conversation with a friend should resolve the problem. Only rarely will the student consult the user manual.

To the thesis of Stages of Learning there is now an antithesis: There Are No Mistakes. The alterations in the task are part of the learning. Students use Edit: Undo; Edit: Clear or Exit: Don't Save. The process is auto-didactic.

The material base of computer access supports a superstructure with its twin pillars of apparent wisdom. The first assumption on the part of many students is that "the answer is out there": that information access through the use of CD-ROMs and the Internet, and information handling through cutting and pasting and downloading, will somehow lead to knowledge and understanding. The second assumption is that the most important aspect of a piece of work is its originality in creative terms. The creation of artefacts is a process of self-expression; the do-it-yourself of bricoleurs.

The synthesis must be that learning is seen as experiential, observational and a semiotic experience. The question of content, contentious when what has been done is not worth learning, must not be subverted by electronic form.

Concern over the subversion of content by electronic form has been identified as 'data dandyism' (Lovink 1995). He describes those who are "…concerned with…the accumulation of as many immaterial ornaments as possible…", where digital style triumphs over substance. The ornaments are a reflection of both technical skill, in that the 'data dandy' demonstrates superior competence, and technical sophistication, in that the user possesses the latest, most powerful (and most expensive) hardware, software and peripherals. The sub-text is that the user has sufficient time to devote to the acquisition of such skills. This demonstration of social worth through cyber semiotics updates the concept of fashion and conspicuous consumption (Veblen, 1899).

Or is the substance inseparable from the style?

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Our post-modern bricoleurs in cyberspace

Do-It-Yourself for Cyborgs.

> *Use the bits of Information and Communications Technologies to construct metaphors for who you think you may be.*
>
> *Be a Bricoleur of the Future, for the Future.*