13:THE USE OF ICT WITH GIFTED AND TALENTED PUPILS

What do we mean by ICT?

When considering the use of ICT with gifted and talented pupils in your school, first ensure that colleagues are agreed on definitions.

For the purposes of this launch pad, ICT (Information and Communications Technology) includes the following:

- computers of all the kinds currently used in schools, e.g. laptops and calculators.
- the in-built facilities of the computers, such as all related software, CD ROMs, and the information available via the Internet.
- related ICT hardware, e.g. headphones, tape recorders, TV, radio, video recorders.
- all potentially useful communications technology, for example communications possible via the Internet, video and computer conferencing, intercom systems, and so on.

The applications of ICT may be considered in three broad categories. It can:

- perform various functions for the user, e.g. inform, entertain, draw, record (e.g. word-process), calculate, and enable the user to communicate. These uses are described by Jonassen (2000) as 'productivity tools'.

- teach the user, i.e. provide an 'apprenticeship' in a particular subject area, on a special topic, in a certain skill or set of skills. Such types of ICT are often termed ILS's (Integrated Learning Systems). Examples are the SuccessMaker software, made by the Computer Curriculum Corporation, , and GLOBAL Learning Systems.

- amplify a user's capabilities and help the user to think. A significant amount of interest is now being shown in applications of this kind. Jonassen's (2000) term for them is 'mindtools', i.e. cognitive aids. He suggests that 'productivity tools' can

usefully be transformed into 'mindtools'. For example, databases *become* mindtools when learners use them to organise and represent what they know about the 'content' they are studying. Used as mindtools, all kinds of ICT can allow users to synthesise, re-format, transform or change direction in their thinking. This, Jonassen argues, is far more stimulating and productive for the learner than using ICT simply as productivity tools. Jonassen classifies mindtools as follows:

- Semantic networks (concept maps on the computer, for thinking and planning), e.g. SemNet
- Tools which demonstrate how ideas are dynamically and causally related, i.e. which show 'If…, then…' relationships. Examples of such tools are spreadsheets; experts systems; systems modelling, such as the American STELLA; and microworlds, such as POLYPS. The latter allows users to create spirals from different sets of variables, while ex-pert systems include some that can be constructed by students themselves, for instance PCExpert.
- Visualisation tools, especially when they are being used interpretatively, not creatively, i.e. so that the user can *understand* his/her knowledge or learning, such as Greenhouse Effect Visualisation
- Knowledge construction tools, collectively known as hypermedia. They include multimedia, desktop publishing, hypertext, website construction and CD-ROMs when they are being used to allow knowledge to be assimilated by the learner, not as directed by the teacher
- Conversation tools, i.e. synchronous or asynchronous conferencing – again, when these are being used by the learner to make sense of his/her learning.

WHO ARE THE GIFTED AND TALENTED PUPILS REFERRED TO?

There are two groups of pupils for whom the uses of ICT in schools should be considered:

- Those who show a special aptitude in their use of one or more kinds of ICT
- Those whose abilities in other areas and subjects could benefit from a use of ICT.

Of course, these two groups will probably overlap.

WHY IS THE USE OF ICT AN IMPORTANT FOCUS IN THE EDUCATION OF GIFTED AND TALENTED PUPILS?

- Children's capabilities and understanding in the use of ICT have evolved rapidly in recent years. It may well be that in our schools we have a higher proportion of very able information handlers and communicators via ICT than we currently acknowledge.
- Research shows that ICT can help make pupils' thinking and learning more explicit. This is the area in which Jonassen (2000) urges teachers to change their perceptions in respect of the real potential of ICT. ICT can increase a 'sense of audience' for the learner and be the learner's 'significant other', reflecting his/her thoughts and ideas. If a computer screen is switched off while pupils are word

processing, it can help produce a rapid, highly productive 'stream-of-consciousness' approach to thinking. As more able pupils develop their thinking skills, ICT can aid them greatly, e.g. with prediction, hypothesis making, and testing,

- Underwood et al. (1994) conducted research into the effectiveness of Integrated Learning Systems (ILS). They found that the pupils who made most gains in mathematics using SuccessMaker over a six-month period were those whose pre-test scores were highest, i.e. the most able. A number of teachers involved in the trials felt that it was the high ability pupils (and to a lesser extent the middle ability pupils) who had most benefited from the ILS experience. This was the case in both mathematics and reading, and not just in terms of results but in terms of improved concentration, confidence, work rates, etc.

- Certain types of ICT may serve to motivate and stimulate some underachieving able pupils, and to improve behaviour and/or attitudes to learning.

- Some kinds of ICT, e.g. ILSs, may provide valuable structure, feedback and direction for those able pupils who find self-discipline and organisation of tasks difficult, or who lack self-esteem.

- Some types of ICT 'free up' able pupils in areas where they are not so competent, so that they may excel in others. For example, voice recognition programs and tape-recorders may allow the orally able with poor handwriting skills or spelling to 'write' at length without being hampered by the difficulties of the secretarial aspects.

- Some types of ICT 'free up' able pupils to concentrate on higher order thinking while large amounts of 'more basic', routine work is undertaken for them. For example, data handling by a computer can liberate pupils to interact with data, control how it is displayed and focus on its interpretation. They may locate key patterns, concepts or issues, or question results, instead of spending time on the mechanics of calculating and graphing.

- One characteristic of some able pupils is the sheer multiplicity of their thoughts and ideas, or the large amount of information or detail that they try to manage. A characteristic of other able pupils is their dogged, in-depth pursuit of only one line of thought. Some sorts of ICT can encourage multiple routes of thinking or the representation of multiple points of view or sets of facts. These might include: different, multicultural perspectives on the same issue; rich images of problem situations in a variety of modalities; and information from various sources. Integrated Learning Systems may do this, and so may video or computer conferencing, or keeping several windows open at once on a computer screen.

- ICT can allow more able pupils a large amount of independence. It can be important to them to have a sense of ownership of their learning methods and media and also a sense of privacy. Many kinds of ICT are able to provide this. Underwood (1994) quotes research by Wishart and Canter (1988) showing that in terms of enhancing children's learning, an increased level of control was one very influential factor. This was coupled with an increased sense of challenge or cognitive demand, which can also be provided by ICT. Some able pupils still need to develop a sense of independence of the teacher and of others, and ICT may help them with this.

- ICT, and perhaps Integrated Learning Systems in particular, can help speed up the pace of learning for highly able pupils. Through ICT, pupils may find it easier to omit or short-cut stages in a process if they feel these are unnecessary. ICT can also offer access to experts, for instance via the Internet or conferencing. An example is the video conferencing with the Motivate Project founded by NESTA, which offers mathematics challenges set by ex-Cambridge professor. ICT can also provide expertise and information at a much higher level than may be available amongst able pupils' peers or in their classrooms. It can thus enable acceleration and enrichment, or even extension.

- Some ICT programs are open-ended, giving opportunities for wide-ranging investigation and exploration of the kind often welcomed or needed by more able pupils e.g. Geometry Sketchpad for exploring geometric relationships, STELLA for 'systems thinking', and ThinkerTools for exploring the laws of force and motion.

- Local and networked communication provides valuable opportunities for collaborative learning for all pupils, including the most able. It includes databases, e-mail, and the world wide web. There are several examples of the good effects that networked communication can have on pupils' learning, Among them are Computer Supported Learning Environments (CSILE), and Technology International Learning Environments (TILES).

WHAT ARE THE KEY ISSUES TO CONSIDER?

- **Clarity on the purpose of ICT.**
  Your school's attitude to ICT is likely to need careful discussion. It is probable that colleagues may regard its usefulness and purposes in very different ways. Current thinking is that ICT should be used to help *with* learning; it should be regarded as a medium and a tool in schools, not an end of learning in itself. Nor should ICT be viewed simply as a way of managing information or communication. Jonassen's (2000) concept of 'mindtools' is of particular value. He views these types of ICT as 'intellectual partners that facilitate knowledge construction and reflection by learners'. ICT, if used appropriately, can develop pupils' higher order thinking skills. It gives them valuable opportunities to exercise their skills of evaluation, criticism and reflection. Able pupils should be challenged to decide for themselves when and whether to use ICT, and how, why, and for what purposes. In short, they should be encouraged to use it selectively and thoughtfully. They should also be given chances to be active critics, if not designers or re-designers, of programs and hardware. Finally, no ICT – including Integrated Learning Systems – should be regarded as a substitute for teachers. Teachers will still need to manage, supervise, and where necessary adapt the ICT available, to suit pupils' needs. And they will monitor and possibly modify the pace at which it is used. The findings of Underwood et al. (1994) suggest that even ILS's may be suited more to providing opportunities for reinforcement and/or supplementary and enrichment than to replacing, or becoming an alternative to, other classroom learning methods.

- **Accessibility of ICT.**
  Providing opportunities for work with the use of ICT should not mean isolating this work from other methods of learning. Nor should opportunities for using ICT be available, or easily accessed, in some subject areas and not in others. Learning through ICT is most effective when it is contextualised and related to real problems,

issues and learning which are being encountered throughout the curriculum. Wherever possible, teachers and classes in all subject departments should have easy access to ICT. This should ideally be within, or very close to, classrooms rather than simply in isolated ICT suites and other 'specialist' settings such as recording studios.

- **The effectiveness of Integrated Learning Systems**
  Be circumspect if your school is considering using these. The findings of Underwood et al. (1994) on the effectiveness of the reading and mathematics components of SuccessMaker and GLOBAL Learning was not conclusive about the benefits. Many pupils made significant gains in mathematics using SuccessMaker, in particular the more able. However, there were not the same gains in reading. For many pupils there were also improvements in attitude, e.g. in motivation, concentration, and enjoyment. But the project could not determine whether gains in learning or improvements in attitude would be sustained, or whether learning was successfully transferred to other contexts, e.g. 'mainstream' classroom work. Teachers had some criticisms and reservations, too. These included the American content and language of SuccessMaker, the necessity for adequate staff training, and the need for teachers to have the confidence to modify ILS's and how they were administered in order to suit individuals. If pupils were not to be demotivated or discouraged it was essential to match carefully the starting-points in such programs and the pupils' existing abilities. Pupils, too, made clear that what suited some did not suit others, e.g. some liked the clear, directive structure, while others found it boring and repetitive. Using an ILS is therefore not a panacea for able pupils, for pupils of lesser ability, or for teachers.

- **Differentiation in ICT.** While some able pupils benefit from being given the clear structure and direction that some ICT can provide, others feel straitjacketed. Some pupils may benefit from ICT that offers a multitude of choices and open-ended problems which encourage independence of thought and action. Others may need programs that simulate the experience of 1:1 tuition and support, though there is evidence that most highly able pupils, if not all, tend to learn more when offered *increased challenge* through ICT So, with ICT, as with any other learning medium, teachers should make choices about what is most appropriate for different individuals or groups.

- **Gender and classroom organisation.**
  It is rare that classes or groups have access to one computer, or piece of other ICT equipment, per pupil. In any case, as stated above, one of the benefits of ICT is the way in which it stimulates collaborative or co-operative learning; for this reason the sharing of equipment by small groups or pairs may have positive advantages. Much research (described in Underwood, 1994) has found that single-sex groups (and pairs in particular) often tend to negotiate joint actions when using ICT, in a way that mixed gender groups often do not. In short, they adopt strategies that actually promote learning. Underwood stresses that this need not be the case as long as mixed gender groups are comfortable when offering suggestions and analysing and evaluating each others' ideas. However, these forms of behaviour may need a lot more modelling, open discussion and explicit teaching than is currently the case, to ensure that mixed gender groups on ICT-based tasks can succeed.

- **Dovetailing 'ICT learning' with 'other' learning.**
  Teachers may find it hard to synchronise the learning of those who undertake tasks on a computer and the learning of those who may simultaneously be undertaking tasks in other ways, i.e. the pace of different learners may become increasingly hard to manage in parallel. Similarly, teachers may fail to notice mismatches or omissions in 'content' or skills between the ICT-based learning in which some pupils are engaged and the learning methods pursued by other pupils. Unless ICT-based learning is carefully integrated with 'other' learning, and pupils are encouraged to compare their learning across methods, there is a danger that 'ICT learning' will become 'ghettoised'. In particular, pupils may not transfer their ICT-based learning to a range of other contexts and even to other subject areas, as is desirable.

WHAT MIGHT WE DO IN SCHOOL?

- Examine your register of gifted and talented pupils.
  - Does it identify those who are especially able in the use of ICT? Having read this launch pad, do you still think those you have named really represent the numbers in school likely to be highly able as managers of information and/or communication systems? Are there ways in which you could give such pupils more recognition and opportunities to celebrate their abilities, e.g. by tutoring those less able in the use of ICT?
  - Have you identified, or can you identify now, those able pupils whom you and colleagues feel

    (a) could benefit from the challenge, open-ended approach, multiple routes etc. that some types of ICT might provide

    (b) may currently be underachieving but could benefit from the structure, support, direction and/or stimulus and motivation that some types of ICT might offer?

- Audit your ICT resources, perhaps in one subject area to start with . Identify which programs, types of hardware etc. could benefit group (a) and group (b), described above. Discuss with colleagues how you could trial and monitor the effectiveness of maybe one ICT resource with one or more pupils from each of these two groups.

- Audit your most important and useful ICT resources. Evaluate the logic of their current locations and of the storage/access arrangements. What proportion are close to or within the subject departments that would like to use them? Can any improvements be made in their storage or accessibility?

- Use the list of types of 'mindtools' that Jonassen (2000) identifies. Does your school/department have any of these? Are they being used as mindtools, or more as 'productivity tools'? Discuss with colleagues how you might exploit their potential for developing more fully the cognitive abilities of gifted and talented pupils. For example, plan one lesson or sequence of lessons to include the use of one mindtool. Deliver the lesson/s, and evaluate its/their success.

- Discuss with one or more colleagues when and how often you use ICT in lessons, and why.

- How well do you integrate the use of ICT with other learning methods in lessons, or do you use a withdrawal system, or timetable use of an ICT suite or recording studio for 'set lessons' only? Debate the pros and cons of each system.
- How do you group/pair pupils for ICT work, e.g. single or mixed gender, single or mixed ability, in the use of ICT or in the teaching of the subject? Debate the advantages and disadvantages of different groupings for improving learning and the skills of collaboration and co-operation.
- Try a different method from your usual method and report back on its success.

RECOMMENDED READING

Jonassen, D.H., 2000. *Computers as Mindtools for Schools: Engaging Critical Thinking*, 2nd ed. New Jersey: Merrill/Prentice Hall.

McGuinness, C., 1999. *From Thinking Skills to Thinking Classrooms.* Nottingham: DfEE. (Also available in digest form on DfEE website under 'Research Briefs')

Underwood, J., ed., 1994. *Computer Based Learning: Potential into Practice.* London: David Fulton.

Underwood, J., Cavendish, S., Dowling, S., Fogelman, K. and Lawson, T., 1994. *Integrated Learning Systems in UK Schools: Final Report.* Coventry: National Council for Educational Technology.

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