



13 : THE USE OF ICT WITH GIFTED AND TALENTED PUPILS

What do we mean by ICT?

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

ICT

For the purposes of this launch pad, ICT (Information and Communications Technology) includes computers of all the kinds currently used in schools, e.g. laptops, calculators, with all their in-built facilities, e.g. the information available via the Internet; all related software, e.g. programs, CD-ROMs; all available and/or related ICT hardware, e.g. headphones, tape recorders, TV, radio, video recorders; and all potentially useful communications technology, e.g. the communications possible via the Internet, video and computer conferencing, intercom systems, etc.

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, enable the user to communicate, etc. The different kinds of ICT, when used in this way, Jonassen (2000) calls '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, CCC) 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 these kinds of applications: what Jonassen (2000)

terms uses of ICT as ‘mindtools’, i.e. cognitive aids. He argues, for example, that ‘productivity tools’ (explained above) can usefully be transformed into mindtools, e.g. 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 their use of ICT simply as productivity tools. Jonassen classifies mindtools as follows:

- Semantic networks (concept maps on 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, e.g. spreadsheets; experts systems (some constructed by students themselves, such as PCExpert); systems modelling, such as the American STELLA; and microworlds, such as POLYPSI, which allows users to create spirals from different sets of variables
- 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, i.e. 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 CONTEXT OF THE EDUCATION OF GIFTED AND TALENTED PUPILS?

- Children’s capabilities and understandings 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

with regard to the real potential of ICT. ICT can increase a 'sense of audience' for the learner and be the learner's 'significant other' reflecting back his/her thoughts and ideas. If a computer screen is switched off while pupils are word processing, it can facilitate a rapid, highly productive 'stream-of-consciousness' approach to thinking. As more able pupils have, and/or need to develop, their thinking skills, ICT can aid them greatly, e.g. with prediction, hypothesis making and testing, etc.

- Underwood et al. (1994), in their research on the effectiveness of ILS's, 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 (and to a lesser extent the middle ability) pupils who had most benefited from the ILS experience, in both mathematics and reading (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 behavioural problems and/or their attitudes to learning.
- Some kinds of ICT, e.g. ILS's, 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, e.g. 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, e.g. data handling by a computer can liberate pupils to interact with data, control how it is displayed and focus on its interpretation, perhaps locating key patterns, concepts or issues, or questioning 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 facilitate or even encourage multiple routes of thinking or the representation of multiple points of view or sets of facts, e.g. different, multicultural perspectives on the same issue, rich images of problem situations in a variety of modalities or information from various sources; ILS's may do this, as, too, 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 can provide this. Underwood (1994) quotes research by Wishart and Canter (1988) showing that in enhancing children's learning, an increased level of control was one very influential factor (along 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 others; ICT may help them with this.

- ICT – arguably ILS's in particular – can help speed up the pace of highly able pupils' learning. Through ICT pupils may find it easier to omit or short-cut stages in a process if they feel they are unnecessary. ICT can also offer access to experts (e.g. via the Internet or conferencing, for example the video conferencing possible with the Motivate Project founded by NESTA, which offers mathematics challenges set by ex-Cambridge Professors); it can provide expertise and information at a much higher level than what may be available amongst able pupils' peers or in their classrooms. It can thus allow both methods of **acceleration** and means of **enrichment** or even **extension**.
- Some ICT programs are open-ended, providing 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 (e.g. databases, e-mail, the world wide web) provide valuable opportunities for collaborative learning for all pupils, including the most able. There are several examples of the positive effects that networked communication can have on pupils' learning, e.g. 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. With gifted and talented pupils, Jonassen (2000)'s concept of 'mindtools', in particular, should be valued; 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 provides them with 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, how, why, and for what purposes; i.e. 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 ILS's – 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, monitor and possibly modify the pace at which it is used, etc. The findings of Underwood et al. (1994) suggest that even ILS's may be suited more to providing reinforcement and/or supplementary and enrichment opportunities for pupils than to replacing, or becoming an alternative to, other classroom learning methods.

➤ **Accessibility of ICT.**

Providing opportunities for work using 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 being encountered throughout the curriculum. Wherever possible, teachers and classes in all subject departments should have easy access to ICT, ideally within, or very close to, classrooms rather than simply in isolated ICT suites and other 'specialist' settings such as recording studios.

➤ **The effectiveness of ILS's.**

Be circumspect if your school is considering using these. Underwood et al. (1994)'s research project into the effectiveness of the reading and mathematics components of SuccessMaker and GLOBAL Learning Systems in secondary schools 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 there were also attitudinal improvements, e.g. in motivation, concentration, enjoyment, etc. 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, e.g. about the American content and language of SuccessMaker, about the necessity for adequate staff training and about the need for teachers to have the confidence to modify ILS's and how they were administered in order to suit individuals. It was essential to match starting-points in such programs carefully to pupils' existing abilities if they were not to be demotivated or discouraged. Pupils too highlighted 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 that encourage independence of thought and action, others may need programs that simulate the experience of 1:1 tuition and support. (There is evidence, however, that if pupils are highly able, most, if not all, tend to learn more when offered *increased challenge* through ICT, as mentioned earlier; this is an influential factor with the majority.) 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; thus small groups or pairs sharing equipment may have positive advantages. Much research (described in Underwood, 1994) has found that single-sex groups (in particular pairs) often tend constructively to negotiate joint actions when using ICT (i.e. adopting strategies that actually promote learning) in a way that mixed gender groups often do not.

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; but these behaviours may need a lot more modelling, open discussion and explicit teaching in classrooms than is currently the case in order 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, for example, undertake tasks on computer or using a calculator with the learning of those who may simultaneously be undertaking tasks in other ways, i.e. the paces 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 ICT-based learning undertaken by some pupils and learning undertaken by other methods 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 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 pupils able in a wide variety of subjects whom you and colleagues feel a) could benefit from the challenge, open-endedness, multiple routes etc. that some types of ICT could provide and b) may currently be underachieving but could benefit from the structure, support, directedness and/or stimulus and motivation that some types of ICT could offer?
- Audit your ICT resources (perhaps in one subject area to start with). Identify which programs, types of hardware etc. could benefit group a), which 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 group a) and/or group b).

- Audit your most important and useful ICT resources. Evaluate the logic of their current locations and storage/access arrangements, e.g. what proportion are close to/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 gifted and talented pupils’ cognitive abilities more fully; 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 use of ICT or in the subject studied? 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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