Information handling skills, cognition and new technologies

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Abstract

Few would dispute the efficacy of multimedia technology and the worldwide web in promoting declarative knowledge or the acquisition of facts. It is the argument of this paper however that, apart from assisting a learner in “knowing that”, these technologies are underestimated in their capacity to facilitate intellectual skills—procedural knowledge or “knowing how”. Via examples from children employing information handling skills with a CD-ROM, this paper attempts to illustrate the ways in which new technologies support and enhance a range of skills associated with deep level processing and meaningful learning such as metacognition, problem solving and critical thinking.

Introduction

As more multimedia technology becomes available to schools and users of the internet continue to grow in number it is clear that such technologies are becoming an intrinsic part of our educational armoury. And yet, as far as their specific educational applications are concerned, such technologies would appear to have only superficial claims as to their capacities for supporting learning and teaching. Databases of factual material, such as encyclopedias, are the commonest new learning resources in schools and marketing ploys are fixated on the power of multimedia encyclopedias to provide factual knowledge in a manner which would meet fully with the Thomas Gradgrind (Dickens, 1955) model of learning in which “little vessels” are filled with facts. But is there evidence of anything more significant than this occurring? Have we yet brought “the breadth of imagination” to the use of CD-ROM (or other new information technologies) “that the designers brought to the design of it” (Kenny, 1991)? Are the world wide web and multimedia technologies only to feed a reproducing model of learning? Or have they the potential to facilitate a transforming model of learning (cf. Dahlgren, 1984)?

Many commentators (Laurillard, 1995; Taylor, 1995; Kumpulainen and Mutanen, 1998) have stressed the importance of teaching information handling skills in order to use new technologies effectively. While this writer recognises the importance of such
skills this paper explores the extent to which they might in fact come via the use of new technologies. This view of ICT is one in which a database is perceived as an alternative memory with wide ranging and deep resources, allowing the learner to conceive information (written, pictorial, aural etc.) as a “vast workspace in which to build his own interpretive skills” (Bolter, 1986, 230). Such a view is more akin to a transforming as opposed to a reproducing model of learning. In keeping with this view Papert (1980) saw children actively in control of their own learning, and, through control of the computer, exploring their own thinking processes. This metacognitive approach posits learners as problem solvers working in Bolter’s “vast workspace” in ways never before possible, interacting with and supported by, new technologies.

Methodology
The pupils were twenty eleven-year-olds in a state sector school all of whom were familiar with CD-ROM technology, specifically through the use of the Encarta 96 Encyclopedia (1996). Each one worked individually on the questions, which were administered by the writer and related to a recently undertaken science project. The CD-ROM with which the pupils worked was the New Grolier Multimedia Encyclopedia (1993). This provided a range of search options including key word searching and browsing.

The questions were chosen to focus the activities of the pupils rather than to encourage them to browse freely. As such it was deemed appropriate to time responses and to stress the importance of the efficiency of the search in what was characterised as a large database of information. Before the study began the pupils were informed that their search strategies would be timed in order to judge the efficiency of the methods employed.

In the results analysis which follows, the occurrences in articles numbers 83/52, indicate that the word METHANE occurred 83 times in 52 articles. When combined with the word SCALE the occurrences in articles is reduced to 5 times in 3 articles (5/3).

Questions and results
Name one large-scale use of methane
Ten different search strategies were utilised by the twenty pupils in attempting to answer the question. In each instance the choice of key words to search always included METHANE. With the exception of one pupil, when the occurrences in articles were high (83/52), they attempted a second search in order to reduce the amount of material with which to work. This was achieved by adding the word USE to the original search word. Fifty per cent of the cohort used the word SCALE in combination with METHANE which reduced the occurrences in articles to 5/3. Two pupils searched METHANE and USE initially, thus eliciting the correct response in 1.5 minutes while another two subjects searched LARGE SCALE with METHANE; the first took six minutes over the search, not making any attempt to narrow down the search but instead reading irrelevant material on the subject of the solar system. Reducing the search space occurred only as a result of prompting from the investigator. The second search of the two using LARGE SCALE and METHANE was considerably more efficient, arriving at the correct response in two minutes by immediately choosing the article title “fuel”.

Why is lime added to soil?
Familiarity with the area of learning implied in the question was in evidence in the case of at least half of the pupils, who either mentioned the answer before searching or explained that they were currently working on a gardening project in science. All pupils, without exception, searched for the two key words, LIME and SOIL. The ensuing occurrences in articles (9/9) elicited four different choices on the part of the pupils, all of which proved to be similar and highly pertinent. “Land reclamation”, “fertiliser”, “compost” and “history of agriculture” all confirmed the pupils’ familiarity with the area of work, yet from an individual standpoint. The outcomes, in terms of the answer to the question, were greatly varied, thus demonstrating the fact that the CD-ROM was not, even in the area of retrieving responses to factually oriented questions, restricting to the individuals. The contrasting lack of diversity in the search strategies would suggest that the most efficient strategies were being employed here. Although these could be partly accounted for by the direct and uncomplicated nature of the question, it seems possible that even at this early stage, some of the pupils are beginning to identify efficient patterns of searching and to establish routines.

What oxides cause the pollution that damages vegetation and buildings?
All but one pupil chose to search OXIDE or OXIDES as a key word, and all but three chose to search POLLUTION linked with OXIDE or OXIDES. In addition five employed a search for VEGETATION or DAMAGES, thus reducing the number of occurrences in articles to readily manageable levels (2/1). As in the first question one particular pupil demonstrated an ability to search for the “right” word, in both instances eliciting a response with accuracy and efficiency.

This would appear to confirm that the majority of pupils had established the routine of searching what they believed to be the key words in the question. There was also considerable uniformity in respect of the words searched, again pointing to the utilisation of efficient search strategies.

The strategy adopted by one pupil was particularly flexible. Out of a choice of nine occurrences in four articles the initial choice was to look at the text of the first article title. This resulted in a decision then to consult the previous pages of the article and then a change of strategy when the desired outcome was not available. The next strategy was to look at the text under “pollution, environmental” suggesting that the pupil had rethought the question. This decision may also have been motivated by the fact that “pollution, environmental” was mentioned more frequently, four times, than any of the other article titles.

The impasse arrived at by another pupil also suggested an ability to be flexible, in that, after reading the information on stained glass he decided both to limit the search space by adding another word, DAMAGE, and to use the exact wording from the question: OXIDES instead of OXIDE. This strategy successfully took the pupil to the correct response to the question.
The search strategies proved to be particularly efficient here. Only three pupils took three or more minutes to reach the desired outcome, the other seventeen all managing to retrieve the required information in between one and two minutes. Two search strategies were particularly efficient, taking only one minute. This would appear to be related to the simplicity and directness of the searches employed: in the first instance the words OXIDES and DAMAGE being entered and in the second the same two words plus VEGETATION. Both of the pupils involved adopted a strategy of not entering the exact word DAMAGES but instead omitting the final “S”, thus accessing the required information directly through a readily manageable number of occurrences in articles (3/2 and 2/1 respectively). This latterly mentioned factor of omitting one letter also proved to be a crucial aspect for another pupil who initially entered VEGETATION along with OXIDES, POLLUTION and DAMAGES. This entry was met with a zero response, but the subsequent removal of the final “S” from DAMAGES resulted in the successful retrieval of the required information.

In another search strategy four of the five key words in the question were entered and by a technique of searching for these words in the same paragraph (but not adjacent to one another) the pupil met with success. This was in marked contrast to the earlier example of a successful search where the emphasis was upon simplicity and directness rather than an elaborate search.

Why is graphite used as a lubricant?
The majority of pupils, nineteen out of twenty, elected to search GRAPHITE and LUBRICANT. Seventeen of these nineteen went initially to the article title “lubrication” before finding the required information under “carbon”. Lubrication was referred to in the title and so seemed a sensible choice. It did not, however, elicit the required information in this instance. This therefore tested the pupils in terms of their capacity to be flexible.

The other two pupils went directly to “carbon”, suggesting either previous experience or a good guess, while the remaining pupil searched GRAPHITE on its own, despite the very high occurrences in articles (72/46). This methodical and highly systematic approach took five minutes, in contrast to the other recorded mean times of 1.5 and 2.4 minutes.

What are the three main effects of oil spills? In your opinion which is the most serious?
The pupils were prompted to look at this two part question in two separate phases in order to clearly define their objectives, stage by stage. This method of processing the question was paralleled by the cumulative structure of the questions in relation to each other (in that subsequent questions demanded techniques applied in prior questions).

Without exception the pupils were able to list the three options from which to choose, and the results, although precisely the same in content, were expressed quite differently. These differences were reflected to a considerably greater degree in that aspect of the problem which involved selection of the most serious effect.
All pupils used the key words OIL and SPILLS, though in a variety of ways. Two pupils entered the words on separate lines, thus searching for them in the same paragraph, but not adjacent to each other. Six pupils, the largest group, entered the words on the same line, thus searching for them in the same paragraph and adjacent to each other. These searches elicited 19 occurrences in 10 articles and 11 occurrences in 9 articles respectively. Every one of these eight pupils selected the article title “oil spills”, which took them, after using the next page function key, to the required section of the text. The mean time taken by the second search strategy was one minute faster than the first, thus confirming the efficacy and the efficiency of searching the words as adjacent to one another, just as they were in the question.

All of the other searches effectively reduced the search space by using the word EFFECTS along with OIL and SPILLS. Despite this efficient reduction of the material to be worked with, five out of six of these alternative search strategies took considerably longer than the first two. (Between 4.2 and 8 minutes.) The only strategy to compare favourably with the first two in terms of time taken was the third one, which immediately searched EFFECTS along with OIL and SPILLS.

Four pupils entered the word THREE as part of their search strategies. This highly generalised demand on the database was omitted by two of these four pupils in their second searches, though one pupil used it two more times before excluding it from the search. Another pupil used the number 3 instead of the word, and through fortune rather than judgment, arrived at the required response. (The number was by chance included in some data in the relevant paragraph.)

Another search strategy exemplified the importance of attention to minutiae, in that one pupil, after his flexible exclusion of THREE from the search, went on through a reading of what proved to be irrelevant information on energy sources and then subsequently added an “S” to EFFECT to reach the desired outcome.

In your opinion what is the main environmental consequence of acid rain?
The question demanded similar techniques to those applied in the previous one, that is, its division into goals and sub-goals. All of the pupils tended to do this without exception, finding a range of possible consequences to select from and choosing one. This developed strategy was extended both in its immediate context and in its potential for informing subsequent questions by asking for a reason for the choice.

ACID RAIN, both on its own (twice) and in combination with ENVIRONMENTAL (five times) or ENVIRONMENT (two times), was the key phrase chosen by all pupils. Other attempts used CONSEQUENCE (five times), but in each instance reverted to one of the above by eliminating that word when confronted with a zero response. This strategy of reducing the words to be searched, appeared to be aimed at producing the higher number of occurrences in articles in order to open up the search space. This was in direct contrast with the one in which the search words are added to, in order to reduce the number of occurrences in articles and thus limit the search space.
For the most part pupils chose the article title “acid rain” when confronted with a list of articles which varied from 20/10 through 16/9, 8/5, 7/5, 4/1. This was not surprising since it was [1] the key phrase in the question, [2] at the top of the list of article titles and [3] always had the most frequent occurrences in all of the lists in which it figured. It was therefore very surprising, given the above, that some pupils chose “pollution, environmental” which was well down the list of article titles and had a very low frequency, occurring only once. This would suggest, however, a thorough reading and understanding of the question on the part of the four pupils who managed the required response in only 2.5 minutes. The initial search strategy used here was to enter ACID RAIN on one line and thus search it as a phrase in its own right.

Explain the similarities and differences between welding and soldering. Responses confirmed with some finality that most of the subjects were well aware of the need to search key words in a particular way. In fifteen out of the twenty examples WELDING and SOLDERING were searched for in the same paragraph but not adjacent to one another. This appeared to be consistent with the response of the largest group of pupils to the first analytical question (on “oil spills”) where words were entered on the same line, just as they were in the question. In this instance, however, the two words, WELDING and SOLDERING were separated by “and”, so to search them in the manner described above appeared to be the most efficient method.

Most of the pupils then tended to work in stages, focusing on sub-goals one at a time rather than attempting to answer the question in toto.

The most successful pupil in terms of time was the one who used the BROWSE facility rather than the WORD SEARCH. All of the other pupils, apart from one, employed the same strategy as described in the first paragraph, after trying other unsuccessful combinations, using the words SIMILARITIES and DIFFERENCES. This pupil entered the word WELDING and pursued the search despite the very high (80/41) number of occurrences in articles.

There was evidence in some instances of considerable familiarity with the subject matter of the question. One pupil in particular proved to be very knowledgeable, answering the question beforehand (and subsequently being prompted to confirm his answer through the typically efficient search strategy). Yet another demonstrated in their response how practical experience could influence the answer retrieved from the database, elaborating as they did upon the information and enriching it in its detail.

**Discussion**

*Problem solving*

It would appear that previous experience played a vital part in the execution of the problems. Hand in hand with this it must be acknowledged that correct responses are not necessarily made on the basis of material learned from the study. The importance of prior knowledge is not to be underestimated here. The ability to select key words from a sentence was a significant facilitating factor. This skill or “available function”
(Duncker, 1945) may appear routine but ought not to be underestimated as a fundamental problem solving skill (Greeno, 1980, 12). In this instance the pupils applied skills which they were expected to possess, and in that way the CD-ROM facilitated the implementation of this skill. Concomitant with this is the possibility that where such a skill was not in evidence, it might be taught through the use of CD-ROM.

The strategy of limiting the search space (Wessells, 1982, 348–350) was demonstrated by the teacher as a particular function of the programme. This was an aspect of problem solving in which no expectations were made about prior knowledge or skills. Thus the purpose shifted from the application of knowledge and skills to the acquisition of knowledge and skills (Heaney and Watts, 1988). The majority of the pupils proved immediately capable of doing this and, judging by the frequency with which it occurred, recognised its value in reducing the amount of material to be processed. By the time they arrived at the question on “acid rain” the technique of reducing or limiting the search space was being used by every pupil. This realisation that increasing the number of search words would lead to fewer occurrences in articles was complemented in some instances by the strategy of reducing the number of search words in order to open up the search space by cueing more occurrences in articles. This latter procedure, unlike the one upon which it was modelled, was not taught. What the pupils did was to use the formula for limiting the search space, but to reverse the procedure. In this sense the pupils invented their own algorithm to enable them to answer the question. Thus a definite problem solving strategy was created by the pupils.

**Metacognition**

Lack of flexibility or “functional fixedness” (Wessells, 1982, 325–328) proved hugely inhibiting to some pupils in that when they were invited to answer the last question, which required a fundamental alteration to the strategy to be employed in order to answer it, they were initially unable to change their technique of answering. Fourteen of the twenty pupils did not see that the question required answering in two distinct stages. Rather, they approached it as they had the others, using the most efficient strategy of entering in two key words or phrases. The subsequent interactions with the text nevertheless proved a rich source of learning, the pupils engaging in some significant commentary and analysis upon the procedures they followed. This metacognitive approach, or thinking about thinking, is a particularly important aspect of learning, both in the context of information processing and problem solving. In information processing it sharpens up the pupil’s awareness of how they are operating, and, through seeing this with a sense of clarity and organisation, they are able to extend their own cognitive abilities. In problem solving it helps the pupil in the immediate context to reflect and talk about the problem, rehearsing its different aspects, and helping, through this dialogue or interaction with the database, towards the solution.

It would appear to be the case with the majority of pupils that they gradually became aware of the need and the possibility to “possess” the material with which they were working by employing a variety of discourse patterns and different interactions with the text and by recognising the way in which the material was organised. Conscious
strategies of reading the text out loud and interrogating it were signals to this metacognitive approach: rather than reproducing it the pupils questioned it from the point of view represented by “if this? ... then what?”. seeing where it was going and where it had been. This “talking with the text” would appear to enable the learner to transform the information into learned and memorable forms. In the case of the last question (Explain the similarities and differences between welding and soldering) many of the pupils called on the metacognitive skills necessary to recognise the importance of looking back over earlier responses in gathering information. Further, the organisation of the information in the database and the possibility of retrieving it in a multiplicity of ways, helped to make the necessary connections. This capacity of the hypertext system to model meaningful learning is supported by the research of Lambert and Ropiequet (1986) and Jonassen and Wang (1993).

The deliberate storage and retrieval efforts typical of a metacognitive approach (monitoring and evaluating at all stages of processing to help the decision-making process during encoding, retrieving, organising and synthesising) are facilitated by the organisation of the database and the retrieval capacity of the search engine. These features of the technology promoted logical pathways and elaborate patterns of interaction for some of the learners, from a simple building blocks approach through the use of key words and hierarchical outlines to the more elaborate and overall conceptual approach of using hypertext links and including, ultimately, complex problem solving.

Information processing and problem solving
The two phases of the oil spills question constituted the need for the pupils to utilise the problem solving strategy of breaking the question down into goals and sub-goals (Wessells, 1982). Such a strategy was particularly important in relation to information processing skills, creating as it does, light demands on processing. By being able to concentrate on one element of the problem at a time the pupils’ “resource allocation” (Kahneman, 1973) would not be overloaded. This focusing on goals and sub-goals was the technique similarly demanded by the subsequent question. All pupils seemed to be aware of this demand, effectively applying the previously learned and relevant rules (Gagne, 1985). Such was also the case in the question requiring an examination of the similarities and differences between welding and soldering. Here, the concentration upon one element of the question at a time, through stage-by-stage processing, enabled the pupils to make a detailed comparison. The meaningful (Ausubel, 1963) aspect of the work emanated from the fact that this sort of learning evidences the building upon previously learned and relevant rules. Further evidence of this arose from some subjects who, when answering the final question, broke it into two parts. While this in part may have been due to the cumulative structure of the questions (requiring, as they did, the repeated use of techniques and strategies previously applied) it also points up the importance of the organisational features of the database itself. It may well have been that the successful pupils already possessed the requisite skills for answering the final question though it would seem reasonable to suppose that such skills can be taught. The crucial elements here would appear to concern understanding, planning and organising. The desirability of problems being solved with understanding rather than
mechanically is an important issue (Wertheimer, 1945). Knowledge used in understanding and representing problems simplifies problem solving, reducing the search needed to find a sequence of transformations (Greeno, 1980) that leads to the objective. This further underlines the importance of previous knowledge and the central role of the teacher in facilitating information processing and problem solving activities. “Reflective control” and “deliberate awareness” (Vygotsky, 1983) can be facilitated through encouraging pupils to plan and predict and to recognise the essential organisational features of the subject matter with which they are dealing and to focus on the crucial aspects of the text with which they are interacting. What appears to be vital is introspection on the part of the pupil (Flavell, 1985) and what in Harris’s (1983) conception is “the child as a psychologist”. Both views see the child as knowledgeable about the effect of meaningful organisation on the processing of information and the solving of problems.

The hypotheses, or “intelligent guesses” (Harter, 1986) which are prompted through the intuitive leaps important in Ausubel’s (1963) conception of learning, have led some researchers (Harris, 1983; Harter, 1986; Phillips, 1989) to view the learner in this situation as engaging in a scientific enquiry. Solving problems is likened to an experimenter testing a hypothesis by carrying out strategies and modifying them when they are not successful. After having identified and simplified a problem the learner working with multimedia technology or the world wide web needs to make decisions regarding key words and such features as truncation, proximity of words, whether and how to use Boolean operators and a two word search even before interacting with the text (written, pictorial or aural) in a variety of ways.

Individual differences
The outcomes of the question in which the pupils had to express their opinions as to what was the most serious effect of oil spills were especially revealing in the context of individual differences. Five of the responses were at the intuitive level (Peel, 1960) where the pupils saw only one relation to the question, suggesting that the killing of waterfowl was the most serious effect. Two other pupils both answered the question somewhat irrationally and in a clear emotional context, focusing on the “murder” of “innocent creatures”, while out of the twenty only two pupils worked at the level of hypothesising, offering reasons not merely out of past or present experience but out of what Peel (1960) refers to as “forward thinking”. Both of these pupils used data derived from the article. In the first instance the pupil deduced that if the people concerned were rich enough to deal in oil they were rich enough to be able to use money: therefore the most serious effect was the killing of the birds as they cannot be bought or brought back. The second pupil similarly used the text to develop a hypothesis, this time based on ecological considerations. The majority of pupils (the remaining eleven) based their responses on past or present experience. Their explanations tended to be concrete and explanatory, such as suggesting that it would “not be nice to live if all the birds were killed”, that the birds needed to get food by going in the water, that the birds have no say, that the species would die out, and, in contrast to the emotional response of the two pupils referred to above, the rational explanation that “in figures the most serious effect would be economic losses”.

The outcomes in the case of the question on “acid rain” provided a similar range of responses in terms of levels of maturity. Interestingly, all but two pupils answered the question in a way which relied on past or present experiences. One pupil again responded within a subjective and emotional context, saying that she didn’t like animals being killed and that therefore this was the main environmental consequence of “acid rain”. Another, working at an impressive level of maturity, again displayed an ability to develop a hypothesis out of the data offered in the article. The fact that no pupils at all answered at the intuitive level indicates that in this question, as opposed to the one which preceded it, some pupils were processing the information provided by the database at a deeper level. This again may be accounted for by the cumulative character of the questions, requiring as they did increased interaction on the part of the pupils; an interaction characterised by the willingness of the pupils to frame, scan and browse the information by the electronic means typical of new technologies. It may, on the other hand, be a straightforward reflection of the level of maturity at which the pupils were capable of working. In any event what would appear to be potentially educationally valuable is the usefulness of the database in providing an opportunity for pupils to interact with the material within the constraints of their individual differences. Further, it would appear that in conjunction with the teacher such a database provides opportunities for growth and development in this area of cognition.

Deep and surface level processing
Different levels of processing (Marton and Saljo, 1976a,b) were clearly evident in the outcomes of the third factual question: “What oxides cause the pollution that damages vegetation and buildings?” The verbatim answers of one search strategy contrasted starkly with another in which the pupil displayed evidence of thinking about the question, as was indicated in the changing of his mind and therefore the strategies of searching. This flexibility in search was matched by a precise but considered response to the question. Similarly, in the fourth factual question, “Why is graphite used as a lubricant?” one pupil demonstrated no real understanding of the information provided by the database, reproducing the sign, or the text itself, in a verbatim fashion rather than processing it. In contrast another pupil focused on “what was signified”, processing the text and synthesising it with her own image by giving as the reason, “It’s slidy and stops things sticking.” Examples of deep and surface level processing were also in evidence in the question about acid rain. Here the majority of pupils focused on the sign, going straight to the article title “acid rain” for the answer to the question. While this was both an efficient and, in terms of the outcome, informative strategy, it did not appear to be such an obvious example of deep level processing as did the choice of the article title, “pollution, environmental”. In this instance it would appear that the search strategy adopted by four pupils was not only the most efficient but also demonstrated that these pupils had processed the text of the question at a deep level, reading not the sign but the signal towards the “environmental consequences”. Again, there is clear evidence here to point to the importance of the pupils’ cognitive strategies. Not only do they need to balance out whether it is better to search or to browse and to consider the frequency of occurrences of an article title, they also need to look at the
question itself, not in a manner which promotes the reproduction of information, but through an active search for meaning.

**Conclusion**

Despite the fact that the questions employed in the study did emanate from project work in which the pupils had been recently engaged, it is important to acknowledge that the learners in this study may have had different interests and intentions than those of real learners and as such the outcomes observed in this study might differ in a more natural situation.

The pupils involved in this study were familiar with the *Encarta 96 Encyclopedia* (1996) and through this were aware of the appropriateness of using the key word search facility rather than browsing for information with which to answer the questions. Because of the highly specific nature of the questions this would seem a sensible strategy to employ. This is not however to underestimate the browsing facility for certain types of learning activity, such as those more related to gathering data for a project where a larger search space and no time limit are features of the learning situation. Such a decision points sharply to the sound information handling skills of the pupils involved as indeed does the decision by all of them to use only the text searches. Having been apprised of the fact that they were to be timed in their retrieval of the correct answer it may be significant that none of the pupils used any of the audio or pictorial facilities in their search strategies.

It would appear that encouraging a metacognitive approach when handling information can help hone and improve information retrieval and synthesis. A key role of the teacher then, is to facilitate this during the process of information handling. To further consolidate these skills pupils should also be encouraged to reflect on the processes in which they have engaged, after the event, and with the assistance of the teacher (cf. Kemmis, 1985; Whitehead, 1989).

It is apparent that a logically and clearly organised database and retrieval system might help learners to see organisational features and crucial elements which will match and ultimately stretch the learner’s awareness of their own cognitive abilities. At the same time the teacher might be seen as the key facilitator in ensuring executive control of the routines available to the processing system. Lack of self interrogation, an inability to monitor, or a failure to make effective task analyses might all be seen as lack of experience. The teacher, with new technology as a support system, can offer this experience through guidance in executive control in order to affect the selection and use of various control processes and to exert influence over many different learning processes.

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