EXTENDED USE OF TECHNOLOGY AND STUDENTS' THEORIES ABOUT WRITING

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Writers build theories about writing which they test and reconstruct
(Dyson, 1989). The theories about writing
held by the individual writer influence writing outcomes. If a writer
believes that print is fixed or that form is
more important than content, as Graves (1983) implies many children do,
then such a writer may not readily
rework a piece or, if they do, may revise at a surface level, attending to
neatness or spelling.

These theories and practices of writing are shaped, amongst other things,
by the tools used (Cochran-Smith, Paris
& Kahn, in press, cited in Cochran-Smith, 1991). Thus the way in which the
tool influences a writer's theories
and perceptions of practice merits examination.

As a tool for writing, word processing is the most widespread application
of computers in the classroom
(Fitzgerald, Hattie & Hughes, 1986; Nightingale & Chamberlain, 1991;
Sheingold & Hadley, 1990). The
practices of writing affected by word processing have been considered
largely in terms of the motivational impact
of using the computer to write and the presumed ability of word processing
features, like those of ease of
change, to alter both writing behaviours and the quality of the product.

Although there is consensus that students
like to write using a word processor (e.g. Levin & Boruta, 1983; Riel,
1985), the findings, in terms of other
outcomes, are by no means in agreement (Hawisher, 1989). The crucial factor
in explaining the differences may
be that word processing interacts with the social context of the classroom
(Cochran-Smith, 1991). For example,
the role of the teacher has been suggested to be instrumental in creating
an environment which has positive
effects on writing (Bruce, 1991; Cohen & Riel, 1989).

With regard to the influence of word processing on theories and perceptions
of writing, there is an implicit belief
that the use of word processing helps students reflect on and discuss
writing processes. There is considerable
published evidence that expert writers are able to reflect on their process
of composing at the keyboard and how
they felt word processing might have changed the nature of the process
(e.g. Murray, 1985; Stillman, 1985:
Zinser, 1983) but evidence for the belief in school students' ability to
reflect on and discuss writing processes
is lacking (Peacock & Breese, 1990).

This paper will comment on the effect of extended use of word processing as
a tool for writing on school
students' attitudes to writing and the theories they are building about
writing. The theories of the students are
considered in terms of preferred medium for writing, quality of product,
and aspects of their writing behaviours.
The likely validity of their theories is examined using both empirical data
and the observations of teachers or
parents.

METHOD:
Context: The findings discussed arose from an evaluation of a computer
innovation at a private boy's secondary
school. In 1990 the school devised plans to increase access to and the use
of computers. The long term aim was
to have computers available to all students and staff whenever they wanted
to use them "as a tool and knowledge
source, and a teaching and learning aid which can be integrated into the
curriculum to increase the productivity,
creativity and achievement of both teacher and student" (Bairstow, 1991).

The school decided to investigate personal computers for students for use
at school and at home so, in 1991, two
intact classes received personal computers as part of a pilot project. One
class, largely dayboys, had laptop
computers (an MSDOS machine) and the other, predominantly boarders, desktop
Macs in their home room.

Teachers on the project had access to the same computer as their students. The computers were available for use
in all core subject lessons and for homework. They were used in a variety of ways but predominantly for word
processing.

Participants: Forty-seven boys (mean age 13:6 at the start of the school year) participated in the innovation. The
most academically able class of the form received the laptop computer while those with the desktop computers
were a more average class from the middle ability group, in terms of the school's streaming.

The 13 participating teachers, all volunteers and most with limited experience of computers in the classroom,
taught the core academic subjects of English, maths, Latin, French, science (physics, chemistry and biology) and
social studies to the two classes.

Instruments and procedures: The data for an evaluation of this innovation were collected in a number of ways.
Before the commencement of the project baseline data were collected from initial questionnaires given to the
teachers and boys participating in the innovation. The boys were asked about the extent and type of home
computer use and of previous school use, and to rate statements concerning attitudes to computers. Teachers were
asked details of professional development to date and for ratings of their knowledge and ability to carry out
various computer operations. They reported on the extent and type of their personal and previous classroom use
of computers. They were also asked to rate their degree of concern about a number of issues related to the
innovation.

Then, at the end of a term (12 weeks) and again at the end of the school year, all boys and participating teachers
were individually interviewed. Again, some questions asked for ratings while others were open ended. Students
were asked questions about attitudes to computer use; about type and extent of computer usage; about academic
matters, including written work, and about problems experienced in relation to the computers.

The teachers were also asked a series of questions including some about their personal feelings regarding
computer use; about usage patterns and preparation time; about student learning rates and keyboard skills; about

perceived effects on students, and about classroom management and interaction patterns.

Parents of participating students were sent a questionnaire after the project had been running for about seven
months to seek their perceptions of their son's attitude, academic progress, computer confidence and the
advantages and disadvantages of classroom use of computers, as they perceived them.

In addition to interviews and questionnaires, informal observations were made in classrooms and discussions took
place with staff. Student common test results were available for the core subjects of English, maths, science and
social studies. Some pieces of student written work were assessed, including handwriting samples.

RESULTS AND DISCUSSION

The attitudes of the students to written work and their perception of the process of writing have to be viewed
in the light of their experience of an extended period of personal computer use in the classroom and the skills
which developed from this.

Evidence of extended use: The students participating in the project were using the computer extensively
throughout a school year. They were not novice computer users at the start of the innovation. Over 80 percent
of them had computers at home and only three had no prior experience at their previous schools of computer
use.

When interviewed after a term, students were asked to estimate how long it took them until they felt comfortable
about using the computer in class. It took little time, on average 2.3 weeks for the desktop class and 3.3 weeks
for the laptop group. However, the range was from less than a week to a whole term. Teachers estimated the
learning period similarly when asked how long it took the boys to become familiar enough with the computer
so that the mechanics of operation did not impinge on the progress of the lesson. The particular subject use
requirements tended to account for the variation in teacher estimates which ranged from a couple of lessons to
half a term, with a mean of three weeks.

At the first interview, at the end of three months of use, a third of the boys reported initial problems with

learning to use the computer generally and over half mentioned problems
with learning to touch type adequately.
However, both of these aspects were generally rated the least frustrating
of the problems they had experienced
with the computers and appeared to be of short duration.

During the school year, according to the students, the computer was used in
class a great deal. On average, in
at least three of their five classes each day the computer was employed for
part or all of the time.

Estimates of the actual time spent at the keyboard ranged, for the desktop
class, from 105 to 260 minutes per
day. This includes break times where use was optional, which may account
for some of the variation in
estimates. The laptop class seemed to think that they spent less time at
the computer; their estimates ranged from

60 to 150 minutes. The explanation for the different rates of usage between
classes and among individuals may
lie in the nature of the operating system or hardware durability (the MSDOS
machine was most unreliable), or
it may reside in the level of teacher or class inclination or individual
level of expertise. Both classes reported
spending about two hours of homework time each evening on the computer.

With regard to the type of computer usage, although teachers reported
little classroom computer use prior to the
innovation, they had utilised it in several different ways by the end of a
year. One teacher had produced software
for French using "Hypercard"; another produced material to illustrate
geometrical concepts. Teachers used the
projection pad for documents, notes and instructions. The computer was used
as a storage device for information;
the hard drive was used to store prepared handouts, like those on style and
essay writing features or descriptions
of chemistry experiments and these could be accessed as required. Some use
was made of software for graphing,
producing maps, and of databases like PC and Mac Globe and, in Latin, drill
and practice software was used
very profitably. All teachers had used word processing extensively.

When the boys were asked at the end of a term and at the end of the year to
recall the main uses they had made
of the computer, word processing figured large; all estimated it to account
for between 75 and 80 percent of
usage and this, they felt, had remained consistent throughout the year.
Teachers concurred; their estimates of the
amount of use of word processing were comparable. Students produced

assignments, both research projects and
essays, wrote up science lab reports, and typed in notes, both from
reference materials, from discussion and from
the teacher. The computer was largely, for these students, an electronic
notebook and publishing tool.

The exposure to a variety of teachers, each with a likely different
instrumental and expressive use of the
computer (Olson, 1988) makes it difficult to isolate the effect of specific
teacher implementations in relation to
written work. In this respect, the overall conclusion from the evaluation
of the innovation was that teachers
tended to utilise the tool of word processing in a way which melded with
their own favoured pedagogoical style
and beliefs about learning. If they believed in self directed learning,
they tended to use word processing to allow
students to create their own products whereas, if they favoured a
transmission mode of learning, the word
processor was used to record given information (Parr, 1992). This finding,
that teachers' use of the computerreflects their educational philosophy,
accords with the conclusions of other studies (Dwyer, Ringstaff &
Sandholtz, 1990; Honey & Moeller, 1990; MacArthur & Malouf, 1991; Porter &
Sherwood, 1987; Rubin &
Bruce, 1986; Sheingold & Hadley, 1990.

Attitude to written work: Like numerous studies (e.g. Bridwell, Sirc &
Brooke, 1985; Levin & Boruta, 1983)
a basic finding was that students liked writing with a computer. Three
quarters of the students liked written work
more using the word processor; the rest perceived no change in enjoyment.
Teachers report an increased desire
to "get on with things academic", while parents noted that their sons were
keen to begin new projects and to
produce extended pieces of work. Amongst reasons given for the increased
enjoyment include the high quality
presentation, the speed with which work could be produced and the ease with
which a piece could be organised
and changed.

Theories about writing:
The aspects considered which may contribute to each student's theory of
writing are the medium and the
relationship between writing quality, writing processes and the medium.
Preference for writing medium: The students preferred word processing to
handwriting, evidenced by the fact
that they produced remarkably little written work with pen and paper,
although they had the choice. On average,
they reported writing less than three pages by hand per week and this
included maths workings! This finding
is in contrast to that of Peacock and Breese (1990) who report that

handwriting remained popular and quicker
amongst their portable writing machine users. Similarly, Porter (1986) reported instances where students did not
elect to use word processing. The explanation for the preferred medium may lie in the differing experience and
level of expertise of the group in this study, especially with respect to their systems and keyboard skills.

The boys in the study rated themselves as more confident computer users at the end of a term of use than they
were at the beginning. At the end of a year, they were demonstrably able to generalise their knowledge of
systems operation to different pieces of software. There is not agreement in the literature as to the extent to
which the value of word processing for writing is dependent on mastering the technology of word processing
(the commands and keyboard skills) relatively quickly and easily (Cochran-Smith, 1991).

Typing skill, however, may be a factor moderating the outcomes of word processing in terms of some of its
perceived values. The boys in the computer innovation improved markedly as typists. Teachers emphasised
keyboard skills from the start and a number of lessons, in the first month, were devoted to instruction and
practice using a typing tutor. The boys began the year already having used a keyboard. The mean typing speed
at the initial test was 15 words per minute; some could already type more than 30 words per minute but many
employed a hunt and peck strategy. At the end of the year the mean touch typing speed was 44 words per minute
(SD=13.6). One boy could type at 84 words per minute, while another could manage only about 20. It is
interesting to note that faster typing speed was perceived, by the students, to be an academically advantageous
skill in that it enabled more work to be accomplished more quickly. Use of the computer appeared to accentuate
differences attributable to the speed of recording in a way that handwriting does not. In terms of a theory of
writing, speed of production was seen as related to other writing behaviours such as generation and recording
of ideas.

Although students used word processing in preference to hand writing for written work, the majority did not feel
that their hand writing skill had suffered as a result of minimal practice throughout the year. Only two thought
that legibility had declined and a further five felt that their speed was

down a little. The perception of the
majority is borne out by empirical data. A sample of handwriting from the
laptop class at the beginning of the
year was compared with a sample taken at the end of the school year. The
mean legibility score (out of 10)
initially was 6.6 and, at the end of the year, it was 6.9. There was no
significant difference between these means
(t=1.53, p>.05,n=19). Likewise, when the average length of a handwritten
exam answer from a computer class
(296 words) was compared to a similar ability class (253 words), there was
no difference in the mean number
of words produced (t=1.87, p>.05, n=46).

The preference for word processing appeared to be related to the ease and
speed with which work could be
produced, as well as to the high quality presentation and to the facility
with which text could be arranged and
changed. These factors, in the students' minds, clearly facilitated better
quality written work.

Quality of work: The boys clearly believed that their written composition
had improved as a result of using wordprocessing. Others have similarly
found that students believe that their writing improves (e.g. Bridwell &
Ross,
1984). About 70 percent of the students reported that their written work
had improved, aside from presentation.
In fact, one boy commented that his written work had improved because he
felt that the content had to equal
the presentation! The reasons the students gave for their rating of degree
of improvement were perceptive and
illustrate an ability to reflect on writing processes.

Speed of production was seen as having advantages and as allowing new modes
of operation. A number of
students mentioned the fact that they felt that they had a better chance of
capturing ideas as they occurred to
them. This was especially so where a student could type very much faster
than he could write (as the mean
handwriting speed was about 17 words per minute, this stage was reached in
less than a term) . As one student
said, "It is easier to trap a train of thought with the computer". Another
aspect of speed of production was that,
for some, there appeared to be more time to think and to plan.

The students, regardless of typing skill, also felt that they had more
"space to think" in that there was no need
to be concerned about mechanics like presentation and spelling. These could
be easily taken care of at a later
date so available energy could be directed to the content. Several
indicated that they felt able to spend more time

researching content. The focal point of their attention could shift, perhaps as Kahn (1988, cited in Cochran-
Smith, 1991) suggests, to topic, information and audience.

There was consensus from the student interview answers that there was not only more time or space available
to think or rethink but there were other advantages from word processing especially when reading work over,
both in order to generate more text and to revise text produced to date. One respondent said that "the text is so
clear and easy to read that more ideas just pop into my head".

Almost all students mentioned that altering text is facilitated on the computer. Several found features like the
spell checker and synonym finder helpful, largely as part of an editing process. When asked, at the end of a term,
about specific word processing features utilised, less than a quarter had used the block move or the cut and paste
function. This suggests that they had yet to perceive a need for a function which would help them revise their

text at other than a word or phrase level. At the end of the year, however, the majority talked of rearranging
sections of their essays or reports, making changes at the text as well as the local sentence or word level. Several
commented that the structure of a piece of work was easier to see when it was typed; their teachers specifically
commented on the improved structure of written work. Questions about word processing features indicated that
the students had moved on to a more sophisticated word processing package and they reported using numerous
of the less basic commands in relation to searching, ordering and formatting text.

Many students reported that written work was better ordered and more readily available and easy to read for later
study. According to several teachers, organisational skills, such as those required for file management, appeared
to transfer across to situations where the computer was not used.

Process differences highlighted: In the interview at the end of the year, the boys were asked whether they had
to make any changes in the way they went about writing an essay when they were required to hand write it, as
in the final examinations which they had recently sat. Admittedly, an exam essay answer is somewhat different
to a reworked and revised essay and the conditions under which it is generally produced may accentuate
differences from normal written work. However, the answers illustrate that

some of these students were able
to reflect on their thought processes and strategies with regard to writing. Students were also quite clear about
process differences when writing with the computer.

Students were asked "Did you have to make any changes in the way you went about writing the essay in the
exam compared to when you write your essays on the computer?" and a positive response was followed, where
necessary, with the probe "And, what were these?" About 80 percent of the students felt that they had to make
a change in the way they went about composing for the exam answer. An analysis of explanations of the nature
of these changes yielded five foci, namely, planning, care, crossing out, improvements and speed.

The change most often commented on (in 52 percent of statements) was that they had to think ahead and
mentally, or on a scrap of paper, plan the order of ideas. Yet another three comments, although not specifically
mentioning planning, mentioned being careful as changes could not be made readily. The majority of those whotalked of planning and thinking ahead commented that they wanted to avoid making mistakes in the exam
answer. Several went on to say that it became very important not to make errors in the exam essay and they had
to concentrate especially on this.

The original thoughts and plan were seen as having largely to suffice. Crossing out was mentioned as the only
available strategy for making changes in the context of a handwritten exam essay and, as one student noted,
"You can't change large amounts". About 15 percent saw this very visible aspect, crossing out, as the main
difference in their writing.

Others commented that they missed being able to make changes readily as a result of a rethink. Two students
specifically recalled that they had thought of more and better ideas after they had started to handwrite but could
not find a suitable way of including them. One even admitted, unsolicited, that he could see where improvements
could be made in his exam essay, but he did not make them as it seemed too bothersome.

About 15 percent of the comments were concerned with speed as it affects length, idea generation and reflection.
Most volunteered that they would have written more on the computer. With reference to idea generation, one
student suggested that writing with the computer was almost "stream of consciousness" writing, whereas by hand

it was slower and did not flow as readily. Several commented that the time available for reflection (a function
of speed of recording) seemed to disappear when they wrote by hand in an exam. As one boy observed,"writing
by hand, you just have to keep going, never stopping to consider".

The fact that an essay had to be "perfect" first time, as the students perceived an exam answer had to be,
seemed, to some, at the end of a year writing with a word processor, to be a tall order. In the final interviews
the students talked of the strategies they had evolved for writing with the computer. These included typing in
a plan in the form of headings, then filling it out; or typing in all their ideas, then blocking those they wanted
to use, extracting them and sorting and ordering these ideas; or typing in brief notes (often at the bottom of the
document), then using these as a memory aid to write the essay and deleting them when the transcription was
completed. From their descriptions and comments, it appeared that through use of the tool of word processing

for writing they clearly had experienced something of the writer's crafting of ideas.

CONCLUSION
The tools used for writing not only influence attitudes towards writing but the theories formed about both product
and process. Students in the innovation claimed to enjoy written work more with the use of a word processor.
They expressed a preference for the new medium. One of the major reasons for their preference, speed of
production, was quite obviously related to keyboard facility. Another reason for preference was perceived
increased quality of product.

Students were able to identify characteristics of word processing which, potentially, could increase the quality
of writing produced. These characteristics included speed of transcription which allowed them to keep up with
their thoughts and record them before the limits of short term memory were exceeded. Speed of recording was
also seen as allowing time for reflection.

Clarity of production encouraged rereading and was perceived to assist generation of additional content and
structuring of that content. And the ease with which text could be changed encouraged revision.

Likewise, contrasting their writing on the word processor to a somewhat

Paper Presented at the Joint AARE/
NZARE Conference, Geelong, 1992
Australian Association
for Research in Education

extreme example of handwritten work,
students were able to identify in what ways their writing behaviours were altered. The main changes were in
extent of planning and revision; focus of attention; extent of capture of ideas, and inclination to reread to
generate more text for inclusion or to review that written.

These abilities, both to identify the features of word processing which facilitate writing and to pinpoint changes
in the way they went about composing in different mediums, show a degree of self reflection about writing
which, arguably, is shaped by the tool employed for writing.

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