

Students, Computers and the Writing Process

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Computers, Writing and Assessment.

ABSTRACT

The main reason for students to write is that they have to be assessed. The focus of this assessment is the subject content of the students' course: writing is the vehicle. What is usually subject to assessment, however, is the writing itself. This poses a problem for students. How can they shift attention from the surface of the writing to the content? How can they use the writing to demonstrate their higher-level learning, where skills, information and processes have been integrated and applied in a complex way?

The quality of students' writing is thus used as a gateway to academic courses: within them, the ability to achieve high grades is closely related to writing fluency. One consequence is that student selection for academic or vocational courses focuses on writing errors, rather than the cognitive outcomes of learning. Another consequence is that judgements

are then made about the intellectual ability of vocational students. These judgements then predicate what constitutes appropriate curriculum content.

This paper examines the ways in which students use computers and word-processing tools, to improve the surface quality of their work and to structure the content. The process of formative evaluation is therefore enabled to focus on concept formation and development, rather than surface errors. Computers offer the means for students to establish their learning autonomy by facilitating the writing process. What is written -- the artefact -- is so transformed by Information Technology that the basic skills involved in structuring a piece of writing no longer present themselves as the major task.

The ability to achieve higher-level learning outcomes -- with all that implies for enhanced cognitive performance -- is transforming the intellectual output of students. The autonomous assessment of writing improves performative competence. The rôle of formative evaluation is then to reinforce and develop student learning.

Writing, development, evaluation and computers.

When writing is used as a vehicle for evaluation two factors are examined. The first is the quality of the writing itself: **Writing as Artefact**. The second factor is that of the ideas that are intended to be communicated: **Writing as Discourse**.

Judgement is then passed: on the Author; on the Text; on the Concepts. The assumption throughout this is that Evaluation is a neutral, objective process. To this end examination boards, curriculum inspectors and the great and the good cast themselves in the rôle of arbiters, to ensure that those teaching and those learning adhere to accepted canons.

Evaluation of writing by teachers has traditionally been through three processes: reading, writing and thinking. A text is read: the authorial voice is heard through the clamour of surface errors. The writing is then evaluated through the process of writing -- initially as the correction of surface errors, then, as the initiation of a dialogue, through thinking. These three processes can be compared to the oral stages of talk, speech and conversation.

They match three stages in the development of writing competence.

The first is where the student *can't write*. Convention suggests that this may be because orthographic skills are lacking, because the effort involved in transcription is such that there is no continuity or fluency, or because the writer has no access to the specific discourse required. What is often the case, however, is that the student apparently cannot write

because key ideas are imperfectly understood. The Sapir-Whorf Hypothesis¹ can be brutally reduced to the aphorism:

*If you don't have the ideas, you won't have the language:
if you don't have the language, you won't have the ideas.*

The second stage is that of *writing as writing*: The process is seen by the student as self-referential. Writing is Writing: the task is to write. A sense of audience and purpose is subsumed by the mechanics of the task itself.

The final stage in the development of writing competence is that of *writing about* in which the necessary orthography has been internalised, the audience and purpose have been identified and the writer is able to structure the text as discourse. It is at this stage that the evaluation can focus on form as well as content; style as well as surface.

If the evaluation of writing is to be anything other than an exercise in classification then it must be seen as one element in the cognitive development of the individual. Where evaluation can become part of the cognitive process then the empowerment that this produces will act in a transformative way.

The key issue is whether this evaluation has to remain an external process, mediated through teachers, or whether it can be re-focused as part of the student's work process, through the use of information technology.

¹Whorf, B.L. (1956) *Language, Thought and Reality*. Cambridge. MIT Press.

Computers and the work process.

The utilisation of computers by young people extends throughout their activities: work; entertainment; information; art; 'just messing around': all are mediated through information technology. Whatever employment such young people ultimately seek will be affected by the advanced information technology skills which they carry with them.

“Now I use my computer for all the work I do apart from Maths and things like that. I can draw on my computer, make music, listen to music, write stories, look up words to find a meaning for it like a dictionary, print out any work I want for homework. I think it makes homework a lot easier because of all the different programs.”

They will expect to be able to use, and customise, the latest software, access information from around the world and will have the ability to maintain and modify their desktops and workstations to suit themselves. They will carry these attitudes with them because they will have grown up utilising and modifying their computers, which they know can contain almost endless possibilities.²

The cognitive process and computers.

Neither hand nor mind alone, left to themselves, amounts to much; instruments and aids are the means to perfection.

²de Sola Pool, I. Technologies without boundaries: on telecommunications in a global age. Harvard University Press

Francis Bacon Quoted by Vygotsky.³

“Computers are expensive but if you didn't have one you probably would be degraded because of it in later life ...”

Fifteen-year old male, 1995.

Jerome Bruner considered the development and use of tools as central to the amplification of the thought process: culture provides the technology through which cognitive capabilities are amplified.⁴

Computers can therefore be seen as a vehicle for combining motor skills, manipulation, language and symbolic activities through a range of practical activities. They provide constant access to feedback and non-judgmental correction whilst at the same time enabling the user to withhold an artefact from public scrutiny until it is likely to meet with approval. For the learner, any flaws in the finished product can be ascribed to the computer-as-scapegoat.

Many of the activities undertaken on computer are conducted in a social context in both the educational and work environment. Software offers a rule-governed system that becomes both more apparent, and predicates a greater range of possibilities for action, as the activities for which it is used become more complex.

³Vygotsky, L.S. (1962) *Thought and Language*. Cambridge. MIT Press.

⁴ Bruner, J. 1965 *The Growth of the Mind* *American Psychologist* Vol. 20 No. 17

"Computers can make homework need a lot more time, even if you're very good at using them, because you end up spending a lot of time tweaking your work. The end product can look very good, especially with expert use. Spell checks and automatic language aids such as Thesaurus help your writing. Computers with reference software, such as "Encarta" are great for research. AmiPro2 is the best word processor/d.t.p. program in the world. Apart from AmiPro3. You can also sharpen up your brains playing games such as Tetris and Doom."

Girl, Year 10.

Independent computer use enables learners to engage much more effectively with intrinsic problem solving -- what the task requires -- rather than extrinsic problem solving -- what the teacher requires⁵.

"Once you have finished and the teacher asks you to add or do it again you can say "OK" without a face..."

Bruner's three preconditions for the development of cognitive processes, the directive function of language, the translation of concrete experiences into verbal and symbolic terms and the varied forms of representation can all be mapped onto the developing use of computers by young people in general, and adolescents in particular. The growth of the intellect is seen as moving forward in spurts that correlate with the adoption of innovations, transmitted to the child 'in some prototypic form by agents

⁵Cuthell, J.P. (1992) The GIGO Factor. Classroom-based learning as a psycholinguistic guessing game. Transcend Technology.

of the culture.'⁶ These lead to ways of responding to stimuli and to their perception that, in turn, lead to ways to imaging and, finally, to ways of encoding these within linguistic forms.

The stages of learning all involve the representation of experience. The initial phase is one of imagery and perceptual organisation characterised by ostensiveness -- the operation of pointing, which links experience, and knowledge, to the immediate present.⁷ These images enable prior experience to be translated into a visual form, iconic representation grounded on a perceptual organisation that Bruner identifies as being tied to 'point-at-able' spatio-qualitative qualities and properties of events.

The ubiquity of Graphical User Interfaces and WIMP environments suggests that novice users and young learners should find the learning process enhanced by these 'point-at-able' spatio-qualitative system properties. Cultural differences should therefore be identified in terms of user/non-user, as well as teacher/pupil and adult/child.

"It won't get you extra marks for content, you may get some for presentation. It may be possible, though, to pick up extra marks if you use a special program like Encarta 95 ... an easily operated, vast encyclopaedia with many facts and lots of information. At home it will help improve research skills and speed up the time doing it, so you can get more written content in your work."

⁶ Ibid.

⁷Ninio, A., Bruner, J. (1978) The achievement and antecedents of labelling. *Journal of Child Language*, 5, 1-15.

In fact, the distinction can no longer be seen in terms of adult/child or teacher/learner, but more starkly, in terms of user/non-user. Cognitive growth, whether general (age/developmental) or specific, (task-related) should correlate with these differences, particularly where the approach to problems is characterised by reliance on symbols and language shaped by use of specific tools: in this case, computers. The ability of knowledge to be represented by computers in symbolic terms, which are then capable of transformation, represents a significant shift in the hierarchy of the learner and the learning process.

What has developed is a situation in which young learners use computers for an increasing range of activities, and for many of the writing tasks demanded by the education process. This underlying facility of young people has produced a disjunction between the expectations of many of their teachers, whose perception of computers is that of an electronic typewriter, and the established procedures of the students.

Computers and the writing process.

The use of the computer as an intelligent electronic typewriter is ubiquitous. Children see word-processed documents as a way to present their ideas for assessment without the superimposition of the filters of handwriting and performance errors in spelling. This surface environmental purity is seen as a guarantor of higher grades than text that is hand-, rather than word-processed.

Writing strategies.

When one considers the strategies used in the writing process one can see the use of computers and word-processing programs as facilitators and amplifiers.

Three perspectives that relate to strategies employed by writers have been developed by Chandler, Sharples and Williams respectively.

Metaphors for Writing.

Chandler categorises writing strategies as differing *processes* (Chandler, D. (1995)).⁸ He defines these through the four metaphors of Architect, Bricklayer, Water Colourist and Oil Painter.

The **Architect** process is focused around planning. Writing is seen as a means of communicating or recording ideas that are already clear in the mind of the writer, and so the writing task is organised in the stages of **pre-writing, composing** and **post-writing revision**. Because of

⁸Chandler, D. (1995) Sussex University: work in progress.

this there is less need to review text, and so the size of the screen does not inhibit the process.

The **Bricklayer** constructs the text one sentence at a time, and the thoughts, language and structure of the document take shape together.

Water colourists produce an overall draft very quickly, and work with minimal revision.

Oil painters, on the other hand, write first and then organise their material later. The writing process is considered as a **process of discovery**, in which the **text is reworked repeatedly and frequently**, with minimal pre-planning. Words and ideas are played with in a physical form, and so the hard copy -- the printouts -- **are subject to constant manual revisions**.

Tools for Writing.

The Architect and Oil Painter can be seen as occupying opposite poles of the writing spectrum. Most word-processing software, however, takes the Architect process -- **pre-writing, composing and post-writing revision** -- as the paradigm. (Williams, N. (1995))⁹ The three apparently distinct phases of planning, composition and revision not only

⁹ Williams. N. (1995) Communication and Information Research Group. Sheffield Hallam University.

contain varying degrees of overlap (Flower, L.; Hayes, J. (1995)¹⁰, but the majority of people rarely write in this way.

The key to successful use of word-processing tools, therefore, is for them to be as flexible as possible, so that they can be used in ways that do not have to conform to a pre-determined straightjacket.

Applications of Strategies.

Work in progress into writing strategies (Sharples, M.)¹¹ studies the rhythm of movement set by authors. These move between **full engagement** with the creation of text and **reflection** on what has been done and what should be done. This rhythmic cycle pushes forward the process of composition, and the **tools that are being used play a part in the rhythm and the process.**

When text is created on a computer it can be played with, '**tinkered**' with, (or "tweaked", as one student commented) during the process of composition, and this generates temporal spaces during which the author can reflect on what is being created. These temporal spaces can range from the comparatively small, as occurs during saving a document, through the slightly longer, as when a spell check is used, to the space created by experimenting with different formatting. During each of these processes the writer is able to look at (and reflect on) what has already been created.

¹⁰Flower, L; Hayes, J. (1995) Carnegie Mellon University.

¹¹ Sharples, M. School of Cognitive & Computing Science, Sussex University.

Multi-tasking.

When the computer user is able to switch to a totally different document, program or function in the middle of a document, (as I do when I switch to my finances, or play a game in the course of writing this,) then the temporal space created enables a great deal of thought on what should be done. The computer is still being *used*; therefore one still feels that work is in progress: it is the act of closing down the program and the machine that signifies that work is finished, rather than switching to something else.

"If I can't do my work I play a game to take my mind off things."

In an educational context this additional space is generated when students are able to explore directories other than those in which their work is located, as, for example, when clipart files are searched. Students who have access to, and use, a computer at home for their work consistently comment on the fact that they are able to spend more time thinking about what they are doing.¹²

"The only bad point of doing your homework on a computer is that you tend to find you have a lot more homework as you cannot write things up in lesson. ... PS Make sure you get some good games etc. Doom2 is an excellent game...."

Boy, Year 10.

"the writing is smaller when you print it out ... you have to write more so you get a better mark."

Girl, Year 9.

¹² Cuthell, J.P (1994-96) Unpublished research in progress. Boston Spa Comprehensive School, West Yorkshire, United Kingdom. University of Huddersfield.

"Computers can make homework need a lot more time, even if you're very good at using them, because you end up spending a lot of time tweaking your work. The end product can look very good, especially with expert use..."

Boy, Year 10.

Writing as a psycho-linguistic guessing game.

The use of computers by students, and the availability of word-processing tools and text utilities, enables students to undertake their own evaluation of work whilst it is in progress. The comments from students indicate their awareness of this.

The first stage in the process is that of a legible print-out. The move from handwriting to print enables students to correct surface errors, using spell- and grammar-checking tools, and in so doing, text can be viewed objectively, as an artefact.

The second stage is for the structure of the work to be evaluated by the student. This stage involves the movement of blocks of text from one location to another, until the final shape fits with the student's perception of what the assignment requires. Has the assignment addressed the question that was set?

When the student thinks that it has, it is submitted for assessment by the teacher.

What does the student do with a piece of writing after it has been evaluated? In many cases, rewrites it. If the initial artefact has failed to

meet some of the performance criteria, then it is imperative that the rewrite does so. The act of writing becomes, for many students, a psycho-linguistic guessing game. If the act of evaluation is to be anything more than a subjective reaction to the textual guess, then criteria for evaluation must be made explicit: for the student, who has to achieve them; for the assessor, who has to apply them. To paraphrase Searle,¹³ the criteria must be locutionary, rather than illocutionary.

¹³ Searle, J.R. (1969) *Speech Acts*. Cambridge. Cambridge University Press.

What needs to be done.

Teachers have to understand the ways in which computers can be used to construct text, and the ways in which their students use computers to produce documents. This understanding must not only be built into the way in which an assignment is constructed, but it must also recognise that work practices change as the technology changes. This recognition should therefore shape the ways in which formative evaluation can be conducted. It will relate to the ways in which students build up the cognitive structures associated with the curriculum unit. It is critical to the construction of the curriculum that educators ensure that the **unit of learning** is identified, together with the time frame, for the student, the teacher and the evaluator.

Specifications for the unit of learning must be laid down: as **performance criteria**, with **range** statements outlining the scope of the performance criteria, and **evidence indicators**,¹⁴ detailing the context within which the performance criteria must be demonstrated. The learning outcomes and behaviour patterns must be identified in terms of what the student is expected to learn, and what the student is expected to do.

¹⁴ Definitions used by the National Council for Vocational Qualifications, United Kingdom.

Bloom's Taxonomy¹⁵ provides a useful framework for this. We can define knowledge -- what the student is expected to learn -- as

a. terms;

These are grounded in the curriculum content. They are the start-point; the subject of the work.

b. facts and

c. rules and principles.

Skills -- what the student is expected to do -- consist of

d. using processes and procedures The written format: briefing paper; report; letter.

and the ability to

e. make translations and transformations of (a -- c) To apply (a -- c) to a context, a case study, etc.

and to transfer these to

f. applications.

The artefact that is produced by the student.

¹⁵ Bloom, B.S. (1956) Taxonomy of Educational Objectives. New York. David McKay.

Conclusion.

Formative evaluation must therefore determine the critical points within the unit of learning and enable them to be tested. Basic competence must be established in **terms; facts, rules and principles** within the context of **using processes and procedures**. The higher level skills of **making translations and transformations** (of a -- c) to transfer these to **applications** can then be attained.

If specifications for the unit of work have been made sufficiently clear to the student then self-evaluation can take place through a feedback loop. Has this objective been achieved? Have the performance criteria been met at each stage of the assignment?

This should improve both the quality of the learning and the quality of the performance for students.

It should also ensure that formative evaluation is exactly that: one stage on the road to the achievement of full potential for the student.

Appendix: Overhead Transparencies.

Disjunctions.

**Students with a computer at home: the uses to which it is put.
(1995)**

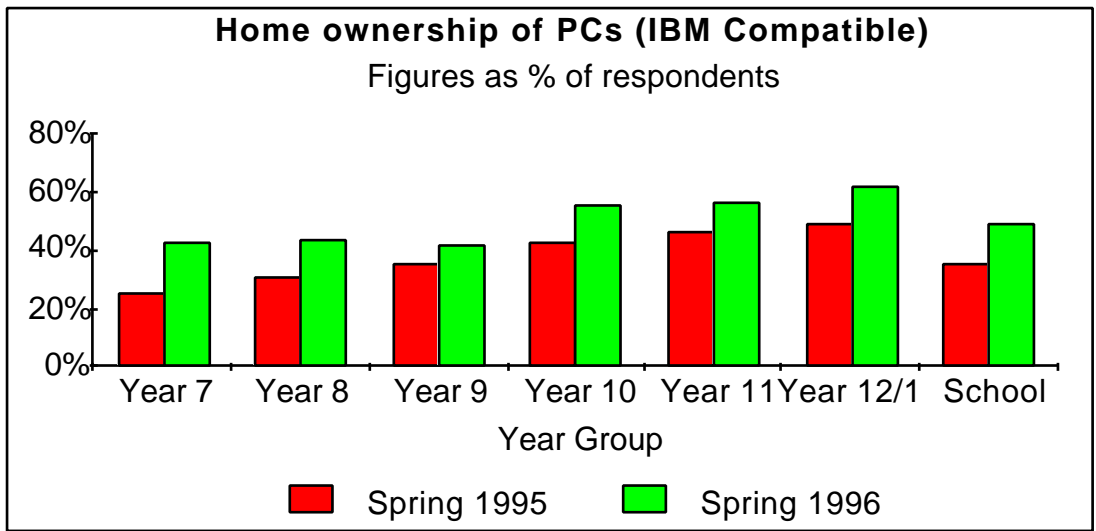
Total Number of Respondents in Survey.		Number of Respondents with a Computer at Home.	
Sex	Number	Work	Games only
Male	674	418 (62%)	229 (34%)
Female	657	355 (54%)	170 (26%)
Total:	1331	773 (58%)	399 (30%)

88% of all respondents (1172 students) either owned a computer, or had access to one at home.

- 58% of the students (773) who completed the sample stated that they had a computer at home that they used for work.
- 35% of the students - 466 - stated that they had access to a PC with a Windows operating system.

1996 update:

Home ownership of Personal Computers (IBM Compatible) as %		
Year Group	Spring 1995	Spring 1996
Year 7	26%	42%
Year 8	31%	43%
Year 9	35%	41%
Year 10	42%	55%
Year 11	46%	56%
Year 12/13	49%	62%
Whole school, as % of respondents	35%	49%



	Spring 1995	Spring 1996	
(Year 7)	26%	43%	(Year 8)
(Year 8)	31%	41%	(Year 9)
(Year 9)	35%	55%	(Year 10)
(Year 10)	42%	56%	(Year 11)

Computer use at school and home: teacher response 1996.

Staff	111=100%	W/P	S/S	D/B	CD-ROM	CAL	CAD	Control	Inter-net	Video-conferencing
School use	40% (44)	40% (44)	11% (12)	18% (20)	7% (8)	29% (32)	6% (7)	2% (2)	4% (4)	4% (4)
Home use	32% (35)	32% (35)	11% (12)	11% (12)	9% (10)			1% (1)	4% (4)	

Students and Computers; Uses and Gratifications.

I think that no matter what teachers say about you not getting any extra marks for the work being printed, a well-presented piece of typed work with (obviously) no crossings-out and no spelling mistakes can make a teacher go “Wow!” as soon as they see it.

Value reinforcement. The perceived correlation between computer-produced work and better grades (% response.)

1995 survey

Year	Male	Female	All
Year 7	97	99	98
Year 8	94	91	93
Year 9	100	97	98
Year 10	100	96	98
Year 11	100	95	98
Year 12/13	87	97	91

Summary of responses.

Taxonomy of Computer Gratifications as % of whole school.						
	1.	2.	3. Personal identity.			4.
Category:	Diversion	Relationships	(a.) Personal reference	(b) Reality exploration	© Value	Surveillance
Female	51%	1%	16%	4%	96%	16%
Male	69%	1%	28%	5%	97%	18%
Whole:	60%	1%	22%	4%	96%	17%

1995 survey

How can IT-Illiterate Teachers Cope?

Information Technology poses problems:

- **language is dense;**
- **it contains key concepts;**
- **it contains multilateral references;**
- **it is Iconic - not simply transactional.**

We must consider:

a. The interaction between language, thought & experience:

Sapir-Whorf Hypothesis.

b. Language and Thought.

The symbolizing qualities of language: the conceptualizing qualities: the need to internalise the meanings. Piaget's finding: that 'correct' verbal responses can mask inadequate, or 'wrong', concepts.

c. The nature of knowledge: practical; propositional.

Many learners are stuck at the 'practical' level. They therefore have no satisfactory concept formation.

d. There are problems which then link to memory and perception. The key is **Codability**: the iconic value of language.

e. The Thinking Process.

Bruner: Motor; Sensory; Thought Processes;

Piaget: Sensori-motor; Symbolic; Concrete;

The representation of reality (Bruner):

Enactive; Iconic; Symbolic.

The Issue is therefore to move the learner

along the stages of:

Motor/Enactive

Symbolic/Iconic

Concrete/Thought Processes.

If teachers are not aware of these stages,
one must ask the question:

Is this possible?

Understanding the Learning Process.

Bruner: Motor; Sensory; Thought Processes;

Piaget: Sensori-motor; Symbolic; Concrete;

Skills transfer Knowledge Concepts.

understanding;

ability to solve problems;

think creatively.



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