The Development of a Writing Aid for Secondary Education

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In October of 1984, the Department of Education at Twente University of Technology in the Netherlands started a research and development project on the use of information technology in the field of writing skills in secondary education. The goal of the research was to gather information about the possibilities and limitations of the use of the computer as a tool in the instruction of writing, communication about texts, and word processing in the classroom. The planned final product is a curriculum for all kinds of writing skills, with an integrated software package as a part of the curriculum materials. This paper concentrates on the development of this innovative prototype of educational software, a computer-assisted writing environment with the working-title SPIRIT.

For obvious practical reasons, the project focused on two parts of the writing system--the planning system and the input system. In the design process we are in the stage of the functional specification; that is, we're trying

to say what it should be by saying what it should do. This is not an exultant story of how we "made it," but a report of the difficulties in deciding exactly what we wanted, and of realizing our decisions in a product.

SPIRIT: A Short Introduction

"SPIRIT" is an acronym for "System voor het Plannen, Invoeren, Reviseren en In omloop bregen van Teksten." The Dutch name explains the program's four functions:

Plannen (planning): a planning tool, for the wide variety of activities that help pupils with orientation toward a writing task. The planning aid coaches the pupil in choosing an appropriate subject for the text, generating ideas about this subject, choosing an adequate text structure, and making an increasingly sophisticated organizational plan (in goals and subgoals) for content and language usage. This planning aid will be the main point of interest in the writing-research part of the project.

Invoeren (input): an input aid, a word processor as a pupils' tool for formulating thoughts. This educational word processor must interact with the other parts of the writing environment.

Reviseren (revision): an evaluation tool that helps the students to revise their texts properly, by providing text analysis data, e.g., sentence length, but also by presenting evaluation questions based on the planned goals.

In omloop brengen (communication): a tool to present texts to others. The computer serves as a communication system that gives students the opportunity to communicate via screen or hard copies of the writing process.

The Design Rationale of SPIRIT

The development of this software package was started for the reason every educational technology application should be started: teachers felt that they didn't succeed in reaching the standards at which they aimed. In our opinion, such a needs assessment must be the starting point of every design process. We don't believe in an often-used strategy in designing educational software: producing a solution, a tool, and subsequently starting to look for a problem to solve with it. For reasons of designers' integrity, effectiveness of the solution, and success of implementation, a thorough needs assessment is absolutely necessary (Fullan, 1982; Kaufman, 1981; Kaufman and English, 1981a). An educational tool will be used effectively by teachers and students only when they feel it is a solution to a problem they have experienced.

On starting the design of a computer-assisted writing aid, we felt that three important groups of considerations should contribute to the legitimation of this design, that is, considerations concerning

(a) the role of the computer in education,
(b) theories about the writing process,
(c) the composition lesson's process.

In a preliminary research report by Van der Geest (1986), these considerations are described extensively.

It's not possible to pay attention to all considerations assembled under these categories in this paper. We'll give only some important starting points as an example of each category. Limited attention will be paid to the first category because an overwhelming amount of literature is available (e.g., Kulilk, Kulik, and Cohen, 1983; Lesgold, 1982; Papert, 1980; Plomp and Van der Wolde, 1985; Taylor, 1980; written in Dutch: Camstra, 1980; COI-informatie 4 1985; COI-informatie 8 1985; Moonen and Gastkemper, 1983; Plomp, 1985). Since there is a smaller amount of literature available on (b) and (c), we will pay more attention to these two.

An important remark has to be made first: almost all of the examples of writing tools which are discussed are in the literature from North America. Although the American writing-skills teaching practice differs considerably from the European, experimenting with American packages is useful for exploring possibilities and problems surrounding the use of the computer in the teaching of writing. Such an experience is expected to be a fruitful source for generating ideas for applications in our situation. An inventory of existing writing-skills software packages was a part of the pilot research (Van der Geest, 1986).

The Roles of the Computer in Education

New information technologies will have a deep influence on curriculum, especially on

general curricular goals: new goals will become more important, already existing goals will be aimed at in new ways. Hunter (1982) supposes that problem solving, information handling, and social interaction will become more important, while skills such as handwriting, spelling, arithmetical computation, and memorization of facts will become less important. Development of productive skills, in contrast with reproductive skills, must be the main goal in every language arts curriculum.

The rapidly growing importance of the new information technology in our society also influences the goals of language arts curricula; while concerns such as expressing information in a clear way becomes even more important, mechanics, like correct spelling, can be expected to become less important as machines learn to do these tasks. Computer use in language arts classes should be based on a conviction about which goals are important in an information society.

Students have to be "masters" of their computers, instead of "slaves." Computers in language arts classes shouldn't be merely mechanical trainers of subskills like verb conjugation, but should provide a tool for a pupil and aid the pupil in effective and creative planning, thinking, and problem-solving processes. The use of computers as tools in composition lessons creates the opportunity for open-ended, computer-assisted instruction, appealing to both the sexes.

The favorable qualities computer-assisted instruction can have should be used as often as possible in educational software. This may appear to be a superfluous remark, but to my

regret, not much software can be characterized as having these favorable features, such as flexibility, individualization of learning processes, interactivity, motivation by its contents and appearance (Becker, 1984). Similarly, the limiting features of computer use in education, such as difficulties in "understanding" natural language and lack of attention for the social implications of language behavior, should be avoided whenever possible.

Theories About the Writing Process

Using a word processor influences writing behavior, as far as we know at the moment. Collier (1983) proved that writers made more revisions and experimented more with different possibilities when using a word processor. On the other hand, computer-supported revisions didn't make the overall quality of the text higher, and the writers with pen and paper planned their texts better in advance. Teachers using computers in their writing classes observed that their students liked to use word processors. The students got a better insight into the writing process, used the features of the word processor to save time and energy, and produced neat copies of their texts. The danger of concentrating too heavily on lower-level text problems (e.g., spelling) during the writing process seems to be less, because it's easy to write in different versions with the focus of attention on different language problems (Daiute, 1985; Schwartz, 1985; Wresch, 1984).

When using the computer influences the writing process, this process should be an

important starting point in the development of a computer tool for beginning text writers, like our secondary education students. Hayes and Flower (1980) developed a model for the writing process, based upon the protocols of writing sessions (see Figure 1):

The task environment and the long-term memory of the writer form the context of the writing process. During the planning process, the writer sets goals: she or he generates ideas and organizes them in a content plan and a structure plan. These activities, preceding the actual formulating, we call the orientation towards the writing task. In the process of formulation, the writer chooses words, clauses, and sentences to produce a text, determined by the plans and goals made in advance and during the writing. When a text or a text part has been produced, the writer revises and edits the text. The writing process is not strictly linear, although there is more planning in the beginning and more revising towards the end of the writing session. The way the writer proceeds through these processes is determined by the monitor.

Although other researchers of the writing process don't agree with Flower and Hayes about whether this model fits all types of writers and writing tasks, they agree with some important characteristics of the model. They endorse that writing is a linear-recursive process; the subprocesses interrupt each other and alternate. During the writing, the writer proceeds through the subprocesses many times.

If a writing aid should be a support for the writing students in all stages of the writing process, the aid has to have the possibility to

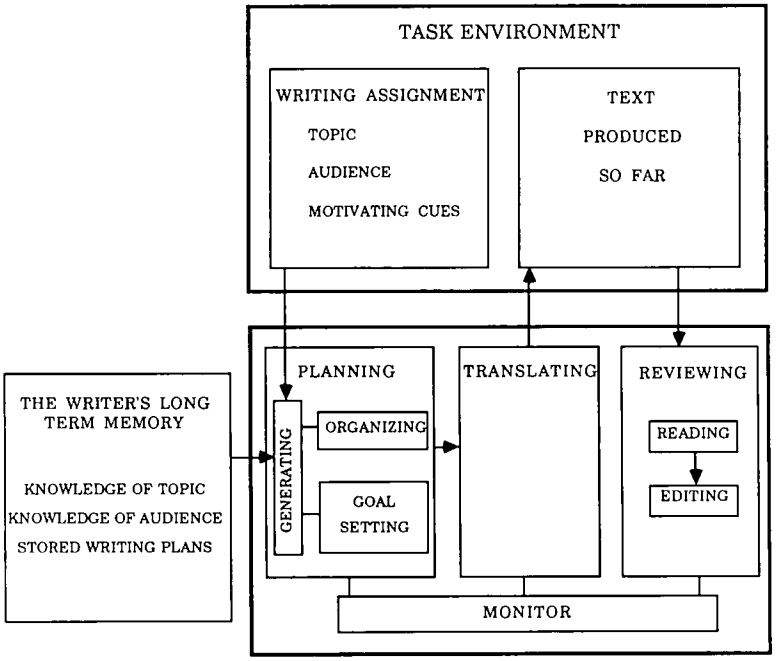

Figure 1. Structure of the writing model

be used in a linear-recursive way. For example, jumping from the formulation processes (word processing) to the processes of generating ideas must be easy and should not disturb the cognitive processes underlying the writing. The word processor must be integrated with the other parts of the writing environment and interact in a clear and reflective way.

A writing aid based on the writing processes, like SPIRIT, makes it possible to approach the teaching of composition as a process.

The Composition Lesson's Process

The experiences of teachers using word processors or writing systems seems to indicate that just dropping a tool into the writing class doesn't improve the quality of the produced texts significantly (Collier, 1983; Southwell, 1984).

Expecting sensational results is like giving students a tool kit with hammers, chisels, and planes and expecting them to produce good and beautiful chairs and tables. The tool, whether it is a chisel or a writing aid, must fit in a curriculum that defines the instructional use and the materials that go with the tools. SPIRIT will be designed as a part of a systematic, process-oriented writing-skills curriculum.

A thorough knowledge of the daily course of events in writing classes is an absolute condition for a good design. The writing environment can be a solution to the problems in composition courses and should be designed in accordance with the needs of teachers and pupils. Moreover, these needs are influenced by

a number of related factors. The limitations of the instructional situations (e.g., one teacher for thirty beginning writers), the complexity of the writing processes (evident from the downsliding), the rather small amount of knowledge about the didactical praxis of writing skills--these and many more factors determine the success of the implementation. If we want SPIRIT to be used in classrooms, we'll have to design it with these factors in mind.

Summarizing, we can define SPIRIT as having the following characteristics (which could not be completely discussed in this paper):

--tool for students: helps writing text;

--tool for teachers: helps to teach students how to write texts;

--based on writing-process theories;

--based on learning-process theories;

--problem-solving approach to planning process;

--builds rhetoric awareness;

--software integrated with other curriculum materials;

--appropriate for different writing tasks;

--appropriate for students with different abilities and interests;

--software functions (e.g., word processing,

planning) integrated;

--uses good features of CAI, avoids bad ones;

--user friendly;

--interactive;

--motivating;

--shows computer use can be creative and open ended.

Software Features as a Consequence of the Design Rationale

At some point, the premise we have just described will have to be translated in software characteristics. In this translation process, the needs, arising from the premises, often collide with limiting conditions, such as the available time and money for the development of some complicated system features, the state of the art in computer technology, the hardware present at schools, etc. We'll give two examples of this often conflicting and contradictory translation process, concerning two subfunctions of the input system, the word processor.

One of the many goals in composition instruction is that students learn to compose a tidy letter, with a clear and attractive layout. Letters are written on A-4 paper sheets, with about thirty lines per sheet; computer screens only show twenty lines. In fact, the students need an A-4 format terminal screen to lay out *a*

letter properly, but these large screens are only available for a few dedicated word processors, and they are very expensive. Here the limiting technical conditions interfere with the subject goals of the writing-skills practice.

In SPIRIT, we'll try to solve this problem by including a simulation of the text layout: indentations, sentence length, and blank space are represented in a reduced A-4 format. This solution seems to be rather simple, but it has far-reaching consequences for the way the screen contents will be processed by the computer. The words on the screen have to be considered as graphics, not text.

The second example also deals with the design of the word-processing program. In a text, different text levels can be discerned: sign (e.g., a letter, a punctuation mark), word, clause, sentence, paragraph. The inexperienced writer typically revises at the lower text levels: adding, deleting, or substituting letters and words (Collier, 1983). If we want our students to be good revisors of their own texts, they must learn to manipulate blocks of text as well. In the existing educational word processors, e.g., BANK STREET WRITER, manipulation is a rather difficult and confusing operation. A word processor designed for teaching writing skills must provide the ability to shift larger text units in a way that fits the writing process. As an illustration, let us imagine a student writing an essay assignment. The student has been generating a number of arguments about the chosen subject and has made a structure plan. During the process of formulation, the student sees that the last

argument shouldn't be in the place that was planned. At that moment, he or she must be able to go back to the structure plan and manipulate the arguments there and in the text in one action. After changing the structure of the text, the student must have choice of going back to the place where the process of formulating was interrupted, in order to disturb the cognitive process underlying the writing as little as possible.

Translating the problem in software terms means that there has to be a chosen way that the computer can discern text parts. And how do we define text parts? As paragraphs? As screen contents? As windows or frames? Decisions like this one determine the architecture of the word processor to a large extent. New integrated software, e.g., idea processors like FRAMEWORK or MAXTHINK, provide examples for our development activities.

Final Remarks

Maybe some readers expected another paper for a journal on computers in writing instruction, more about computers and less about instruction. For those people, we want to re-emphasize that the starting point for the development of educational software has to begin with instruction. The computer must be a means to realize the optimization of education. A thorough needs assessment, in close relation with the teachers and the subject experts, can produce criteria for computer applications, both for use in a curricular context and for the technical applications. The quality of the needs assessment will determine the quality of

the final product to a large extent. Of course, other factors, e.g., implementation aspects, also influence the effectiveness of the chosen solution (Fullan, 1982), but in the context of this paper, we can't pay attention to these important aspects. In the present design stages of SPIRIT, we're trying to distinguish clearly which aspects in the writing process and writing-skills practice offer a good way to the optimization of the writing instruction. We consider this effort a very important stage in the design process.

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