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forerunners and other teachers. Computers have been used in the computer lab as well as in the classroom. A real integration in the curriculum is still an exception. Most of the computer use is additional.

## **DESIGNING AND TESTING FOR IMPLEMENTATION**

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The project Computer-assisted Writing Instruction (1985-1990) was initiated to investigate claims that the computer could serve as an useful tool in process-oriented writing instruction. As appears from survey studies of writing achievements of students of secondary school level, most students experience severe problems in producing texts that fulfil their communicative function adequately. This could be due to the little attention that usually is paid to other aspects of writing skill than the 'mechanicals' of text production. In the project an attempt was made to develop courseware for an innovative type of writing instruction in which much attention is paid to defining the communicative goal of the text to be produced and to planning the text with an open eye for the needs of the reader and the consequences for the content of the text.

The material developed should support student writers of secondary school level in their processes of text planning and text production. It was to be used in the traditionally non-machine-supported language arts courses. But especially it was meant to be feasible both for teachers and students in ordinary classroom situations.

To achieve such innovative, well-implementable courseware, a cycle of formative evaluation activities was planned, in order to assess problems teachers and students actually met when using the materials. As soon as plans for or parts of the new materials were available for testing, they were commented on and tried out by users of the target group, that is both teachers and students. A variety of instruments has been used, chosen according to the evaluation question at hand. In an extended field test with eight classes of the target group of students, data were collected and analyzed with regard to factors known to be influential from the educational innovation literature. In a cyclic process, the experimental materials were repeatedly revised on the basis of the results of the evaluation activities. Subsequently the feasibility and effectivity of the revised materials has been assessed in an effect study in nine classes of secondary education (N = 200). In the paper presentation, attention will be paid to the design of the formative evaluation study and the revision based on its results. The methods used will be informally evaluated for their merits and demerits with regard to usability and practicality. The process of revision on the basis of the data collected will be described.

The following study of the feasibility and effectivity of the revised materials, focused at students' and teachers' perception of the materials and the changes in achievements that could be related to the use of the materials. Quantitative and qualitative measures were combined. Results with regard to the feasibility of the writing courseware, particularly as experienced by the teacher will be reported.

Teacher perceptions of the characteristics of the materials and their use appeared not to be completely parallel to the students' perceptions and their writing achievements, measured in the effect study.

## **COURSEWARE CHARACTERISTICS AND THE TEACHER**

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In the 'Computer-assisted lab work project' the computer has been used as a tool for collecting and displaying data during students' lab work. The courseware, a comprehensive set of laboratory exercises on 'Heat and Temperature', a student-textbook and a teacher guide, intended to improve students' inquiry skills, particularly interpreting graphs and drawing conclusions. The courseware promoted hands-on learning experiences. It was supposed that most teachers participating in the project were not used to hands-on learning. So the teacher guide paid special attention to recommendations for coaching students while learning by experience.

Goodlad et al. (1979) proposed a typology for different manifestations of the curriculum: ideal, formal, perceived, operational and experiential. In the symposium characteristics of the courseware (the formal curriculum) which positively or negatively influence the desired planning and coaching behaviour of teachers (considered critical in the operational curriculum) will be highlighted. To describe the implementation of the courseware a case study approach has been used. The cases in the study were five teachers, teaching in six lower secondary science classes (two schools, three classes per school). All lessons (N = about 60) with the courseware were audiotaped and observed, teacher-student interactions could therefore be carefully registered. A structured interview with the teachers about their perception of the courseware goals, about lesson preparation and execution and about effects on students, took place after all lessons were executed.

To analyze the observed lessons a so called 'curriculum profile' (Van den Akker, 1988) has been developed and validated by experts. In the curriculum profile the essential lesson elements were described in operational terms, with a differentiation between 'threshold', 'ideal' and 'unacceptable' elements. Information about the exact amount of time spent to each lesson and about technical problems with hard- and/or software could be derived from the lesson observations.

At this moment data-analysis is still in progress thus the final results are not yet available. Results about the following issues can be expected: (a) which characteristics of the courseware promote or inhibit the desired teaching and coaching behaviour; (b) do teachers change their teaching and coaching behaviour during the execution of the courseware; (c) for what reasons teachers show or don't show the desired teaching behaviour; (d) if and in what way side effects threaten the implementation process.

The findings of the study will be related to literature about implementation and courseware characteristics.