

Courseware Development from an Implementation Perspective: Emphasis on the Teacher's Role

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Framework and research question

Central to the implementation of computers in education is the classroom teacher. Most teachers are still inexperienced in using computers in their classroom activities. In initial implementation stages small scale successful experiences in their own classroom practice are an important factor in stimulating further use of the innovation. These experiences help teachers in acquiring clarity about the meaning and potential of the innovation, in gaining confidence in their own competence, and in developing their own view of the appropriateness of the innovation for the students and themselves.

Our study is based on the assumption that such successful experiences in the initial implementation stage can only take place when teachers have high quality courseware (computer software and written (lesson) materials) at their disposal.

In this study we investigated which characteristics of courseware, especially teacher materials, contribute to successful implementation experiences in the initial implementation stage. In answering this question, we concentrated on teacher materials as a part of open ended courseware for lower secondary education.

Design of the study

The study consisted of two main stages. In the first stage, design guidelines for courseware materials were formulated, based on:

- an extensive analysis of research literature;
- three subsequent pilot projects, in which courseware was developed and tested.

In the second part of the study, we tested the effectiveness of these guidelines in a field experiment. In this experiment two versions of the same courseware (covering five geography lessons in lower secondary education) were compared: an experimental version, with teacher materials developed in accordance with the design guidelines, and a control version, with teacher materials similar to the kind of materials that were available from courseware publishers. We conducted the experiment with the cooperation of 37 geography teachers who were inexperienced computer users.

Data were gathered on three dimensions of successful implementation:

- teachers' perceptions, through a written questionnaire;
- lesson execution, through observations;
- learning results, through a written student test.

The observations were based on a profile, in which an "ideal" lesson was made operational by formulating "necessary", "positive" and "unacceptable" lesson activities. Based on this profile we were able to assign a numerical score to each lesson and to elements of the lesson.

Results of stage 1: Design guidelines

Summarizing the conclusions from the first stage, we can formulate two main design principles (which we elaborated into more specific design guidelines):

- Teacher materials should:
 - indicate clearly which elements of the courseware are essential for achieving the intended change and the desired learning outcomes, and which elements can be adapted without distorting the change;
 - contain very accurate how-to-do-it advice, focused on essential but apparently vulnerable elements of the courseware.
- When courseware developers provide detailed procedural advice, they should make sure that this advice is effective and validated. Therefore a careful development approach, with much attention for formative evaluation and revision of the materials, is needed.

In our attempt to support teachers through teacher manuals, we encountered two interrelated problems: teacher manuals are rarely used, and teachers have very little time available for lesson preparation. In our study we applied two solutions to these problems:

- providing a videotape with examples of the intended use of the courseware in actual classroom settings, that can function as an advance organizer;
- integrating teacher and student material, resulting in an extended version of the student materials, in which student texts and exercises are supplemented with practical suggestions for the teacher. This integration limits the number of courseware components the teacher has to deal with.

Results of stage 2: Testing of design guidelines

The field experiment yielded the following results:

- Teacher perceptions
 - The experimental version of the teacher materials did not result in a more positive perception of teachers about the lessons: both conditions were fairly positive about the lessons and the materials in general. However, the two groups did differ in their opinion about the teacher guide: teachers using the experimental version were more positive.
- Lesson execution
 - The lessons in the experimental group were more in accordance with the intentions of the developers than the lessons in the control group. Teachers using the experimental materials took better care of the introduction of the lesson and the discussion of the activities with the software at the end of the lesson.
 - However, a mean score of 53% (on a scale from 0 to 100) in the experimental group, indicated that not only teachers in the control group (mean score: 38%) had difficulties in realizing an "ideal" lesson. This shows that there is still room for improvement in the experimental condition.

- Student learning

Students in the experimental condition attained better results on the test than their peers in the control group. Their average score, on a scale from zero to ten, was almost one point higher than the average score in the control group.

Conclusion

The study showed that teacher material can serve as an important aid for teachers who are inexperienced in using the computer in their classroom. It is possible to stimulate a successful implementation of courseware, by anticipating implementation problems during the development of the (teacher) materials. The guidelines that were formulated in the first stage of our study have proven to be productive tools to do so.

However, the results also supported the well known fact that materials alone can never be the whole solution to the problems teachers face. The effects of the teacher materials were significant but limited. Additional support (e.g. in-service training and coaching) is needed to achieve lasting and successful change in classrooms.

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