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Source	<i>MERA-ERA Joint Conference, Malacca, Malaysia, 1-3 December 1999</i>

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IMPROVING MULTIMEDIA DESIGN THROUGH FORMATIVE EVALUATION

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Abstract: Authoring tools are increasingly available to schoolteachers. Many teachers are using these tools to develop multimedia projects for instructional purposes. This paper describes an experience of pre-service teachers using formative evaluation to improve quality of multimedia courseware design. In the first semester of 1999, we introduced formative evaluation to a group of trainee teachers enrolled in module Learning, Thinking and Instructional Technologies. To fulfil the requirements of this module, the trainee teachers had to design and develop a multimedia courseware within the period of three weeks. By the end of the second week, the trainee teachers tested their courseware on their respective target audience. They, then, revised the courseware according to the feedback obtained in the formative evaluation. Some of the trainee teachers managed to do the second test before the final submission of the courseware. Through such an experience, the trainee teachers learned the importance of formative evaluation in instructional courseware development, which is usually one of the least well-done parts of multimedia design. All agreed that the feedback generated from the formative evaluation helped improve the quality of their multimedia courseware. One of the expected competencies of the pre-service teachers enrolled in the module of Instructional Technology at National Institute of Education is to use authoring tools to develop multimedia courseware. The module tries to prepare pre-service teachers to be fluent in pedagogy and basic design theory so that they may use their newly acquired IT skills to produce educationally sound products. However, one question that always comes up is how do we know whether the courseware made by trainee teachers will work. How do we know whether it will work is probably the most frequently asked question about any educational products. In developing a courseware, we may have good reasons to believe that it will work as intended, but we do not know whether it actually works. Although formative evaluation may help to address such a concern, it often receives low priority. It is not uncommon that commercial software is released before being tested on that target audience. The assumption is that this software will be validated by the clients who buy the products. Nonetheless, we believe that as educators pre-service teachers should know the importance and procedures of formative evaluation. This paper describes an experience of pre-service teachers using formative evaluation to improve multimedia courseware design. It discusses the implications of such an experience and suggestions for improvements. The paper argues that formative evaluation is critical for instruction in any medium, especially multimedia. Formative evaluation should be an integrated part of the design process and must be stressed through all stages of courseware development.

Background

What is Formative evaluation?

Formative evaluation is “the systematic collection of information for the purpose of informing decisions to design and improve the product” (Flagg, 1990). Different from summative evaluation, formative evaluation seeks specific information or opinions that may serve as feedback for product improvement rather than for the purpose of grading (Beyer, 1995). Because formative evaluation is conducted while the product is in the process of being created, it helps to ensure that the products being produced meet the objectives set by developers. Whatever evaluative feedback generated determines the quality of that product.

Why Is Formative Evaluation Important in Multimedia Design?

As courseware developers, pre-service teachers are often too close to their products to detect inadequacies of their products. Especially for the trainees who do not have any or much teaching experience or have no contacts with school age children, it is often difficult to imagine how youngsters learn.

Formative evaluation offers a practical and cost-effective way of determining the quality or potential quality of a newly developed courseware before it is put into regular use. Results obtained from formative assessment may help modify the courseware and avoid errors that arise from unfamiliarity with intended learners. As a result, the courseware being developed may work as intended without any unwelcome surprises.

How Is Formative Evaluation Conducted?

Formative evaluation employs many well-established strategies. Frequently used methods are expert review, in which drafts of proposed products are submitted to experts such as experienced classroom teachers for comments; observations of individual learners; pilot studies; and field tests. Data-gathering instruments include (1) annotated analyses of observation, (2) interviews, (3) anecdotal records, (4) questionnaires, (5) quantitative performance or achievement assessment, (6) learning logs, (7) error logs, (8) focus groups, (9) video and audio recordings, and (10) open-ended reports (Beyer, 1995).

Methods

In the first semester 1999, we introduced formative evaluation to a group of trainee teachers enrolled in module Learning, Thinking and Instructional Technologies at National Institute of Education. To fulfil the requirements of this module, the trainee teachers designed and developed multimedia courseware in-groups within the period of three weeks. By the end of the second week, the trainee teachers tested their courseware on intended learners (primary school level). They, then, revised the courseware according to the feedback of the intended learners. Some of the trainee teachers managed to do the second test before the final submission of the courseware.

Because of the time constraints, we asked the trainee teachers to use annotated analyses of observations and interviews. In the guidelines provided, we asked the trainee teachers to look for two main areas: (1) ease of use and (2) clarity of information. To be more specific, we asked the trainee teachers to look whether the interfaces of their courseware are consistent and easy to use; whether the information is presented at the level of the intended learners; and whether activities are appropriate given the ability and knowledge levels of the intended users.

Each group of the trainee teachers showed unfinished courseware to at least one youngster similar to their intended learners. No comments were made while the youngster used the courseware. The trainee teachers were instructed to pay special attention to the ease of navigation and understanding of directions of the courseware, and to keep close look at the users' facial expressions and body language. Interviews with users were conducted following observations. We told the trainee teachers to avoid general questions, such as "do you like it?" Instead, interview questions were based on observations, such as "I noticed that you paused quite a long time before completing the questions on this slide. Do you remember why?"

We did not request the trainee teachers to test how well the structure and sequence of the materials enable their users to achieve the stated objectives. However, all the groups asked their subjects to answer some assessments questions after viewing.

Findings

Through observations, the pre-service teachers learned whether their intended learners had difficulties in using the courseware; whether learners understood intended learning outcomes; and whether unanticipated or unintended consequences occurred. The observations and interviews provided invaluable information for the pre-service teachers. By identifying the sections where children's attention wandered and confusions in navigation, the pre-service teachers learned why pupils liked and disliked certain features in the courseware.

Ease of Use

In addressing the question whether the interfaces of their courseware were easy to use, the pre-service teachers reported consistently what young learners like and dislike. The pre-service teachers found those primary school students

- like animations
- are interested in sounds produced
- are amazed by hyperlinks
- prefer cartoon figures to real life pictures
- prefer animations added to the texts
- like colorful pictures

One group reported that the pupils showed more interest and spent more time looking at the colorful slides while spending less time on slides with no background colors. Another group reported that the pupils paid more attention to the slides with audio effects. "She liked dialogues the most as she found that it aided her understanding." Still another group reported the following. "For the courseware, originally, we used orange as background as we wanted to create an effect of 'fiery' situation. However, students complained that their eyes hurt after looking too long at the background of bright orange. So, we changed the background color to a more soothing deep blue that was much easier on the eyes and used bright colors for the words to create a clear contrast. After the modification, the primary students liked the simple effects."

Of the seven groups, five made changes to screen layout and design after the formative evaluation. One pair reported that "we added some background colors to those slides whose backgrounds were previously white after the subject commented that he found less interested in concentrating on text on white background."

The trainee teachers were positive about the experience. Some of them were surprised by the reactions of the pupils tested. Two pre-service teachers commented that while the primary school pupil worked through the slides, "he began to respond by telling us how he felt the text should be arranged and the background colors. We were quite surprised by the creative ideas he suggested which we had never thought of".

Clarity of Information

Formative evaluation provided opportunities for the pre-service teachers to find out whether the information was presented at the level of the intended learners, and whether the activities in their courseware were appropriate given the ability and knowledge levels of the intended users. In general, the trainee teachers overestimated the pupils' language abilities. All groups reported that primary pupils do not like long words that are difficult to understand, and that after the formative evaluation they all made modifications on the words used in the courseware to make them easy for the learners to follow.

The pre-service teachers also found that audio and voiceover actually help young learners to understand instructions. One group reported that their pupil "read aloud as she was going through the presentation. We asked her if it would be better if we include a voice in the reading of passage. She suggested that some sounds be added to make it more interesting."

On the basis of the evaluation results, some groups expanded narration to increase clarity of instruction and others added more instructional games. One group reported that "we changed the arrangement of some tests and icons when the subject commented that placing them at the bottom right corner would be better." "We added a certificate on the last slide to further encourage the student to be more motivated to learn about the topic."

Through such an experience, the trainee teachers understood the importance of formative evaluation in instructional courseware development, which is usually one of the least-well-done parts of multimedia design. All agreed that the feedback generated from the formative evaluation helped improve the quality of their multimedia courseware design.

Learning Objectives

Although we did not request the trainee teachers to assess whether the learning objectives were achieved, of the seven groups, six conducted assessments at the end of viewing. All reported that their learning objectives were achieved. The pupils were able to answer the questions presented either on the assessment part of the courseware or additional worksheets.

Discussion

Teachers need competencies in instructional design. We believe that it is crucial that pre-service teachers are prepared in the development of design skills such as task analysis, learner analysis, specifying objectives, and using formative evaluation to modify teaching materials. Basic strategies in instructional design, especially design using interactive technologies, should be introduced. Planning and conducting formative evaluations should be incorporated as an important component of multimedia courseware design and made an on-going process through all phases of design and development.

It is evident that the pre-service teachers benefited from evaluating their multimedia courseware during the design process. Evaluation of the areas of ease of use, functionality, and content helped improvement of multimedia quality. The experience further strengthened our belief that formative evaluation should be integrated in the whole design process and as many people as possible should be involved in the process.

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