Knowledge Acquisition by Hypervideo Design: An Instructional Program for University Courses

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This article presents an instructional program for collaborative construction of hypervideos. The instructional program integrates (a) hypervideo technology development, (b) assumptions on learning with hypervideo systems, and (c) the application of research on knowledge acquisition by writing texts or hypertexts to hypervideos. The aim of the program is to support knowledge transforming processes (Bereiter & Scardamalia, 1987; Stahl & Bromme, 2004) by collaborative construction of hypervideos. In the first part of the article a hypervideo system that enables collaborative design activities by users is described. Afterwards the instructional program is presented in detail. Results of evaluation are consistent with the assumptions. The courses showed to be successful and well appreciated by the students.

Hypervideo is defined as *video based hypermedia* that combines nonlinear information structuring and dynamic audio-visual information presentations (videos presenting realistic images or animations). In hypervideos, video information is linked with different kinds of additional information (like written or spoken texts, pictures, or further videos). Users can mouse-click on *sensitive regions* within the videos to access the additional information (see Figure 1). One main difference between sensitive regions in a hypervideo and links in a hypertext is that the sensitive regions have spatial and temporal characteristics. This allows highlighting a specific object or person within the video for a predefined timeframe. The main difference between videos in traditional hypertexts and hypervideos lies in the importance attributed to the video itself. In hypertexts videos are often illustrative and optional. In hypervideos, video sequences form the "backbone of the system" (Zahn, Schwan & Barquero, 2002). Thus, videos and the additional information elements are interwoven in ways that videos can be viewed interactively and navigated in nonlinear order.
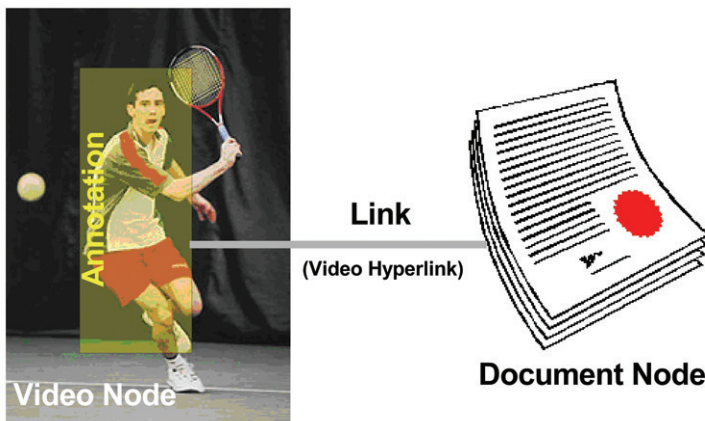

Figure 1. Concept of hypervideo

Defining hypervideo-links in a video sequence enables an author to refer to a specific object / person within the video by providing additional information. This concept was extended by developing a collaborative hypervideo system that supports the collaborative authoring of hypervideo systems where group members can share their ideas (Zahn & Finke, 2003). The system provides specific facilities to jointly elaborate on video materials and to change a hypervideo presentation according to the development of knowledge present in *any* group. In this sense hypervideo can be defined

as *dynamic information space (DIS),* which can be changed and extended as a basis to share knowledge and to communicate. The dynamic information space integrates interactive videos, additional information and communication.

The human computer interface of the software is based on a view model. The model allocates separate views within the graphical user interface to access certain parts of the dynamic information space in form of the different node types within the DIS:

Video nodes are video sequences with sensitive regions, which are presented in the video view. By means of VCR-functionalities a user can control the tempo of the presentation. The existence of a sensitive region is announced by its visualization within the video display. Since it might be disturbing in some learning situations, the user is in charge to initialize the visualization process of sensitive regions. Hypervideo-links can be activated by clicking on the corresponding sensitive region with a mouse pointer. Furthermore, the video view allows users to generate own sensitive regions.

Additional information is presented in a separate view and can be of different media types such as texts, images, animations, audio recordings, and so forth. It is possible to link multiple nodes with additional information to one sensitive region within the hypervideo system.

Communication nodes describe the conversation between users and are therefore highly contextualized. The communication view presents the group conversation in form of text based dialogs (chat). A dialog is always related to an object in the video or to a specific information node.

In addition, a fourth view is introduced that enables the disclosure of the *hypervideo-structure* in order to support user orientation within the graphical user interface. The arrangement of all node types within the structure is visualized in a text-based manner. Users can browse the navigation view and activate hypervideo-links, which will lead to the presentation of the content in the associated views.

These facilities, in turn, can be used in formal educational contexts such as projects at the university, as will be described in the following paragraphs.

COLLABORATIVE HYPERVIDEO DESIGN

During the last years a growing number of courses in hypermedia production have been offered in schools and universities that focus on students' collaborative design of multimedia. These courses are often based on the

assumption that multimedia design projects foster an active, collaborative and constructive learning process about the subject matter to be processed, as well as more general cognitive, meta-cognitive and social skills (*design skills,* Carver, Lehrer, Connell, & Erickson, 1992; Liu, 2003). This idea is sometimes also defined as the learning by design approach (Reimann & Zumbach, 2001).

From the constructivist perspective of situated cognition (Jacobson & Spiro, 1995) learning by design allows one to create a learning context, which incorporates important features to foster deeper understanding and knowledge transfer. Students have to solve the realistic and authentic problem of how to present a topic within their hypermedia in an appropriate way. They are engaged in an active and constructive process of learning, and because of the complexity of the task that can only be solved in collaboration, they are challenged to articulate and negotiate meaning with their fellow students. Further on it might foster their understanding to comprehend the same contents from multiple perspectives.

However, to define the production of hypermedia as a design act clarifies the complexity of the task: It is not easy to maintain the balance between thinking about the content to be processed and thinking about design features of hypermedia (Dillon, 2002). Accordingly, problems that arise in such projects include that either too much attention is paid to the design of hypermedia while the contents are only included with "copy & paste" (Bereiter, 2002), or that students present the contents in a way that is inappropriate for the format of hypermedia. A consequence of both cases is that students develop a superficial comprehension of the subject matter presented by their products.

Therefore it appears necessary to find an appropriate balance to encourage reflection on the contents on the one hand and reflection about the hypervideo design on the other. This assumption is made in analogy to ideas from research on writing traditional text and hypertext.

Concerning text production, Bereiter and Scardamalia (1987) proposed that writing can only contribute to knowledge acquisition when a text is formulated within a continuous interaction between content-related knowledge (on the topic addressed in the text) and rhetorical knowledge (on the design of the text, the anticipated audience, the genre, etc.). This problem-oriented procedure (called knowledge transforming) requires authors to reflect on and extend their own knowledge about the topic.

Concerning hypertext writing, Stahl and Bromme (2004) used the knowledge-transforming model as a heuristic to examine conditions and processes of learning by constructing hypertexts and to develop a course

program for university courses, respectively. They argued that constructing hypertexts places special constraints on the design of the documents through the features of hypertext, the nodes, the links and the multi-linear structure. As they described in detail, the processes of writing nodes, selecting appropriate links, planning the overall structure and flexible ways of reading might result in deeper knowledge about the concepts within a subject matter, a deeper comprehension of semantic structures within the subject matter and to a more flexible use of this new knowledge.

The medium specific features of *hypervideo* can be defined as constraints that might promote knowledge transformation in university courses if they are used consciously in the design process as well (Zahn et al., 2002): The first feature is that filmic codes constitute the primary means of symbolic expression. Dynamic visual information can be used to present dynamic contents both explicitly and realistically. Additional audio information may further support the presentation of dynamic contents by enabling dual coding and dual cognitive processing (Mayer & Moreno, 2002; Paivio, 1986). And more generally video, as dynamic and figurative information, can represent a powerful means of communicating knowledge rapidly and efficiently. It can bring context to topics, enhance the motivational power of a presentation and the authenticity of a learning experience (Chambel, Zahn, & Finke, 2004).

The second important feature of the hypervideo with regard to educational contexts is that the filmic presentation (unlike traditional TV or video) is not a continuous stream of audiovisual information but may be structured through links and integrated with abstract symbol systems and then be arranged according to various structural patterns ranging from "films with multimedia footnotes" to "video networks" (Zahn, 2003). Because of the possibilities to set sensitive regions within the films that highlight certain objects, persons or interactions, references between the information presented in the videos and additional texts, pictures, further videos, and so forth, can be established on a very detailed level.

Considering this together it can be concluded that hypervideo design can serve as an effective instructional method just as writing texts or hypertext. In designing hypervideos, the rhetorical and design knowledge that can be acquired by learners is even more broadly defined than it is with writing hypertext. It is additionally important to consider, which symbol system is appropriate for which kind of information, which information should be presented as dynamic information in the videos, and which is better suited to be presented as static information in additional text nodes. Further on, the new link type of sensitive regions within videos (which was described earlier)

determines new kinds of decisions about the setting of links and the design of an overall hypervideo structure. It is assumed that these reflections should also contribute to a more detailed mental model about the main concepts and to appropriate situational models of the whole topic at hand (in sense of Kintsch, 1998). This, in turn, should help students to understand the respective topic more deeply and to use it more flexibly in transfer situations.

Nevertheless, designing hypervideos is a highly complex task. Students have to plan, shot, and cut videos, they have to plan and develop the additional materials, they have to find an appropriate design, and to structure the video and additional materials to form a coherent product. As explained above, a fundamental challenge of hypervideo design is to match the design of the product and the content that is presented: The semantic structure of the content should determine the structure of the hypervideo; and the features of hypervideo determine how the contents should be presented (Zahn, 2003; Stahl & Bromme, 2004). In university courses using hypervideo design as an instructional method, these issues must be taken into account, otherwise students might get lost in the complexity of the task (Stahl, Zahn, Schwan, & Finke, 2006).

A series of regular university courses about "*learning with new media*" was run to examine whether the complex task of designing hypervideos could be managed by the students and to test, which instructional help the students needed. These courses will be described in more detail in the next paragraphs.

HYPERVIDEO DESIGN IN REGULAR UNIVERSITY COURSES

The courses in hypervideo design are part of the psychology masters program (diploma) and are offered as courses on e-learning, which take two semesters. During the first semester, students learn about theoretical issues of e-learning. During the second semester, students design a hypervideo for an anticipated audience of university students. The course purposes are threefold: First, the design process should foster a deeper understanding of the topic to be processed, as previously described. Second, students should gain practical knowledge in designing learning environments. This should contribute to their media literacy. Third, students should gain experiences in projects that require collaboration in order to finish a complex product within limited time. Ten (10) to 16 students participate in each course. The topics of the hypervideos are negotiated between students and the lecturer. The topics of the hypervideos produced so far were "techniques of presenta-

tion and moderation" in the first courses (two parallel courses), "information system about study of psychology" in the second course, and "conflict management" in the third course (this course is still running).

The hypervideos have to be designed from scratch, that is, students have to plan all the video materials and the additional information, to write storyboards and text nodes, to film and to edit the videos and to integrate the different video and additional nodes in a coherent hypervideo structure. A screenshot of one of the students' hypervideos is shown in Figure 2.
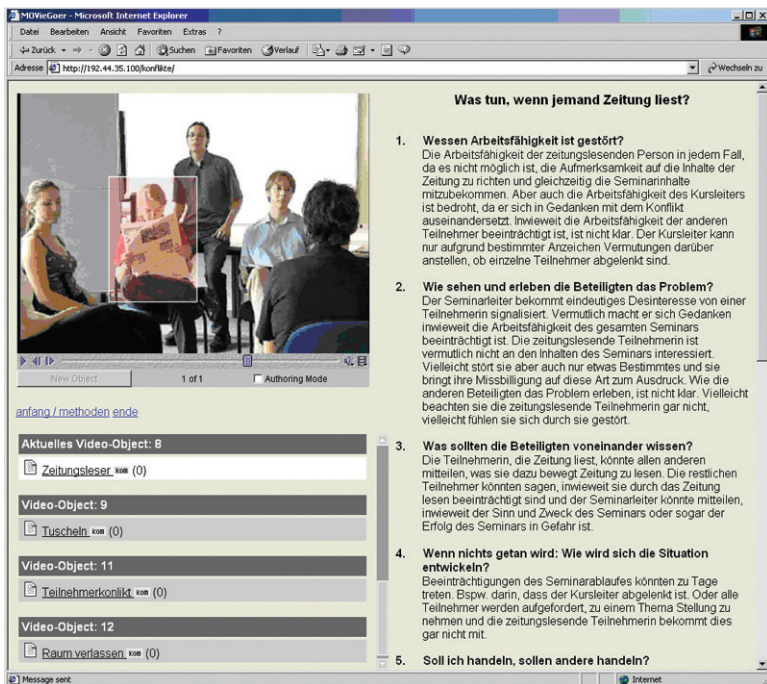
Figure 2. Hypervideo about "techniques of moderation"

As a heuristic to structure the (second and third) courses of hypervideo design a course program for hypertext writing developed by Stahl and Bromme (2004) was used. The program is based on results from studies on writing hypertext in secondary schools and several experiments on knowledge acquisition by writing hypertext (Bromme & Stahl, 1999, 2001, 2002, 2005; Stahl, 2001).

The program of Stahl and Bromme (2004) consisted of five instruction-al units to teach university students how to use the features of hypertext con-sciously. Each unit covered one aspect, which have to be dealt with during writing hypertext. We made minor adaptations within each unit to meet the specific needs of hypervideo, resulting from the importance of the videos, the combination of different symbol systems (videos, texts, pictures) and the new link type of sensitive regions within the videos.

In the following the adapted instructional program will be presented in detail:

Unit 1: Developing a Basic Understanding of Hypervideo Design

First of all, students have to understand what hypervideos are. They have no experience with this medium and therefore it is necessary to give them appropriate task schemas to understand the goal of the task and the processes to accomplish it. Further on, they need knowledge about the genre. Newspapers, books, articles, and so forth follow conventions of style and layout (Dillon, 2002). This knowledge about texts and genres is im-portant for text comprehension (Hayes, 1996; Kintch & Yarbrough, 1982) and text production (Kellogg, 1994; Torrance, 1996). For the new medium "hypervideo" students have no schemas about such regularities, and might rely on more familiar media formats such as traditional instructional films or with traditional hypertext that are inappropriate for hypervideos.

To familiarize students with the idea of hypervideo, students watched practice examples consisting of those hypervideos that were produced dur-ing our first course, and discussed them in detail in the first week of the sec-ond semester. Additionally, we shot a "concept map video" that visualized the planning phases of the video nodes and the additional material (Figure 3). This video enabled students to plan, produce and revise their materials using the hypervideo system from the very beginning of their design work. Further on, a possibility for discussions was embedded in the concept map videos with help of the integrated chat-tool explained earlier (Figure 3). Students were able to comment and discuss their ideas, materials and vid-eos, exposés and storyboards within the collaborative hypervideo system. This facilitated revision processes in the design process. The possibility to work with the hypervideo software from the very beginning substantially enhanced students understanding of hypervideo. They developed a concrete mental model of their own hypervideo to-be-developed, because the drafts of the materials could be successively exchanged with further versions, until the hypervideo was ready.
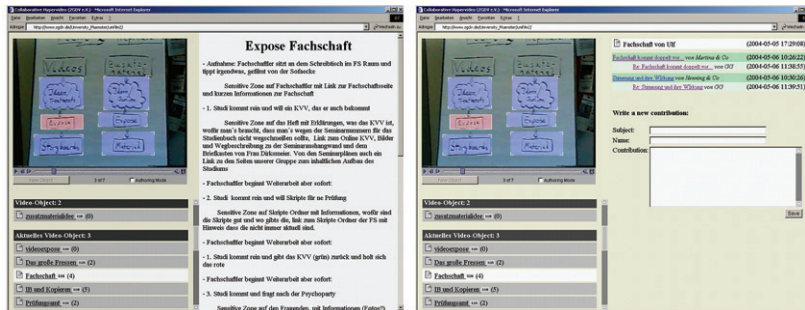
Figure 3. Concept map video: Left side: Students are able to integrate their ideas, treatments and videos from the beginning; right side: An embedded chat-tool enables them to discuss and review their material

To understand hypervideos requires understanding on two levels: on the first level, students have to understand the principles of hypervideo as explained earlier. On the second level, they have to develop an idea of their own *concrete* structure of hypervideo. Developing a "metaphor" can help students make their own design idea explicit (Stahl & Bromme, 2004). Thus, within the first week we also discussed an appropriate metaphor for the hypervideo. In the first two courses, students chose this metaphor to be a "kiosk-system" implying that users mainly navigate through the material and have a more "passive" role of a recipient. In our third course that is currently running, the metaphor of "interactive film" is being tested implying that users have to make more active decisions that affect the videos themselves.

Unit 2: Producing Video Nodes and Text Nodes with Additional Information

Secondly, students have to decide, which concepts of the subject matter they want to include in their hypervideo and to design the nodes explaining each of these concepts either with the videos or within the additional materials. The important issue that students have to decide is: Which symbol system is appropriate for which kind of information? Students had to plan their video nodes and the additional material within a series of three steps with help of a "concept map video" (see Figure 3). Planning the videos starts with the presentation of the *main idea* of the video nodes, written down in one or two sentences. Then the *treatment* is developed, outlining the idea and the moods that main scenes of the video should communicate in a short

abstract of one or two pages. In last step *storyboards* are created that present the scenes of the videos in temporal order in form of comic strips presenting camera perspectives that are accompanied by written descriptions of the scenes and the dialogs. Parallel to this they were asked to develop the ideas, treatments, and concrete nodes for the additional material. For the additional material some general principles of node design within hypermedia had to be considered. Nodes present information in a fragmented form (Whalley, 1993). Therefore, a widespread recommendation is to design nodes following a "just enough" principle (Gerdes, 1997). Each node should only contain the necessary amount of information. Details or examples should be presented in separate nodes, which can be read whenever required. Each node should also be written in a way that can be called "cohesive closeness" (Gerdes). It means that the main information in each node must be comprehensible without reading further nodes. Students in the courses are asked to design their additional material with these principles in mind. In our courses we needed about five weeks to develop the storyboards and the draft of the additional material and another five weeks to shot the videos and write the text nodes.

Unit 3: Organizing an Overall Structure of the Hypervideo

During the third unit, Stahl and Bromme (2004) asked their students to discuss the macrostructure (in the sense of Kintsch, 1998) of the contents and how to transfer it into the structure of the hypertext. Thus, the aim of this unit is to foster students' comprehension of the semantic structure. This unit also offers the possibility to check, whether every important concept is presented within the nodes, or if something crucial is missing.

To design an overall structure for a hypervideo it is important to note that a whole hypervideo includes a series of single videos with their additional material. For example, the hypervideo of the second course about "study of psychology" included 14 short videos (each about 2 to 3 minutes) presenting different aspects that are relevant for the study of psychology. Each video included about 6 to 20 links to nodes with additional material. Therefore the students had to plan the structure of each of these single hypervideos (one video and the relevant additional information) and how to structure all single hypervideos within an overall hypervideo. To plan the single hypervideos mainly refers to plan how to link the information within the videos with the relevant additional material and to decide, if references to other videos should be included. For planning the overall structure the

students are asked to construct a concept map of all single hypervideos and of the nodes with additional material. Then some overview nodes had to be planned that build the "content frame" for all information presented within the single hypervideos. Depending on the content of the hypervideos such overview nodes might be written texts with links to the single hypervideos, graphics that present structural overviews of the contents with hot spots to the hypervideos, or a hypervideo itself. For example, in the second course students shot an introduction hypervideo that referred to all other information that was presented within the other hypervideos. During the first two units students already had (more or less implicit) thought about different aspects of the overall structure of their hypervideos. We had also used the five weeks of video production to discuss the structure of the hypervideo. Therefore this unit took only about one additional week.

Unit 4: Considering Multiple Perspectives in the Hypervideos

During the fourth unit, the students are asked to consider different perspectives and to present multiple ways of navigation. In most cases semantically complex subject matters can be organized in different ways. Due to the multi-linear structure of hypervideo students should offer a variety of ways to navigate through the products for users with different interests. This idea is based on Cognitive Flexibility Theory (CFT; Jacobson & Spiro, 1995). CFT deals with how knowledge about a complex ("ill-structured") domain can be acquired in a way that ensures its flexible use. The goal is to stimulate learning transfer and to avoid "inert knowledge," that is, knowledge a learner can reproduce, but fails to apply in new situations (Bereiter & Scardamalia, 1987).

Cognitive flexibility refers to this transfer of knowledge and is defined correspondingly as the ability to structure one's own knowledge in a variety of ways in adaptation to changing situational demands. Since content coherence is a fundamental prerequisite for understanding texts (Kintsch, 1998), the author has to find a balance between flexible ways of reading the hypertext and a possible loss of coherence (Foltz, 1996). Ideally, the author should think about possible audience perspectives and should try to imagine, which contents and structure might be desired by an audience with a particular reading aim. If authors are asked to take different perspectives into account, knowledge could be acquired in a way that supports its flexible application.

Concerning hypervideo design multiple perspectives can be included on different levels. First of all, it is possible to communicate perspectives

through the videos, for example, in a hypervideo about communication strategies it might be useful to present the same scene from different camera perspectives or to show parallel videos that differ in some aspects (e.g. present effects of different behavior within the same context). In the collaborative hypervideo system it is also possible to link different additional information to one sensitive region in the video. Therefore it is possible to interpret the same scene in a video from different perspectives. On the next level different possibilities to navigate within a single hypervideo can be considered. In the collaborative hypervideo system users can navigate by the sensitive regions in the videos, by the links in the additional material and with help of a structural overview of all links between videos and additional material. When a link in the structural overview is activated, the video automatically jumps to the relevant scene and the relevant additional material is shown as well. If these features are considered carefully by the students, it is possible to set links that are appropriate for audiences with different interests and navigational strategies. On the level of the overall structure that connects all single hypervideos (see Unit 3) students can plan different guided tours or different structural overviews for audiences with different perspectives. Therefore, hypervideo offers many possibilities to reflect about and include multiple perspectives. In our courses we had already discussed possible perspectives within the videos and the additional material during unit 2. Therefore we used only about one additional week to discuss multiple perspectives on the level of the overall structure.

Unit 5: Planning and Setting of Sensitive Regions and Links

During the fifth unit, students are asked to discuss the sensitive regions to be placed in their hypervideos and the links within the additional information units. Links have two important and closely related functions: they enable the user to navigate within the hypertext and they represent the semantic relations between the node contents. These two functions are relevant to designing hypervideo: concerning the former, it is important to consider that a user has to rely on links if she wants to get to the desired information (Dillon, 1996). Therefore, the selection of offered links has a great influence on the recipient's navigation (Wright, 1993). Concerning the latter, students have to consider that links represent the semantic relations between the node contents and the recipients have to interpret the links on this semantic level. Therefore problems of comprehension could arise, if recipients do not know where a link leads to or if they have inappropriate expectations about its

purpose (Gray, 1995).

Consequently, for the purpose of designing hypervideos in university courses linking nodes is a sensitive task that should result in a deeper processing of the information content. When linking the additional material, rules of authoring hypertext have to be taken into account to find a nonlinear structure according to the underlying content (Stahl & Bromme, 2004). Also, specific design rules have to be taken into account for hypervideo design, considering the fact that hypervideos are dynamic and contain a new dynamic link type (temporal-spatial links or sensitive regions). These dynamic links that appear and disappear in the course of a video are new to authors and users and only little research on this topic exists (Zahn, 2003).

In the first courses, defining sensitive regions within videos was still a challenge. It required extra software handling and the sensitive regions in the videos were not highlighted in any way. Students complained about this and their feedback was used to improve the collaborative hypervideo system. Now sensitive regions can be set very easy with a mouse click and the sensitive regions can be highlighted with transparent colors that the students can choose on their own. These technical improvements enhanced students' conscious planning of the links. Further improvements such as a textual annotation to a sensitive region are planned. This annotation can be defined as a keyword, presenting the content of the node that users are going to see, when they activate the link.

Students are asked to justify each link that they want to set to enhance their awareness and comprehension of semantic relations. They have to discuss, which kind of semantic relation they want to express by a link, and why this relation might be important in the context of this particular node. We use the last two weeks of the seminar to discuss and set the links and to revise the whole hypervideo.

It is important to note that the discussions in each of the units might result in revisions of the material developed so far. Therefore, the process of hypervideo design should be seen as a circular process, even if the units are arranged in an instructional sequence.

EVALUATION OF THE COURSES

Up to now there is little empirical evidence about the effects of the instructional units on knowledge acquisition by hypervideo design. Stahl and Bromme (2004) had developed the units as a result of their studies in six different school classes, their series of five experiments about effects of dif-

ferent instructions on hypertext writing and their own courses on hypertext writing with university students. Therefore it is reasonable to assume that the course design might be beneficial to support knowledge transformation in courses on hypervideo design as well.

Nevertheless, short evaluations of the courses were done by analyzing the design process and the products together with the students using interviews, questionnaires, and group discussions. Comparing the first parallel courses with the second course gave first confirmations of the assumptions. The instructional program was used only during the second course. In the first courses the students had more freedom to decide for themselves how to organize their work.

Strong differences in the products of these courses that confirmed the appropriateness of the instructional units could be found. The hypervideos of the first two courses included 5 hypervideos with 16 additional texts, 8 hypervideos with 37 additional texts, and 2 additional videos in the parallel course. The hypervideo of the second course was significantly larger with 14 hypervideos, 9 additional videos, and 195 additional texts. Further on, the hypervideos of the second course included—on average—significantly more sensitive regions then those of the first courses, $F(1, 27) = 4.13$, $p = .05$ (first courses: $M = 3.85$, $SD = 2.12$; second courses: $M = 6.67$, $SD = 4.38$). The approximate duration of the hypervideos in the second course was on average significantly shorter than in the first courses, $F(1, 27) = 25.05$, $p < .01$ (first courses: $M = 301.39$ sec., $SD = 87.71$; second courses: $M = 143.71$ sec., $SD = 75.92$).

Qualitative analyses of the hypervideos confirmed these differences. The hypervideos of one of the first courses looked like instructional films. All relevant information was given in the videos and all additional information seemed unimportant to understand the videos. In the parallel course it was the opposite way around. In half of the videos all relevant contents were given in the additional information and the hypervideos themselves seemed unimportant. In contrast, the product of the second course looked like a real "hypervideo."

It appeared that the students within the first courses were not able to develop an appropriate idea of hypervideos: They compared hypervideos either with traditional instructional films or with traditional hypertext. This resulted in planning activities, which focused either too much on the videos, or the main focus was given to the additional material (Unit 1). This also led to significantly longer videos (Unit 2) and less links between videos and additional information (Unit 5). Further on, the hypervideos of the first course were "stand-alone" videos compared to the hypervideos of the sec-

ond course that were integrated in an overall structure (Unit 3) with multiple possibilities to navigate though the information space (Unit 4).

The group discussion and the interviews with the students also revealed that they differed in their opinion about the learning outcome about the topic and the design of learning environments: Students in the first courses were more ambivalent about learning benefits of hypervideo design then students in the second course. From these results and observations during the courses it appears doubtful that the anticipated knowledge transforming processes occurred in the first courses. In contrast it can be concluded from interviews with the students of the second course, their products and a special designed questionnaire, that they gained substantial experiences with the design of learning environments and complex project work. They also gained a deeper understanding about the topics to be presented. To give an example, students of the second course completed a questionnaire with different items concerning their judgments of knowledge acquisition in the course. Each item had to be rated on a 5-point scale from 1 = "I completely disagree" to 5 = "I completely agree". Students assessed that the collaborative design of hypervideo fostered their active knowledge acquisition about the topic to be presented (M = 4.28, SD = 1.11), their knowledge about designing learning environments (M = 4.71, SD = 0.49), and their knowledge about collaborative project work (M = 4.85, SD = 0.38). They also rated the quality of their hypervideo on a spectrum of school notes (with 1 = very good to 5 = insufficient) as "very good" (M = 1.29, SD = 0.48).

Their hypervideo was also presented to another course on learning with new media (n = 16) that was not involved in the design process. The students rated the quality of the hypervideo as "good" (M = 2.00, SD = 0.73). This is only a very indirect measurement for the quality of the design process, but it can be seen as evidence that the goal to develop a hypervideo for an audience of other university students was achieved.

From such results and the informal feedback of the students, it can be assumed that the anticipated knowledge transforming processes occurred when we used the instructional program. These results of the evaluations can only be seen as first hints, but they support the necessity of a didactical concept like the presented instructional program.

CONCLUSION

It can be concluded that it is possible to integrate the complex task of hypervideo design into regular university courses. Feedback from the stu-

dents resulted in improvements of the hypervideo system and the enhanced features of the system resulted in better didactical possibilities within the courses. This is an ongoing process. It is planned to continue it with further courses and to expand the courses to classes in schools.

An important aspect is that it is highly relevant to structure the complex task of hypervideo design for the students. Otherwise they get lost in the diversity of aspects that they have to think about. The knowledge transformation model of Bereiter and Scardamalia (1987) as a background to define the goals of the design process and the instructional program of Stahl and Bromme (2004) for writing hypertexts are helpful to plan the courses in hypervideo design. It was no problem to adopt them to the specific demands of hypervideos.

Thus, to follow a constructivist approach such as learning by design should not mean that students' should learn without an organizing framework given to them. They still have enough possibilities for active, collaborative, and constructive learning within such a framework.

Nevertheless, the experiences within the courses should only be seen as a starting point for experimental research on the affordances and benefits of learning with hypervideos. A lot of open questions appeared. Thus, concerning future perspectives, the experiences within these field studies will be used to conduct a series of controlled experiments to investigate selected aspects of collaborative hypervideo design in laboratory learning settings.

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