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IMPROVEMENT OF UNIVERSITY COURSES ON TEACHERS' TRAINING FACULTY BY USING OF HYPERVIDEO DESIGN PROJECTS

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Key words: Collaborative hypervideo design, knowledge transforming, hypervideo.

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Abstract: *In this paper we presented a course concept based on collaborative construction of hypervideos. We demonstrate how collaborative construction of hypervideo can support knowledge transforming processes in university courses of Teacher Training Faculty students. Active learning through hypervideo is becoming an increasingly valued model that complements the academic (distance) education, but an efficient exploitation of their potential has not yet been reached. The main aim of this work is to present in a realistic way how to incorporate hypervideo as a new feature into the traditional university course. In the first part of the paper a term of hypervideo is discussed. Afterwards the course concept is presented in rough detail. Evaluation results are consistent with our assumptions that proper use of hypervideo can improve university course (in terms of improving knowledge transfer and increase a better understanding of the topics dealt with, at students who attend this course). The course concept showed to be successful and well appreciated by the students.*

1. INTRODUCTION

One of today's research trends in the hypermedia field is hypervideo. Hypervideo, or hyperlinked video, is a displayed video stream that contains embedded, user-clickable anchors, allowing navigation between video and other hypermedia elements. In other words, hypervideo is defined as video based hypermedia that combines non-linear information structuring and dynamic audio-visual information presentations (Stahl et al, 2006). In hypervideos, video information is linked with different kinds of additional information (for example: written or spoken texts, pictures, or further videos, etc.) (Stahl et al, 2006). Users through sensitive regions of videos access to the additional materials and information (see figure 1). Namely, hypervideo combines video with a non linear information structure, allowing a user to make choices based on the content of the video and the user's interests. Hypervideo is thus analogous to hypertext, which allows a reader to click on a word in one document and retrieve information from another document, or from another place in the same document. A crucial difference between hypervideo and hypertext is the element of time - main difference between sensitive regions in a hypervideo and links in a hypertext is that the sensitive regions have spatial and temporal characteristics (Stahl et al, 2006). This allows highlighting a specific object, characters or some other spot within the video for a predefined timeframe (hypervideo might involve the creation of a link from an object in a video that is visible for only certain duration) (Stahl et al, 2006).

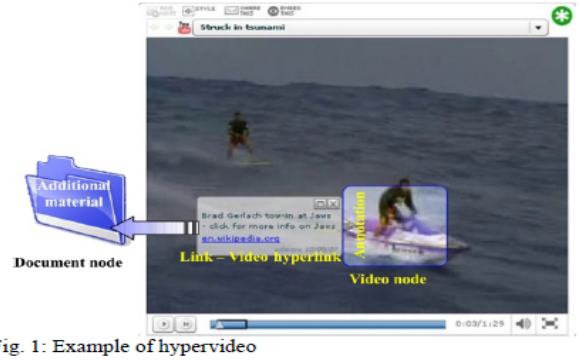

Fig. 1: Example of hypervideo

The main difference between videos in traditional hypertexts and hypervideos lies in the significance attributed to the video itself. In hypertexts videos are frequently descriptive and optional, while in hypervideos, video sequences form the backbone of the system (Zahn, Schwan & Barquero, 2002). Therefore, videos and the additional materials are combined in way that allows interaction during seeing hypervideo and non-linear navigation in it.

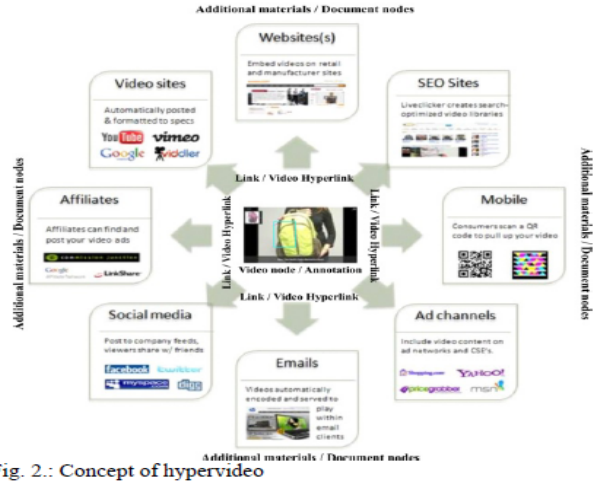

Fig. 2.: Concept of hypervideo

The leading question that differentiates hypervideo from linear video is related to interactivity. There has been a development in relation to this parameter between traditional audiovisual products like cinema or analogue video and the digital video formats that are used in multimedia applications. Interactivity has been growing from the sequentially of first formats to multiple access options of video in webs, CD-ROMs or DVDs. Hypervideo implies a new step in this progression allowing interactivity within the clip, and not only by depending on the menu options (Hoffmann, 2011). Hypervideo clips are not just clips depending on a bigger structure that provides interactivity possibilities but they are clips with their own capacity of interaction.

Some element included in a video could link to additional information such as text, photos, audio, video or animations. Defining hypervideo links in a video sequence enables an author to refer to a specific objects / characters / spots within the video by providing additional information (Zahn & Finke, 2003). Video nodes are video sequences with sensitive regions which are presented in the video view (the existence of a sensitive region is announced by its visualization within the video display). Hypervideo links can be activated by clicking on the corresponding sensitive region with a mouse pointer. Additional information is presented in a separate view and can be of different media types (texts, images, animations, audio or video clips, etc). It is possible to link multiple nodes with additional information to one sensitive region within our system (Stahl et al, 2006).

A node is considered in a hypertext as a unit of information. Similarly, it is also a unit in a hypervideo context. They could belong to one of these categories (Chambel et al, 2004):

- Node containing textual information – It is the most common situation: the activation of a link shows text with complementary data that is in relation with the object that has been clicked.
- Node is constituted by video information and its information is showed as associated data and both are on the screen. Usually the reproduction of the first must be stilled while the new clips are playing. And when these are stopped, the first one replays the reproduction.
- Node contains graphs that could be animated or not – They are usually graphic information associated to the main node, especially with the object that has been linked.
- Node with audio information – It could also contain visual information but the critical or main part of the content relies on voice information.
- Nodes with video information as in the second case but different from it by the fact that when a link is activated in a node, navigation to another new node is carried out. The new content substitutes the previous one in the timeline. These kinds of nodes allow full navigation between video clips. (Chambel et al, 2004)

The recognition of elements that have to be linked and the segmentation of information in nodes are only some of the questions to which the hypervideo design has to face (Chambel et al, 2004).

2. EDUCATIONAL USE OF HYPERVIDEO

Hypervideo has a great area of possible applicability (education, advertising, TV…). Just about any application area that already uses video may benefit from hypervideo. Hypervideo amenities can be used in formal educational contexts such as university projects, as will be described below.

Active learning through hypervideo is becoming an increasingly valued model that complements the academic (distance) education, but an efficient exploitation of their potential has not yet been reached (Bonaiuti et al, 2011). The main aim of this work is to present in a practical way how to include hypervideo as a new media into the traditional university learning course. This kind of technologies favors the introduction of new learning skills because of their potential to be used as an educational resource to support teaching. This is due not only the richness of multimedia content, which facilitates assimilation and comprehension of information by the student but also for its accessibility and availability (Chambel et al, 2004).

An effective design of tools and environments that support learning requires the understanding of human cognition and learning processes. This section presents the main cognitive concepts relevant for discussing video and hypervideo as supporting tools for learning (Chambel et al, 2004).

Two cognitive modes can be identified:

- the experiential mode (relates to a state in which we perceive and react to events in an effortless way, it is about perception and motivation, and good for accretion of facts and tuning of skills) and
- the reflective mode (relates to comparison and contrast, thought and decision making, essential for restructuring of knowledge) (Norman, 1993) (Chambel et al, 2004).

Both are important in human cognition, but they require different kinds of technological support. In addition to cognitive modes, different Learning Phases have been identified for the learning process. The classic learner centered pedagogy model has three phases:

1. conceptualization of the subject and its domain
2. construction, where the learner actively engages with the subject, while relating to her own knowledge framework and
3. dialogue, where the learner expresses aspects of the emerging understanding and relates this to the understandings of fellow learners and tutors (Chambel et al, 2004).

In some educational situations, (hyper)videos or animations are not only a desirable, but a necessary prerequisite for successful learning, for a number of topics or problems exist that can hardly be understood without using dynamic visual materials as a referential basis.

From a cognitive perspective, audiovisual materials support learning by 'replacing' real experience, because of their authenticity and realism, which evoke feelings of "observing real situations" (Schwan, 2000), by visualizing dynamic processes, which might not be observable in reality or which are hard to describe verbally (Park et al, 1993) and by combining diverse symbol systems, such as pictures, texts and narration, into coherent media messages (Mayer, 2001).

The specific qualities of hypervideo presentations are supposed to support the construction of rich mental representations and, by dual coding (Mayer, 2001) improve the transfer of knowledge. In accordance with all said above, empirical findings have consistently shown that dynamic media facilitate the comprehension and transfer of knowledge in individual learning.

In specific collaborative scenarios, hypervideo also can be considered supportive for cognitive processing. For similar reasons to those in the case of individual learning, hypervideo is helpful when meaningful collaboration depends on visual perceptions of concrete objects, actions, or complex relations; and when knowledge is created within networked groups, where learners do not meet in the same place at the same time and, hence, cannot observe the same things in the same situation (Chambel et al, 2004) (Chambel, 2000).

To recapitulate, hypervideo, as dynamic and figurative information combined with verbal audio and other kind of

information media, forms a powerful means of communicating meaning-scenarios rapidly and efficiently. It can bring context to topics and enhance the authenticity of a computer based learning environment, thus fostering an experiential cognitive mode (Chambel et al, 2004) (Chambel, 2000).

2.1 Learning Through Collaborative Hypervideo Design

In recent few years number of college and university courses that focus on the students' collaborative creation of multimedia as well as educational hypervideos, increased. Such courses allow creation of a learning context, which includes important features that encourage a deeper understanding of facts and knowledge transfer (Jacobson & Spiro, 1995). Students have to solve the realistic and authentic problem of how to present a topic within their hypervideo in an appropriate way.

Thus, students 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 communicate, discuss and negotiate meaning with their colleagues. But, production of hypervideo is not simple and easy task. What ever more it is very complex task, because 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).

Problems that occurs in such projects include that either too much attention is paid to the design of hypervideo while the contents are only included with 'copy & paste' (Bereiter, 2002), or the contents are presented in a way, inappropriate for the format of hypervideo. End result of both cases is that students develop a superficial, shallow comprehension of the subject matter presented by their hypervideo. For right solution it is necessary to find an appropriate balance between contents and hypervideo design. As it is well-known knowledge acquisition is the indissoluble link and continuous interaction between content-related knowledge (on the topic discussed in the educational material) and rhetorical knowledge (on the design of the material, the expected audience, the type, etc.) (Bereiter & Scardamalia, 1987). This problem- oriented procedure (called knowledge transforming) requires authors to reflect on and extend their own knowledge about the topic (Bonaiuti et al, 2011).

Stahl and Bromme (2004) used the knowledge-transforming model as a heuristic to examine conditions and processes of learning by constructing hypertexts. As they described, 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. Their conclusions may be analog transferred to the hypervideo design, but the rhetorical and design knowledge that can be acquired by learners is even more broadly defined than it is with writing hypertext (Zahn, Schwan, & Barquero, 2002).

During hypervideo creation it is important to consider 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. Also, sensitive regions within videos determine new kinds of decisions about the setting of links and the design of an overall hypervideo structure (Chambel et al, 2004). All this decision making should help students to understand the particular topic more deeply and to be able use it more flexible in transfer situations.

We ran one regular university course about "learning with new media" at the Teachers' Training Faculty of Užice (Serbia) to examine whether the complex task of designing hypervideos could be managed by the students and to test, which instructional help the students needed. This cours will be described in more detail in the next paragraphs.

3. HYPERVIDEO DESIGN AS A TOOL FOR IMPROVEMENT OF UNIVERSITY COURSES

Hypervideo design is offered as a part of Informatics science course, which is in regular teaching practice of the graduated program (diploma) at the Teachers' Training Faculty in Serbia. During IT course, it is common to 15 students participate in each courses' group (we have 9 groups). Hypervideo design was used just for learning one topic of IT course. The topic of the hypervideos produced within the courses' group was "computer architecture". Students have to plan all video materials and additional information, to write text nodes, to create videos and clips, and to integrate all mentioned in a coherent hypervideo structure. So students were involved in all stages and parts of hypervideo design complex task.

As a starting point for structure our course (or part of course) of hypervideo design we took and we relied on the course program for hypertext writing developed by Stahl and Bromme (2004). This Stahl and Bromme course was based on results from their studies on writing hypertext in secondary schools and several experiments on knowledge acquisition by writing hypertext (Bromme & Stahl, 2002), (Bromme & Stahl 2005), (Stahl, 2001).

Proposed program (Stahl & Bromme, 2004) consists of five instructional steps to teach university students how to use the features of hypertext consciously. Each step covers and reviews one aspect, which must be considered during hypertext creation. Let us briefly consider each of these mentioned steps in the scope oh hypervideo design (Stahl et al, 2006):

1. Basic understanding of hypervideo design – As the first step, students have to understand what hypervideo is. Knowledge about text is important for its comprehension (Hayes, 1996) and production (Kellogg, 1994). Such regularities don't exist for the relatively new media like hypervideo is. So we use concept of mind map to get hypervideo closer to students (MacKinnon & Saklofske, 2011). More precisely told we make a 'concept map video' that visualized the planning of the video nodes and the additional material and their structure, i.e. future links between them (Chambel et al, 2004). Concept map video enabled students to plan, create and modify their materials on easier way. Working in this way, significantly improved students understanding of hypervideo.

2. Creation of video nodes and text nodes with additional information. In the next step, students have to decide about additional materials (which contents will be included in hypervideo). Also, they have to create video and additional nodes. During this phase, students have to plan video nodes and additional material through developing main ideas, exposes and storyboards (before shooting videos), as well as through developing ideas and concrete nodes for additional material (Stahl et al, 2006).

3. Organizing an overall structure of the hypervideo. During the third step, Stahl and Bromme (2004) asked their students to discuss the macrostructure (in sense of Kintsch, 1998) of the contents. On that way students improve their comprehension of the semantic structure. Making of overall structure assumed student 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 (Stahl et al, 2006). The best way is to construct concept map, which present relations between all single videos and nodes with additional material. Thus, students improved their knowledge about the considered topic, because they have to understand and noticed logical relation between concepts.

4. Taking into consideration various perspectives in the hypervideos. During the fourth step, the students have to consider different user perspectives. They have to present various ways of navigation. This idea is based on Cognitive Flexibility Theory - CFT (Jacobson & Spiro, 1995). CFT deals with how knowledge about a complex domain can be acquired in a way that ensures its flexible use. Aim of this step is simulation of learning transfer with which obviates the inert knowledge (knowledge about facts and concepts that can be reproduced, but without true applying in real situation). Taking in account different user perspectives causes knowledge acquire in a way that supports its flexible application. Achievement of different user perspectives is possible through interpretation of the same scene in a video from different perspectives, or by planning different guided tours or different structural overviews for audience with different characteristics (Stahl et al, 2006).

5. Preparation and location of sensitive regions and links. As the last step, students have to discuss where the sensitive regions will be placed in hypervideo and the links within the additional information units. Links allow future user to navigate within hypervideo, but link also represent the semantic relations between node contents. Selection of available links has a great influence on navigation (Wright, 1993) and on understanding of the contents (Gray, 1995). It is very important to increase the awareness and understanding of

semantic relations. That can be achieved by asking students to justify each link that they want to set. By discussing the kind of semantic relation expressed by link, and discussing the reason of relation importance in the context of particular node, the awareness and comprehension of semantic relations are improved.
Consequently, taking in account all above mentioned, the process of hypervideo design should be seen as a circular process (Zahn & Finke, 2003).

4. EVALUATION OF THE COURSE TOPIC

There is little experimental evidence about the effects of the instructional steps on knowledge acquisition by hypervideo design (besides mentioned Stahl & Bromme studies, which is related to hypertext writing).
To show that Stahl & Bromme (2004) theory of instructional steps can be transferred to the hypervideo design we conducted an experiment. We assumed that following of every 5 steps would produce good hypervideo, while hypervideo design which does not respect the presented instructional steps would produce an incomplete, poorly organized and unbalanced hypervideo.

As it was earlier mentioned hypervideo design is offered as a part of Informatics science (IT) course. Hypervideo design was used just for learning one topic of IT course - "computer architecture". Students' task was planning of all video materials and additional information, writing text nodes, creation videos and clips, and finally integration of all mentioned in a coherent hypervideo structure. Other words, students were involved in all stages of hypervideo design task. To create and design hypervideo student used the authoring tool called Asterpix.

Fig. 3: Example of students' hypervideos

We had three students' groups (every group consisted of about 40-45 students, further divided into three subgroups each) and each of them made its own hipervideo concerning the attended course. At the end of experiment we have three hypervideos as outcomes. The instructional program of 5 steps was used only during the third group course. In the first and second group courses the students had more freedom to decide for themselves how to organize their work. We found strong differences in the products of these courses that confirmed the appropriateness of the instructional units.

After experiment was finished, we run short evaluation of the course by analyzing the design process and the products together with the students using interviews, questionnaires and group discussions. Comparing the results from the first group with the results from the second and the third group gave first confirmations of our assumptions.

The hypervideo of the first group included more videos over additional texts and other additional information. The hypervideo of the second group was significantly richer with additional texts also as other additional information. Further on, the hypervideo of the second group included - on average - significantly more sensitive regions then those of the first group. Qualitative analyses of the hypervideos (comparison of the overall structure, content and linking objects, materials and videos) confirmed these differences.

The hypervideo of the students in first group looked like traditional instructional film. All relevant information was given in the videos and all additional information seemed unimportant for videos' understanding. Also, this product has longer sequences of video material and less links between videos and additional information. So, we can say that we have "stand-alone" video in the first group product.

In the second group it was the opposite way around. Most of all relevant contents were given in the additional information and the hypervideo it selves seemed unimportant. But we have more sensitive regions and with that we have more links between videos and additional information.

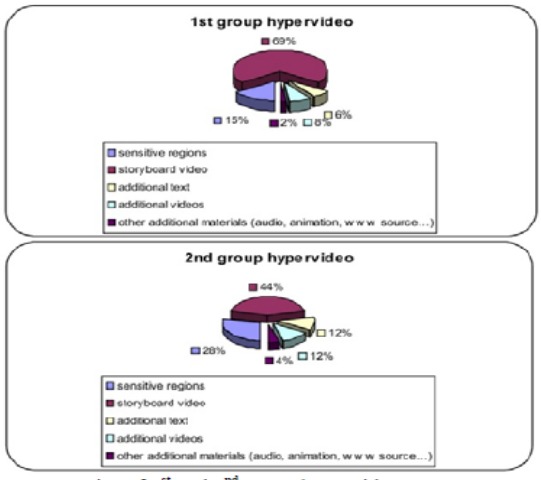

Fig. 4.: Properties of 1st and 2nd group hypervideos

Quite the opposite, the product of the third course group looked like a real hypervideo. They made hypervideo in accordance with 5 instructional steps, and somehow they managed to design balanced hypervideo. Hypervideo of the third group has sufficient and real measure of video clips with a sufficient number of sensitive regions which were linked to appropriate additional material (videos, animation, texts etc.). The hypervideo of the third group were integrated in an overall structure (good understanding of 3rd instructional step) unlike the hypervideo of the first group ("stand-alone" videos). Hypervideo of the 3rd group also has multiple possibilities to navigate though the information space (good understanding of 4th instructional step).

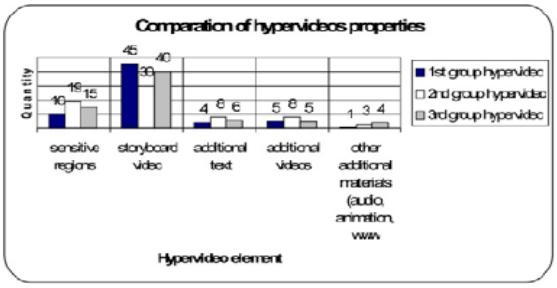

Fig. 5.: Comparation of hypervideos properties

It seemed that the students within the first two groups were not capable to develop and adopt proper idea of hypervideo: they equalized the hypervideo either with instructional film or with traditional hypertext. These misunderstandings resulted in planning and designing activities which focused either too much on the videos or on the additional material (1st instructional step should clarify this confusion). Misunderstanding of primary hypervideo design concepts caused much longer videos (apparent lack of 2nd instructional step) and less links between videos and additional information (apparent lack of 5th instructional step).

Through the group discussion and the interviews with the students of the first and the second course group we discovered that they have different opinions about the learning outcomes of lessons' topic and the learning environments design.

From all these obtained results and observation during the course, fact that expected knowledge transforming processes occurred is questionable (in the case of 1st and 2nd students' group). But from the

interviews and questionnaire survey of the 3rd group students it is obviously that they gained important experiences with whole project (planning as well as designing hypervideo). Also, they acquire a deeper understanding about the related topics they presented by hypervideo. In the case of the 3rd students group transfer of knowledge processes occurred.

These results are just first hints, but they sustain our assumptions about the necessity of a didactical concept like presented instructional program (5 steps).

5. CONCLUSION

From a cognitive viewpoint, hypervideo can be considered as a powerful referential anchor, helping to stimulate and make possible both individual and collaborative processes of learning and knowledge building.

Hypervideo also allows more control and the composition of rich and flexible knowledge structures, corresponding to enriched mental models. Thus, hypervideo provides a better support to reflection and learning, in accordance with learners' individual needs and styles, and different learning phases. From our experiences, we concluded that the ability to integrate hypervideo in rich hypermedia spaces enables learners to create good representations and promotes deeper understandings. However, there are some main challenges. And the definition of design guidelines can help to meet these challenges. Some work has been done in this direction, but more research needs to be done.

Finally, we can conclude that it is possible to integrate the task of hypervideo design into regular university courses. But it is highly important to structure the task for the students. We used the five steps of the instructional program from Stahl and Bromme to teach the students step by step how to deal with the features of hypervideo. This experiment should only be seen as a starting point for further research on the benefits of learning with hypervideos.

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