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The Combination of Instructional and Narrative Models for e-Learning

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Abstract. Combining theoretical instruction and narrative concepts leads to a new quality of learning in e-learning systems. This has already occurred in the classical training and university teachings environments, but is a rare occurrence in current computer based training (CBT) programs. The research and development project, *medin*, utilises various methods of DS-CBT (digital storytelling based CBT) in its production process. The differences between classical hierarchical and new narrative methods are emphasised. Using different instructional and narrative concepts during the initial project planning phase creates a basis for an intense dialog between the author of the learning content, the computer scientists, media pedagogues, and media designers throughout the production process.

1 Introduction

Presently, the emphasis of computer based training production processes is concerned with its technical realisation. The presentation of learning content is similar to the hierarchical structure of a book. Therefore the learning objectives reflect hierarchical and sequential methods; which results in many of the available multimedia narrative techniques remaining unused.

Today's "multimedia" is often reduced to the combining of different media elements. Analogous to a structure of a book the content is presented chapter by chapter. Various elements such as images, animations, and videos are embedded in text of each chapter, whereas dramaturgical structures or narrative concepts are not utilised.

The BLK[1]-project "Multimediales Fernstudium Medizinische Informatik" (predecessor of the project *medin)* created a complete series of courses for a medical computer science program. These courses can be taken at the University of Luebeck and as part of a distance-learning program at the Open University Hagen.

[1] BLK: Bund-Länder-Kommission für Forschungsförderung und Bildungsplanung (Bund-Länder Commission for Educational Planning and Research Promotion)

The ongoing project *medin*'s goal is to convert the hierarchical learning structures of these courses into media-friendly and learner-friendly online learning modules. The gap between didactic concepts, narrative theories and media technology must be bridged. Digital storytelling concepts and corresponding multimedia elements are combined to create an innovative narrative learning structure. This is achieved by creating a dialog between the author of the learning content, the computer scientists, media pedagogues, and media designers.

2 The project *medin*

The project *medin* is sponsored within the framework of a German ministry of education and research program. The project is creating a series of multimedia learning units based on an existing series of courses for a medical computer science program. The computer science students can major in medical computer sciences at many German universities. At the University of Luebeck this major was established in the summer-semester 1993. The Open University Hagen has offered a distance-learning program in computer sciences with a major in medical computer science since the middle of 1998. Initially the printed course material was transferred into a digitised, partly interconnected (linked) and hypermedia form. More than a thousand students have used this material since the winter-semester of 2000/2001. This hypermedia material is the base of the learning content for the project *medin*. .

The author and then the computer scientists update the original hypermedia learning material, media pedagogues and media designers are responsible for the narrative and multimedia conversion. The project implements electronically supported practical learning elements as well as interactive lab and simulation environments.

2.1 Project partners

The Institute For Medical Computer Science and the Institute For Multimedia and Interactive Systems at the University of Luebeck are the leaders of the project. They collaborate with the Technical University of Ilmenau, the Open University Hagen, the University for Applied Sciences Dortmund, and the Aachen University of Technology.

2.2 Methodical columns

The project is based on following four methodical columns:

- the specific didactic processing of the contents
- the realisation of didactical principles
- the software usability principles
- the establishment of a virtual practice platform

These four columns are subdivided between the project partners.

2.3 Goals

The project's goal is to integrate narrative methods in learning material in a multimedia and interactive environment. The main focus is implementing the following learning and teaching improvements:

- to have an easier access to the learning units and materials with the option to choose an individual learning path,
- virtual electronic labs as practice platforms where students can learn interactively and experimentally in situations that simulate real situations,
- 3D-illustration, simulations and animations, which make it possible to explain complex mechanisms contexts in connection with time, which otherwise, are very difficult to explain.

2.4 The target groups of the Open University Hagen

The target group at the Open University Hagen is a very heterogeneous group. Generally the students and their learning motivation vary according to which of the following groups they belong to:

- part-time students (busy in their job, limited time available)
- full-time students (working fulltime with the learning content)
- people interested in further education (using the learning content in segments for their individual needs)

The heterogeneous structure of the target group calls for special attention when converting the learning content into multimedia learning unit. The programming of an XML-based product offers the flexibility to address each target group according to their learning needs. Under the heading "narrative elements in the project *medin*" we take a closer look at this aspect.

3 Building models

We will show that these concepts can be tied together in an effective and ingenious way in the form of two models: an instruction model and a narrative model.

3.1 Motivation as a task of the ARCS-Model

John M. Keller [11] offers a very practical model of designing motivational instruction. This model is termed the ARCS model. The four components of the ARCS model acronym are **A**ttention, **R**elevance, **C**onfidence and **S**atisfaction.

The four main categories define the minimum instructional prerequisites. The motivational instruction process is introduced during the project conception and implemented during the whole designing process. This means that the impact for the students is greater than if it is used solely in the learning content. Hereby follows the ARSC steps in detail.

3.1.1 Attention

Student attention may be initially fairly easy to catch but difficult to sustain over an entire course. One strategy for gaining attention and holding involves using incongruity, e.g. presenting evidence contradictory to an accepted theory. Other attention strategies include varying the pace or style of presentation of the course materials, using humour, and planning activities that require student participation.

3.1.2 Relevance

Relevance is especially important in motivating students, since competing with their other priorities, such as part-time jobs, reduces the amount of time available to them for learning. Skills and information gained through education or training must be perceived as usable beyond the course level. The relevance of the course material can be emphasised by relating its content to the student's experience or the student's future goals.

3.1.3 Confidence

A useful strategy for confidence building is to plan for various "success opportunities" which motivates the students early on in the program. Other strategies for increasing student confidence include helping students to set realistic goals for themselves, providing clear and specific criteria for evaluation, and attributing success to the student's efforts when giving feedback.

3.1.4 Satisfaction

Satisfaction is feeling good about accomplishing instructional goals. To increase the chance of students satisfaction, we should provide activities that allow new skills to be used in realistic settings. Transfer of learning information is intrinsically motivating. Flexibility and choice within the instructional program, by providing options for objectives, study methods and/or evaluations, can increase the student's sense of control. Providing extrinsic rewards for progress and reinforcing students intrinsic feelings of pride will also strengthen students satisfaction.

3.2 Aristoteles' model of the suspense in linear stories

Linear stories were already being told since the time of Aristotle. Aristotle divides the temporal turn of a storyline into four periods: exposition, ascending storyline, climax, and the dissolution (see Fig. 1). Originally developed for the classical drama, this model is used almost everywhere in today's entertainment industry. [20]

In the exposition period the characters and their environment is presented. Beyond that the audience is introduced to a problem, which is the basis for the further storyline.

Introducing and intensifying conflicts increase the suspense of the story. These conflicts can arise either from ideological differences or if the characters have different levels of knowledge.

The climax in the story occurs at that point in time when the main character makes a decisive step towards solving the problem.

In the final period of the story still open conflicts are solved. The audience reaches the level of suspense as it was at the beginning of the story.

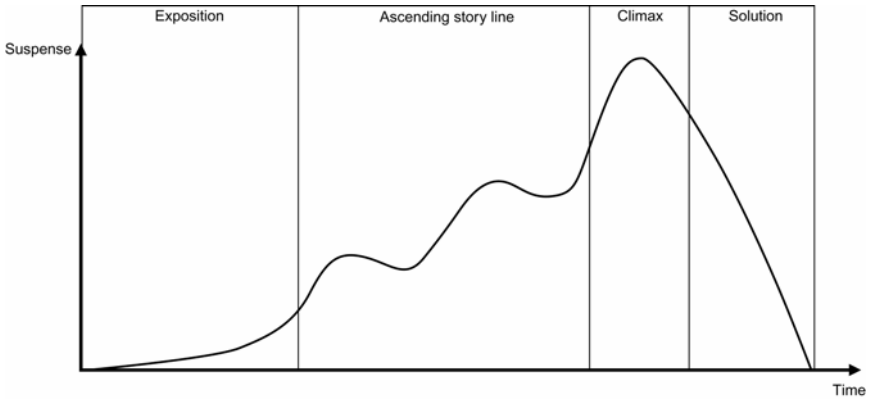

Fig. 1. Classical lapse of suspense according to Aristotle's' poetic

3.3 The combination of narrative and instruction theory

The models of instruction and narrative theory can complement each other. This has already occurred in classical training and university teachings environments, but it is a rare occurrence in current computer based training (CBT) programs.

A comparison of the ARCS-model with the Aristotle's' classical suspense model clarifies that an ideal learning interface is offered if narrative methods are used early on in the production process of computer based training units. In both models there are four phases or sections, which are almost identical in their goals. Both can be harmonized easily.

The students' attention first has to be caught, similarly as the audience of a story. Their attention must be held and then maintained throughout the course. The goal of the first phase is to introduce the students to the problem field. The teaching goals have to be clarified to them, they have to make themselves familiar with the learning environment, and they have to become acquainted with the possibilities offered by the learning environment. This can be achieved by introducing game elements or alternating forms of presentation and interaction. [18]

This motivates the students and therefore contributes to maintaining the students' attention.

The "ascending" in the storyline is the same as the increase of the students' familiarity with the teaching material. The increase of understanding of the material puts them into the position to be able to solve problems, which are becoming more and more difficult and complex.

The climax occurs at that moment, at which the student achieves the first step to independently fulfilling the expectations, requirements, and evaluation criteria of the course.

During the last section of a story, still open conflicts are solved. The students now are offered the possibility of getting answers of their still open questions. In addition, they can also try to use their acquired knowledge and try to adopt a routine with the learning material.

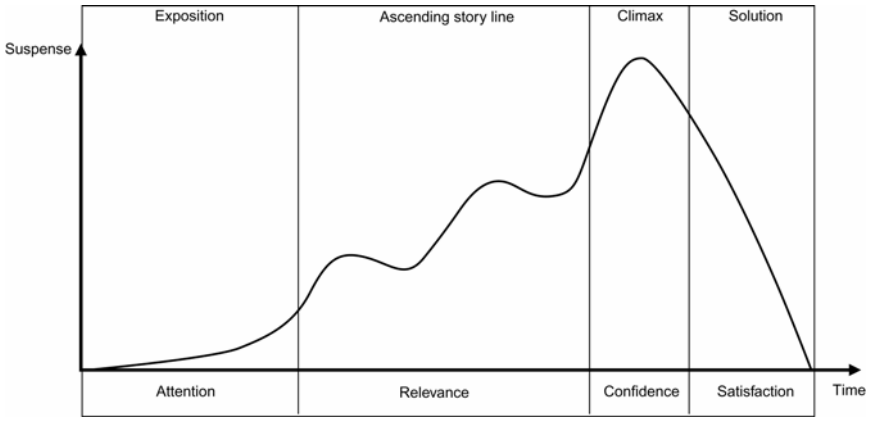

Fig. 2. The comparison of the ARCS-model

The students should be provided with appealing redundant presentation and interaction techniques; this increases their motivation and encourages a greater degree of self-determination. Ideally the students' actions during the course and their answers to test questions must have a perceptible influence on the presentation and the content of the course material. Parts of subject material can be omitted or they can be presented in a target-group-oriented variation: implementing both different media elements as well as different points of view. This is achieved when the CBT-learning unit structure is not purely hierarchical, but also non-linear. The students navigate themselves through the learning material, under the guidance of the system, independently and according to their needs. The following three aspects are of special importance:

- The students should not be left completely alone with the navigation in the subject material. They must be able to acquire the knowledge under the guidance of the CBT system. It must be established that the students learn all the important content, despite of all the granted freedom of navigation.
- Exploring the material may not take place aimlessly. The students should not get "lost" in the navigation, for this decreases their motivation. The presentation and interaction techniques have to be arranged so that the suspense is increased and the students' curiosity is held.
- The students must be challenged by the subject material, but not overtaxed and if they become overtaxed, the CBT-system has to react. It has to lower the level of subject complexity, so that the students are following the training goal again.

4 Narrative elements for computer based training

In opposition to hitherto CBT-systems, the above presented combination of the two models of instructional and narrative theory presents a challenge to radically change current production processes. The four different areas of competence have to cooperate in this creative process:

- The authors of the learning material determine the actual learning goal and content.
- The media pedagogues help to implement the appropriate instruction and narrative models.
- The media designers and multimedia producers create the suitable multimedia elements.
- The computer scientists are responsible for the implementation and the realization.

The author defines the learning goal, the media pedagogue selects an instruction and narrative model, and then, through their dialogue with the media designers and multimedia producers, the design presentation of the learning module is created. The computer scientists and media pedagogue determine the hardware and software specifications. Ideally, this interdisciplinary production process assures that the storytelling concepts and their corresponding multimedia elements are combined into an innovative narrative learning structure.

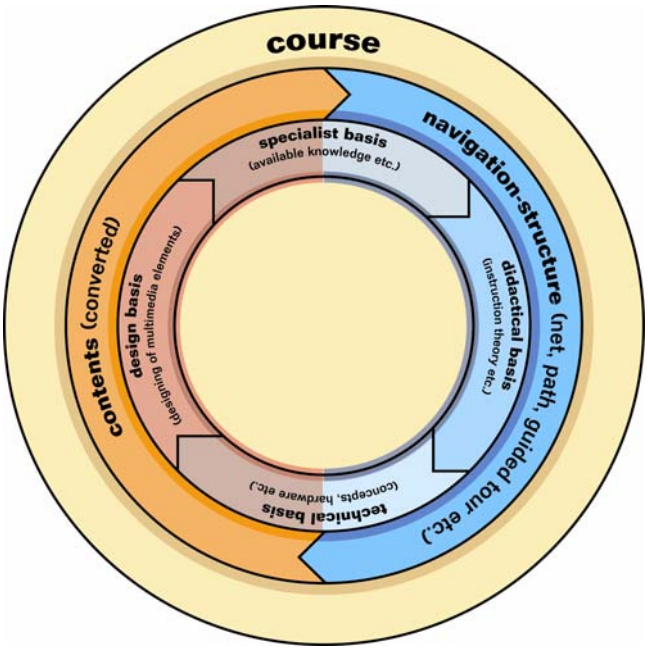

Fig. 3. Combined model of the production process for DS-CBT

The so won media-library is the instructional contents and becomes embedded into the learning structure. This final learning unit is the learning goal for the students. According to the DS-CBT-model more expenditure is necessary than only a web-browser or similar techniques. The learning material, which is presented, needs an application logic, which is more or less intelligent. Building the suspense and keep it upright during the presentation is the task of this DS-CBT-system (Digital Storytelling-CBT). It selects, in which form the learning content is presented whereby it considers the following aspects.

- It considers which instruction and narrative model is the basis for the story.
- It considers which user model is actual, so that the correct target group can be addressed.
- It considers which media elements exist for imparting expert knowledge.

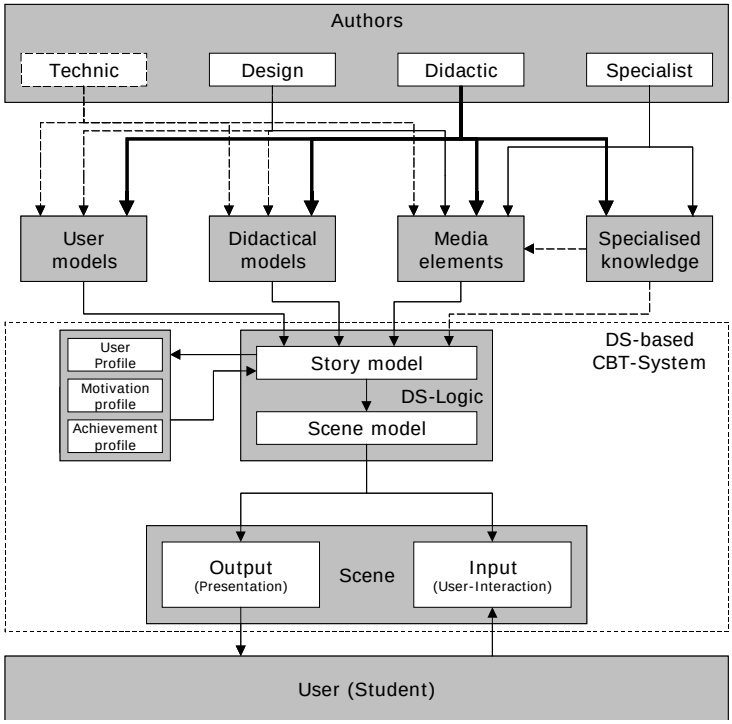

Fig. 4. System architecture of a DS-CBT system

Regarding these points the DS-CBT-system chooses an appropriate instruction and narrative model and generates a story line. Individual scenes or chapters are modeled for this story line. The students navigate between these scenes and interact within them. Their reactions, questions and answers during the presentation are stored in their profile, which is then administrated by the DS-CBT system. The DS-CBT system accomplishes the following:

- The DS-CBT system "notes" the students' interaction preferences and their preferred presentation techniques, for individual adaptation in the future presentation techniques.
- It registers the motivation profile of the students, which again effects the future presentation of the learning material.
- The DS-CBT system supervises also the students' achievement profile and alters the learning task to match the students' learning potential.

The range of the expert knowledge in combination with the presentation in narrative form is very complex.

In interactive stories it is often possible, that the audience is not lead to a logical end of the story. Under no circumstance this may happen to the student. In that case s/he would not learn everything, the author has appointed as necessary. Furthermore the student would remain unsatisfied and disappointed. [20], [21]

5 Narrative elements in the project *medin*

The experience of the *medin* project shows that it is important for the students to be able to choose between linear and non-linear learning paths. The majority of students choose to use the linear path (guided tour) for the major part of their study time. This has the advantage that the students, especially for the target groups of the distance learning students, know they have worked through all the learning material.

After each chapter the students can test their knowledge with a self-test. A final exam will be written at the end of each the course unit.

The students are additionally offered the choice of an individual learning path. This is made possible by creating an XML-based production process. By dividing the contents into several little semantic units makes it is possible to generate different user views. That means that students, while preparing for a test, can be shown different views e.g. all definitions or all chapter summaries. It is also possible for different target groups to have contents of different levels at their disposal.

The visual generating of the learning contents is based on structuring the learning modules so that the conversion of the course material into multimedia elements gives the students the opportunity to be lead through the units according to their individual interests. In this case it must be guaranteed that students will be conducted back to the "guided tour" even if they use the interest navigation.

An example of this flexibility of learning material is a video created about kidney transplantation. It exists in three different versions for the following three different target groups:

- students of the medical computer science,
- surgeons who are to be informed about the operation method, and
- patients who are to be informed about their up-and-coming operation.

The experiences of the project *medin* make explicit that it is a major effort to convert and prepare author knowledge in a way that it can be used in a multimedia narrative supported CBT-System. The following problems were encountered:

- The authors of a CBT content mostly think in a classic hierarchical book-based structure. The necessity to break down these structures into a non-hierarchical form for the benefit of narrative concept and when inserting multimedia elements, often occurs. In projects of great complexity it is an absolute must because a restructuring the learning material at a later point in time is time-intensive and creates redundant work.
- Strategies must be found which support the authors in structuring and converting the learning material. The current authoring-tools offered to the author are very specialised; for each different media there is a different and complex software program.
- There does not exist currently any authoring-tool which would support interdisciplinary collaboration between authors, pedagogues, designer and multimedia producer.

The multimedia aspects can already be taken into account at an early time in the project planning. But the support deficit in the narrative area is tremendous. The development of narrative components in the e-learning is in the moment in its early stages.

6 Prospects

It would be recommendable to use the experiences of the *medin* project in a new production that corresponds to the visualised ideal. This would mean establishing CBT-modules with a strong narrative support platform. In this new project a software program would be devised which would implement narrative elements and technical specifications in developing meaningful structured learning units.

The new software narrator would structurally support the four narrative phases of storyline development. Each of the four phases would contain learning material presented so that it encourages the students to become familiar with the course goals and material quickly, while maintaining their attention and curiosity throughout the duration of the course.

This would still require an intense collaboration between the author of the learning content, the computer scientists, media pedagogues, and media designers, but would insure that the end result would be a target-group-oriented product. Combining narrative and instruction theory with the learning content is the base to improving the motivation and learning performance of the students.

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