An integrated multimedia e-learning model for vocational training

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Abstract

Building an e-learning environment suitable for vocational training in a non-academic context is challenging. Vocational Education and Training (VET) students normally don't have the academic background needed to take university e-learning courses. Pedagogical models developed for university e-learning are often adapted to active and collaborating students, who are used to seek out information in textbooks and on Internet. This is not appropriate or must be adjusted with students in vocational training.

This paper will present an integrated multimedia model developed for practical training. It focuses on a variety of learning styles, developed to satisfy students with different needs (Grasha, 1996). Oral presentations, web pages, video presentations, animations and a thorough automated assessment are important parts in each module of the learning content. The content is produced by rather simple tools and integrated into a powerful combination. This strategy makes it possible to develop high quality, multimedia e-learning content in a quick and inexpensive way.

Keywords

E-learning model, multimedia, assessment, course development, vocational training

Introduction

Team work is a key point in the development of e-learning content, both in the sense of creativeness, distribution of work and competence and quality assurance.

TISIP has developed a training course and a corresponding model for a national trade association of Norwegian butcheries, called Animalia. As an e-learning provider, TISIP is not an expert in the industry of butcheries. The customer's role has been to obtain and deliver the raw material, i.e. subject content. A successful e-learning product is dependent both on the quality of the content but also on an extensive and fruitful communication between the e-learning provider and the customer throughout the entire production phase, also amongst members of the development team. This paper has a practical approach, and is based on experiences gained during the development process.

Pedagogical background

The construction of e-learning models is often based on several pedagogical ideas. In traditional university courses, models with a high level of communication and collaboration, in combination with the students own reading and writing of essays, have been central, i.e. sosio-constructivistic approaches.

Nevertheless, the constructivistic approach is not always applicable. Working with students without an academic background often requires a different tradition. We have experienced that an instructional training program, consisting of a great variety of teaching styles improves the learning experience. Students with certain disabilities like dyslexia find this model especially valuable.

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In Howard Gardner's theory about multiple intelligences (Gardner, 1985), he claims that individuals have seven different intelligences as the capacity to solve problems. These intelligences are linguistic, logical-mathematical, bodily-kinaesthetic, spatial, musical, interpersonal and intrapersonal. In our e-learning model, we have tried to construct e-learning material suitable for several intelligences.

Edgar Dale's Cone of Experience (Dale, 1946) claims that people generally remember 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they hear and see, 70% of what they say and write and 90% of what they do. When students work with the course material from different angles in an integrated learning environment, they get a richer learning experience. The vocational training students will also be able to apply their new knowledge in their work situation as part of their learning or shortly afterwards.

The QUIS project (QUIS, 2007) developed theories for a next generation of e-learning systems. The QUIS model for a personalised e-learning interface (Kolås/Staupe 2007) discusses individualization and differentiation to fit e-learning to the different needs of the students.

Dreyfus (Dreyfus, 1998) has developed a five-stage model representing acquisition of skills, which also has influenced on our e-learning model. He claims that different stages have different needs. These five stages are presented in table 1 below (Gookin, 2004).

Table 1 – Dreyfus' stages

Stage	Short explanation
Novice	Use objective facts and apply rules in a methodical way.
Advanced beginners	Experience fosters the beginning of situational judgment, but still lacks a big picture.
Competence	Able to put options in a hierarchical order and to know solutions to common problems.
Proficiency	Able to take rapid and fluid decisions, and *one* with the activity.
Expertise	Intuitively know their abilities and boundaries, and possess extensive tacit knowledge.

It is obvious that a novice learner has completely different needs of learning styles than an expert. The "novice" needs clear prescriptions while the "expert" learner not only sees what needs to be done, but also how to obtain these goals. In designing our learning model, we focus more at the first stages than the last.

Rapid e-learning

"Enterprise Rapid E-Learning" is an e-learning development strategy defined in the Mohive white paper (Mohive, 2007). By Enterprise Rapid e-learning, we create practical training programmes in a very short period of time, weeks or few months for more extensive programmes. The driving concepts behind rapid e-learning are:

- A reduction in the time spent in creating e-learning
- Enabling SMEs to be the primary source for content development
- Having easy-to-use software tools that lower the barrier to creating content

In our experiments and experience with the integrated multimedia e-learning model for vocational training, we have focused heavily on rapid development combined with low costs. Rapid development is achieved since the model requires that the customer provide the e-learning raw material in a high quality condition. Our task is to transform textual and multimedia material, for example a text book or video recordings, into e-learning.

The low cost goal is achieved by integrating different multimedia tools. The chosen tools make it possible to create videos, animations, tests and podcasts very effectively. In the next chapter we will explain the various multimedia methods and tools used for producing the e-learning content in the e-learning model.

Multimedia integration

Multimedia development is often very expensive (Hjeltnes/Hansson 2007). Our e-learning model use effective tools that makes it possible to produce rich multimedia content both quickly and with relatively low development costs and without involving professional studios. With these tools teachers and researchers are able to produce the content themselves, in their office.

Overall structure and integration with LMS

We use a two level design. The first level is the learning module itself and the second level is the LMS (or infrastructure level). Each module is developed separately, SCORM compatible. The infrastructure layer builds an overall structure around the course, and consists of the chapters/modules and a certification test (assessment) for each module. The model does not have any preferences regarding choice of LMS, as long as the LMS supports the IMS/SCORM standard.

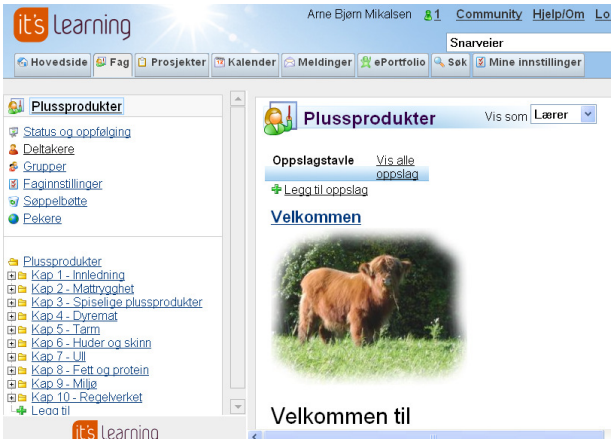

Figure 1 – The LMS layer (image from an e-learning course for a Norwegian Butchery organization)

Learning module

Each learning module consists of five learning activities:

- Front page – here the learning goals are presented, both as written text and orally
- Presentation – a video based lecture presenting the content, with animated slides
- Demo – interactive animation/simulation of important topics
- Course material – web pages presenting the content with both internal and external links
- Assessment – for self-testing and preparation for the mandatory module certification test

For students who want to use their mobile phone or mp3 player to repeat this material, we have produced sound clips from each presentation and every demo, where we have transformed the manuscript and recorded the same material as adapted mp3 files.

Figure 2 – The course module

We will now elaborate further on the presentation, the demo and the assessment parts. We will leave out the front page (learning goals) and the course material (mainly textual content presented in web format).

Video presentation

The video presentation consists of a "talking head", with animated slides. Throughout the presentation, the entire content of a course module is presented from the presenter's view.

Figure 3 – Example of video presentation

The goals for the video presentation are the following:

- The video presentations should give the student an oral presentation of the entire course content, with slides highlighting the main points.
- They should give a closer relation to a human being behind the e-learning material – the teacher.
- The video presentations should make it easier for the teacher to point out clearly important parts of the learning material, and emphasise core issues.
- The student is able to go through the material in his own pace, since he can stop, repeat and choose which part of the presentation he wants to see due to the clickable table of contents.

The production of a video presentation consists of three stages:

First we have to read and understand the original text for the module, and produce PowerPoint slides with the key points. Together with the slides, it is a really good idea to write a detailed manuscript. This makes it easier to update the material, either in a new version after a while or as a result of the quality assurance.

The second phase is to record the production. Without having access to professional studio equipment, the result can still be of high technical quality. However, more investments in lighting, microphones and

similar installations give a more professional impression of the production. Using a neutral background and keep the room fairly quiet improves the impression. Software for showing the manuscript on a screen in eye-level with the camera also gives better eye contact with the presenter.

Finally we have to edit and produce the presentation. It is possible to exchange the presenter video with another video file, for example showing a practical sequence. This will give the student a practical demonstration of the material presented, and create variation in the presentation format.

There are various choices regarding software for producing animated talking head slides. One such alternative is the free Microsoft Producer tool. This tool adds up on Microsoft PowerPoint. You need a digital camera connected i.e. by fire wire and a microphone.

It would be of great help to make the handouts for the video presentation available for downloading. Students will then be able to repeat the presentation, and good slides will give a good overview over the entire content of the course module.

Demo - interactive animation/simulation of important topics

For this part of a course module, we have established the following guidelines:

- The demos are supposed to give another approach to the course material than the original text material and focuses on visualization
- The use of text must be held at a minimum level
- Pictures and videos are used both to visualize and throw light on processes not easily described by words, like practical workflow and work procedures, evaluation of colours, to distinguish different shapes, qualities etc.
- Include comments to explain what the demo is visualizing
- The demos should focus on selected processes and not the entire course material for a module

We are going to take a closer look at the production process of a demo. Remember that the foundation for this production process is to produce the demos with effective tools, in a quick way and with low developing costs.

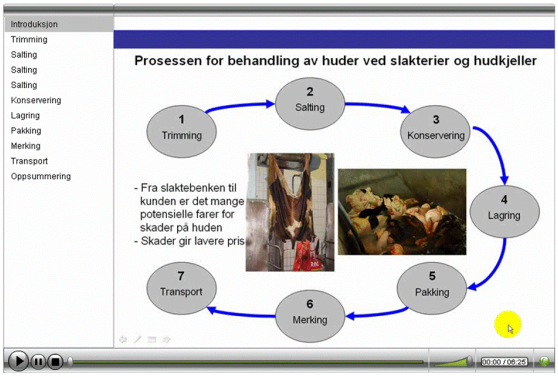

Figure 4 – An example of a demo

First we have to study the original text material for this module in order to get a clear view of the content of the module. The quality of the original material is thus an important factor influencing the quality of the final product.

Furthermore we have to decide what we are going to visualise in a demo. This is a creative process to determine which part of the course material that is suitable for demos. The best situation is if the customer has some ideas themselves on what kind of material they want to visualise. Otherwise we have to ask ourselves the following questions. Are there particular processes/topics that are hard to understand from

the written text, where visualization will give added value to the material? Which of these potential processes/topics will benefit the most from being visualised? When you have the answers to these questions you have a list of prioritised processes/topics that are suitable for producing a demo.

The next step is to start the production of the material that is needed to make a demo. Based on our original idea we have to make a shooting script. As a tool to produce the shooting script we used PowerPoint. This tool is easy to use to produce nice and illustrating animation sequences, without using Flash technology. Here we used a lot of pictures from the original material from the customer. We also used some text to highlight important factors and built in animation effects (in PP) to visualise the different processes/topics. For the most of the time, the order of the different slides decides the order of the demo. It is also possible to add Hot Spots at a later time (the editing process) to go through the animation in a non sequential order.

Moreover we have to make a manuscript for the comments to follow to the shooting script. For most of the demos we were able to extract the comments from the original text.

After preparing the presentation, the actual recording must be done. For this work we used a regular personal computer and an external microphone. You may experience some disturbance. A “please do not disturb”-note on your door and marking your phone occupied will help a lot. The second challenge was the quality of the sound. You need a microphone of good quality because noise makes a poor impression of the quality of the entire demo. When the sound works fine we are ready to record the demo. As a tool to record sound we used TechSmith’s Camtasia Studio. We use this tool also to capture content from our computer screen. The content of the entire screen can be captured or a specific window or PowerPoint presentation. After we have captured the content we are able to produce videos with Camtasia Studio. To produce the different demos for the e-learning course we captured the different presentations we have made in PowerPoint and our audio comments according to the manuscript. In the beginning you may have to do several recordings to get the quality you want. But when you become more experienced it is usually sufficient to do only one recording. These recordings become the raw material for the different demos.

Next we have to edit the raw material to produce the demo. The first task is to put the individual clips together on the timeline. The next procedure is usually to erase the material that contains mistakes or that you want to remove for other reasons. When you have finished the first editing, the demo is in sequential order and is ready for more advanced additions. In our e-learning course we also added so called "Hot spots" to some demos. This activates the user by forcing her to click on some spot for the demo to continue. Hot spots can also be used for selection; which part of the demo should be played next. The added value of interactivity is much more than the cost of the production. The Camtasia Studio also contains a lot of different possibilities on how to edit your demos. Because we didn't want the message to drown in exaggerating the use of different effects and to keep the production costs low, we tried to keep it quite simple. It is very important to consider the added value of the different effects before using them. The editing process was also quite time consuming if we tried to use too many effects at the same time.

Finally we have to produce the demo in Camtasia Studio from our edited version of the recording. When you produce the demo you can choose between different kinds of formats on the result (Flash, WMV, MOV, and AVI). It is also possible to include the production of audio files in the same production process. The time of the production process is increasing according to how many things we want to produce at the same time. For our purpose we chose to produce the demo for distributing it on the web. As a result of this production Camtasia Studio made a folder with the same name as the edited recording. This folder contains a number of files and to play the demo we can make a link to the html-file in this folder. The demo starts to play almost immediately after the user clicks on the link (due to streaming).

Assessment

Automated assessment constitutes an important component of our learning model. We have developed multiple choice tests in order to reduce assessment costs to a minimum. Furthermore, multiple choice tests will ensure the quality of the course due to extensive use of self-testing.

A multiple choice test consists of questions where each item has one or more correct answers among some set of possible alternatives. It is possible to automate the scoring and feedback of a multiple choice test using a digital testing tool. This fact alone makes such tests very appealing for e-learning courses where cost efficiency is a critical factor. The assessment phase was considered critical in our training course. The association of Norwegian butcheries stated clearly that high quality assessment was of the essence in order to secure the competence level of the students after finishing the course. With such requirements, creating questions of high quality becomes essential in order to succeed.

Bloom's taxonomy categorises cognitive levels of competence (Bloom, 1956). Is it possible to test according to the different levels described in this taxonomy? Such a task can be difficult and demanding, but using techniques like distractor (alternatives that are wrong) analysis, using stimuli like carefully crafted text, images or video, or simply carefully craft the questions and make others review them critically, automated tests can be used to test higher level of insight and not only fact-based knowledge (Sirnes, 2005).

In our course, every module had one self-evaluation test, and one certification test. On the latter, the student would meet a limited amount of shots, and the test should be passed with a certain minimum score (typically 80% correct) in order to pass. To obtain the final course certificate the student must pass the certification test for each module, but she can take the test in an optional order.

The self-evaluation tests were designed to support learning and prepare the student for the corresponding certification tests. When taking a digital test, the student can be given immediate feedback upon the answers from the system. This opens the possibility for the student to perform self-evaluation and reflect on the learning process (Saphe), thus guiding and motivating the student. Such a formative use also has benefits when it comes to cost: no tutoring is required. Salmon states the importance of creativity and fun "e-tivities" in order to enhance learning (Salmon, 2002) and we believe that self-tests also in this respect fits well with the other components of our learning module model, and contributes nicely to an even more varied learning environment for the student. Learning something by processing and working from different angles should be good for learning.

To create the self-evaluation tests, a tool called CourseGenie were used. This tool allows for immediate feedback on the item level, with fine-grained comments to both wrong and correct answers. Also, the tool allows for free text questions, with an option to give a predefined response no matter what the student writes. Thus, a test can be both motivating and guiding in nature for the student. Such a tool is therefore ideal for self assessment and reflection.

In the process of making tests, we worked our way through the same learning material that the student would be given (presentation, demo and web pages). When processing the content with Bloom's taxonomy in mind, it is easier to design questions that test fact based knowledge, understanding, the ability to reason and the application of the theory. Furthermore, using images from the learning material in new ways, and creating case descriptions, the question quality will possibly increase. In an ideal world, the person creating the questions (and the learning material as such), should have a deep understanding of the field. Without such knowledge (we are not butchers!) quality assurance from experts are important. All questions were sent to the butcheries' association for quality assurance, instructing them to consider not only the correctness of the items, but also the cleverness and level regarding the question design.

Collaboration and communication between e-learning provider and customer

An effective, friendly and good interaction between the e-learning provider and the customer is important in order to produce a successful course with high quality and good learning outcomes for the students.

The experience from this particular project is that both TISIP as an e-learning provider and the customer as a supplier of basic learning material underestimated the need for pre-specified and thorough standards for quality assurance. Even though it was clear from the contract that the customer was responsible for delivering error free source material of high quality, we found that when the course modules were taken to pilot testing, many faults discovered were actually related to the quality of the source material. Since

the e-learning providers have no expert knowledge of the field, errors in the source material will obviously get built into demonstrations, animations, multiple choice tests and the like. To uphold the cost efficiency, the quality of the source material therefore becomes critical. This is the foundation for the entire course and the quality of the e-learning course can never be better than this material. By quality assurance we mean that the text to be used as basis for the course has been approved both professionally and linguistic. The pictures and videos to be used must have high enough resolution to be cut into pieces and reused in several settings, and the material must be given proper names so it is possible to use it correctly, and at last all the material must be IPR cleared for use in the course. To be able to produce an e-learning course of high quality the customer must have completed their quality assurance work before the course developers starts using the material.

Every type of activity uses the original course material as its foundation. All of the different ideas and creative solutions for the e-learning course are always founded on this course material. If the course material doesn't have the proper quality the quality assurance work of the e-learning course will lead to a lot of changes after the e-learning course has been produced. To avoid this situation the customer should use the same quality assurance group for the e-learning course as they used when the original course material was approved. Changes after the e-learning course has been produced means that you have to do a lot of work one more time to get the wanted quality. This is unnecessary and leads to a lot of extra costs. It is therefore very important when entering into a contract with the customer that the aspect of quality assurance is discussed thoroughly, equally understood and well specified.

Conclusion

Building e-learning courses for vocational training in a non-academic context can be done by integrating several methods of teaching. In this way, we enhance the learning experience, and embrace many kinds of students, also students who normally have difficulties with learning by reading extensive texts.

In this paper, we have presented a general model for vocational e-training, consisting of an integrated learning environment containing web pages with both written and oral content, video presentations, animations and assessment. We have also shown a practical implementation of this model, and discussed our experiences working in a development team with this model.

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