# DIDACTIC SCENARIO'S FOR AN EFFECTIVE USE OF WEBLECTURES: A COLLABORATIVE RESEARCH PROJECT IN HIGHER AND UNIVERSITY EDUCATION TO MAXIMIZE THE USE OF WEBLECTURES AND ITS EFFECT ON LEARNING

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In this research project, running from 1st October 2009 till September 2011, seven institutions of higher education and five university faculties will conduct pilots on how to use web lectures effectively in order to face the challenges of the on-going innovations in higher education: the increase in distance education enrollments, flexible learning paths, diversification of learners, and the implementation of "guided independent learning", which is the directive educational concept at the University of Leuven and its affiliated institutions of higher education.

As well as to offer a solution for the quantitative reduction of face to face contact time between students and lecturers (seat based lessons), the project will promote the use of web lectures as an innovative teaching method to improve the quality of contact time, whereby the teaching method evolves towards ' guidance of the individual learning process of students'.

The paper presents the results from the first phase of the project: the didactic concept and didactic scenario's for a good educational use of web lectures, derived from literature review and SWOT analysis of (best) practices. Four application areas are described: the use of web lectures in support of lab exercises, lectures, remedial teaching/courses and video streaming of physics experiments or processes.

The paper also illustrates the experimental design of the case studies/ pilot projects that will be carried out. The results of the case studies are primarily meant to optimize the didactic scenario's, in providing guidelines on:

- embedding the web lecture into the total teaching-learning process.

- instructional design of the web lecture itself

- technical usability aspects of different production techniques and multi-media.

The project methodology for generating and selecting pilots is problem-based. The rational is that the 'added didactic value' in improvement of study results as well as in study behavior will be more obvious when a problematic teaching/learning situation can be solved. This is intrinsically motivating to the lecturers carrying out the pilots. A convincing result will maximize the dissemination impact.

***Keywords -*** Web lectures, guided independent learning, distance education, flexible learning

# 1 INTRODUCTION

On-going developments in higher education in Belgium show a fast increase in students who can not or choose not to attend classes in traditional in-class lectures. This is due to recent educational policies on 'flexibility of education' and on 'diversification of learners'. These policies aim to make education available to all. Another challenging innovation is the implementation of 'guided independent learning' as the main educational concept of the Katholic University of Leuven (KULeuven).

This research project is funded by the Education Development Fund of the KULeuven and initiated and co-ordinated by the University college, KaHo Sint Lieven. The project runs from 1st October 2009 till September 2011. Five university faculties and seven affiliated institutions of higher education want to offer lectures or parts of lessons online in order to face the challenges. We will conduct pilots on how to use web lectures effectively for specific educational purposes.

ADVANTAGES

An increasing number of students do not follow the standard bachelor or master programs. Individualized learning paths are set out for students taking up credits of a following year. However courses often are only offered once a year, therefore students sometimes having to attend two different classes at the same time. Web lectures can offer a solution for this challenge of flexible education. The group of working students, distance education students, top sportsman, Erasmus students are also increasingly making use of the new possibilities of e-learning.

Diverse learners with a disability (chronic illness, dyslexia, blind or other handicaps) experience web lectures as a very useful medium for enabling learning at own pace and time, adapted to their individual possibilities. [1]

Recent research projects at the Universities of Leuven and Utrecht have also reported the advantages of the use of web lectures for regular students, mainly using it as a repetition tool in preparing for exams. [1] [2] [3] The functionality of rewinding and re-listening to a difficult section of a presentation, makes it possible to make better notes and process the information better. McKinney (2009) [4] even found evidence that students using web lectures pick up the learning content better than students attending regular classes.

Another advantage is simply the attractiveness of the medium because of its digital audio-visual character for the new 'screen age.'

THREATS

Most of the Universities in the Netherlands are already capturing lectures in large amounts.[5]

**There is however a pitfall !**

Web lectures tend to be used mainly for capturing lectures in which the lecturer is teaching in ex-cathedra style, meaning a one way presentation leaving little room for interaction between teacher and students. Technical limitations for capturing the image and sound, might even reinforce this teaching style. In conceptualizing the project we experienced that web lectures are often perceived by students and lecturers as a dull, **non activating learning medium**. Also Filius [6], of the University of Utrecht reported this as the main disadvantage and limitation of the use of web lectures.

However as Clark [7] stated in his debate with Kozma [8] , it is not the teaching medium that causes learning but the teaching method. In attending a traditional lecture or viewing it online, students can sit back and consume in a passive way. Research within the framework of constructivist learning

theories [9], proved that learning results are higher when students actively engage in learning activities. Learning is even more optimized when they regulate their own learning process (meta-cognition).

Therefore we want to stimulate the use of web lectures in combination with several activating teaching methods: lab exercises, remedial teaching, authentic visualisation of physics concepts and also using web lectures for the preparation of in class-lectures covering theoretical concepts, in order for the in-class contact time to be used more effectively.

## 2 RESEARCH FOCUS

Our main focus of research is **"a good use of web lectures",** whereby we want to motivate lecturers to optimize the effect on learning, **by stimulating active learning and guided independent learning.**

In the sections 6.1 Instructional design of the web lecture and 6.2 How to embed it in the total teaching-learning process, we elaborate on specific guidelines of putting this into practice.

When students have viewed the lecture beforehand, the contact time between lecturer and students can be used to deepen learning by answering questions the students have prepared, by remediating gaps in understanding or misconceptions and by coaching the individual learning process.

The main challenge experienced by some of our pilot groups is how to motivate students in really preparing themselves using the online provided teaching aid.

Day [10] investigated whether the time used in real in-class-lessons can be used more effectively when web lectures are provided online beforehand. His findings indicated a significant improvement in the perception of students on learning and their satisfaction with the teaching approach.

In interviews with students of a best practice of one of our project lecturers, Janssens [11] we found similar satisfaction reports. For the learning objective "designing a flash applet", the lecturer has developed an independent digital learning path for the students to work trhu the theory independently. The contact time is used for students to ask questions, to discuss the progress they are making and the problems they are encountering in making the assignment, to get feedback and tips from the lecturer.

The dilemma of course then comes in that making a complete learning path demands a lot of energy from the lecturer. This research will try to find the **balance between optimal educational effectiveness and good usability.** We will elaborate on usability issues in section 6.3 Technical/practical aspects. [12]

## 3 DEFINITION

We use a broad definition of web lecture (WL):

A web lecture is an instruction method whereby the combination of video, audio and digital presentation material is registered and distributed via internet, electronic learning environment, or i-pod (mobile learning). It can be a complete recorded lesson as well as a section or highlights of a lesson, or it can be produced separate from the lesson.

We investigate the use of WL before, during or after the in class-time lecture or as a an alternative of attending the lecture in real time (replacement for students not being able to attend lessons).

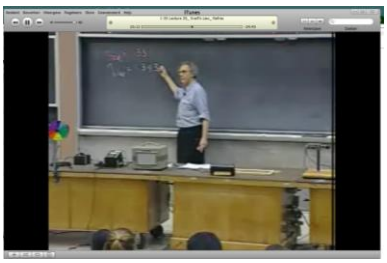
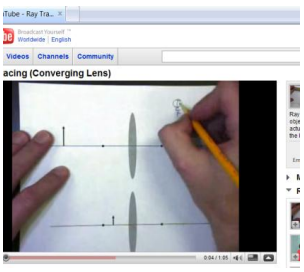
# 4 APPLICATION AREAS

Four multi-disciplinary research groups with members of different institutions will develop the pilot experiments and implement them with their own students. The pilots will be carried out in professional bachelor programs of nursing, health care, building and construction and in academic bachelor and master programs of science and engineering, ...

We cover seven different application purposes for WL, resulting in seven didactic scenario's.

The use of web lecture to support:

1. Labo en practicum
    a. Instruction movie for the preparation of a lab exercise or practicum
    b. Instruction movie to practice the practical skills independently
2. Lectures
    a. Recorded lectures (stand alone)
    b. Lectures incorporated in a learning path (blended learning)
3. Coaching and guidance / remedial online courses
    a. Short web lectures providing extra explanation for FAQ's on difficult subjects/concepts
    b. Remedial courses
4. Visualisation of experiments or processes of physics
    a. Online video used before, during or after the lecture to support conceptual learning

Applications 1b and 2a are primarily meant to reduce or replace in-class lecture time for non-regular students (students with a personalized learning path, working students, distance students, top-sport students,...) (1b, 2a). Also it provides flexible learning opportunities, which makes learning attractive for regular students wanting to study at their own pace and time.

Secondly instead of reducing the in-class lecture time, web lectures can be used for students to prepare themselves for the in-class lecture time, that can be used more effectively. For lectures (2b) covering theoretical insights, the in-class time can be used for answering specific questions on gaps in understanding of students. For lab exercises and practica the demonstration of the practical skills can now be done by video lecture and time is saved during the lab for the real practice. (1b)

A third project group will develop applications for remedial teaching. 3a Frequently Asked Questions (FAQ's) will be explained and recorded and provided online. In that way the guidance services for students of the University Colleges can work more effectively, because of not having to explain the same concept to several individual students separately over and over again. The individual guidance can be more specified after a student has actively tried to help herself an properly reflected on what exactly it is that she doesn't understand.

A remedial digital course (3b) on mathematics will be offered to students needing to improve basis skills.

The main purpose of the fourth pilot group is filming experiments of physics and interchanging these materials between the different education institutions. This is an important advantage for lecturers facing logistic problems when carrying out experiments of physics. The problem of visibility for large groups of students has been stressed. Web/video lectures also offer opportunities to explain and

illustrate a physics concept in various ways, ranging from abstract to concrete 'real life' examples of the application of the concept. A lot of students experience difficulties understanding concepts of physics, primarily because at the predominant abstract way in which the concept is explained and even illustrated.

## 5 METHODOLOGY

The project methodolgy is problem-based. In the selection process of the pilots lecturers chose to apply WL in a specific problem area within their subject area/course. For example subject content for which students get consistently low grades (70% fail) over a period of 5 years. We want the use of WL to have an added didactic value and to make a difference on the learning effect. The use of WL needs to be relevant for the specific teaching-learning context.

Some pilots were also selected on bases of existing practices that need improvement.

With this methodology we believe to derive distinctive criteria for a good use of web lectures. Moreover being able to 'make a difference' is intrinsically motivating to the lecturers carrying out the pilots. A convincing result makes it possible 'to show the difference', motivate other lecturers, therefore maximizing the dissemination impact.

How will we measure EFFECT ON LEARNING ?

Which effects on learning are we interested in ? Cognitive learning results (comprehension of concepts), practical skills (for the lab exercises), study behavior/attitude: self-regulation and motivation (Did students prepare themselves by using the available WL?)

The effect on learning will be measured in some cases using an experimental design whereby we compare effects on learning outcomes. In some pilots we will compare results on similar exam questions over a period of three years. Possible effects of other co-variables such as overall grades, and where possible degree of self-regulation and motivation, will be ruled out by statistical analyses.

In other pilots we will use a control group, half of the student population having the WL as extra tool to support learning, half of the student group does not get the new teaching medium.

Using an experimental scientific design in all twenty three pilots is not our goal and not necessary.

The main objective of this project is to derive didactic scenario's with guidelines on a good design and use of WL. This objective can might as well be obtained by using questionnaires and interviews with students on their perception of strengths and weaknesses of the used W.L. and it's effect on their personal learning process and outcome.

In table 1 we illustrate a questionnaire asking the perception of students on the contribution of each used learning medium (provided textual learning path, figures/photo's, web info) to their successfully being prepared to start a lab exercise. The skill to be learnt is 'using a goniometer'.

Table 1. Section of questionnaire evaluating the effect of the teaching media on learning how to use the goniometer. (Physics lab, Luc Van Den Abeele).[14]

**Were you able to carry out the following skills without demo of the lecturer ?**

**If Yes, indicate which learning medium had helped you most**

| | No, demo needed | Fig/photos | Textual manual before lesson | Textual manual during lesson | Web info |
|---|---|---|---|---|---|
| **Recognizing the parts of the goniometer** | O | O | O | O | O |
| **Placing the light in front of the collimeter** | O | O | O | O | O |
| **Operating viewer** | O | O | O | O | O |

| | | | | | |
|---|---|---|---|---|---|
| **Focussing the lens** | O | O | O | O | O |
| **Reading the nonius** | O | O | O | O | O |
| **Registering the degree of the angle** | O | O | O | O | O |

We asked students which steps of the skill they were able to carry out without needing an extra demonstration by the teacher and to indicate which learning medium has helped them most in doing this.

A majority of the students indicated that it was difficult to carry out the steps: operating the viewer and focusing, without a video being available. Next time when this lab exercise is being prepared by another group of students, the video will be incorporated in the digital learning path, and the questionnaire will be asked again.

Hereby we conclude that we will investigate “effect on learning” both, in objective learning outcomes; as in subjective perceived learning outcomes.

Interviews will be carried out in the form of “hearings”, a developed interview model of the Central Educational Support Unit of the KULeuven [14]. These will provide perceived strengths, weakeness, tips and threats to emprove the didactic scenario’s. This will result in didactic scenario’s specifying guidelines on the design of the WL itself, on how to embed WL in the total teaching-learning process, and practical/technical guidelines.

# 6 OUTCOMES

A result of swot analysis of existing good and bad practices provided us guidelines for effectively making and using web lectures. We divide them into three categories:

## 6.1 Instructional design of the web lecture itself

Who is are public ?

The screen age, also called The HOMO ZAPIENS by Veen from the Technical University of Delft. [15] In his book “Homo Zappiens: growing up in a digital age” he describes the young generation of learners as being. multi-taskers, zapping fast from one attention point to the other (non-linear learning), for whom learning is playing.

The main demand we heard from students and lecturers in our interviews is the need for a flexible navigation functionality, being able to jump in a presentation by clicking slides or chapters.

Therefore is needed in the design:

- flexible navigation functionality (e.g. by selecting slides or chapters)
- short films (max 20 minutes)
- fast shots
- talking head not necessarily beneficial to learning (projected pictures often say more than a thousand words of the lecturer, and it can cause an unnecessary overload for the brain) [16]

In order to support self-regulation of the learning process it is needed to provide:

- advanced organisers = feed forwards, which make it possible for the student to canalize his observations and focus on what he needs to learn.
- self-evaluation questions to monitor own learning
- feedback possibilities

In supporting physics concepts and remedial teaching, attention should be paid to

- different learning styles:

- abstract versus concrete
- inductive learners versus deductive learners
- Interactive, flexible navigation paths versus controlled navigation of the learning path

The pilot group using lab video's also asked faster shots, moving quicker. Also the need for story boarding is identified. Sometimes important insights that the students need before being able to move from one step to another in a practical skill or procedure, are overlooked. A story board makes the lecturer register very carefully all the insights he has to explain in one column next to the column where the visual shots are listed.

We also detected that lecturers tend to first make a film or web lecture and then think how they are going to use it. Often they are confronted with only a small number of students making use of the available web lecture. The next section stresses the importance of purposely designing and using a web lecture in relation to the learning objectives and the learner characteristics. It also requires careful considerations on how to motivate students in using the web lecture.

## 6.2 How to embed the web lecture in the teaching-learning intervention

An optimal use of web lectures is not the stand alone web lecture. The general pedagogic guidelines of choosing a teaching method and learning material in function of the learning objectives and student characteristics and in coherence with all the components of the teaching-learning intervention also apply for web lectures.

Fig 1 represents the educational concept of "guided independent learning" of the University of Leuven. The interrelations between the basic components of the teaching-learning context are accentuated.

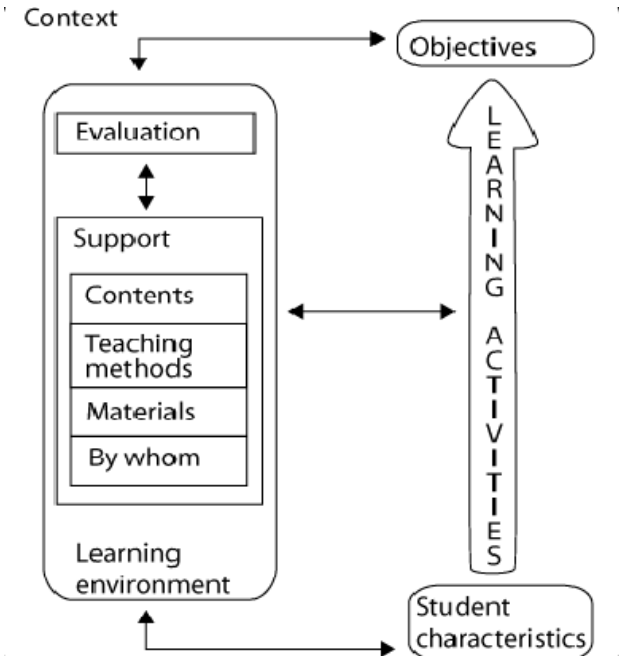



Figure 1: The basic components of an educational practice and their underlying coherence ('global scheme')

The main problems experienced by students and/or lecturers are:

- Students are not aware of the existence of the web lecture.
- The links in the blackboard learning environment between the web lecture and related assignments are not clear.

- Students are not motivated to use it. They prefer coming to the lab without having prepared themselves, especially first year students. (responsibility for learning, self-regulation, intrinsic versus extrinsic motivation)
- Students needing remediation most, use it least.
- Students misunderstand the main purpose of the learning path. Students are surprised during the exam to have to solve a conceptual problem, while they think they just need to know the information presented. (learning activity not in coherence with the learning objective and evaluation, feed forwards on the learning objectives helps)
- Students ask feed forwards (explicitly stating the learning objectives, or example of the expected outcome of an assignment, e.g. in producing a flash animation. )

The main research question asked by the pilot groups is: How can we motivate students to prepare themselves independently by means of the available web lecture ?

Educating and guiding students in their self-regulation skills to monitor their own learning process, should not only be the task of student counsellors/monitors. First years students need to be trained in their perception of learning and in gradually taking more and more responsibility for their own learning process.

In our professional bachelor programs we already find some good practices in successfully motivating students to use web/video lectures before attending the lab classes. In the program nursing one or two students are picked out in the beginning of the class to sum up and explain the steps that need to be carried out for the practicum. Some form of checking whether the students have learnt what is needed to start the practicum, is necessary. Especially with first year students. Their motivation to prepare themselves by means of the online lecture/video still has to be stimulated extrinsically so that they can experience the advantages for themselves. Gradually the students can be guided into intrinsic self-regulation.

This applies as well to students following regular seat-based courses as for non-regular students. Although we experienced students enrolling for distance education programs to be already much more motivated and independent then first year traditional students.

## 6.3 Technical and practical usability aspects

Several techniques can be used to produce web lectures. In the Netherlands Universities are using fully automated server packs (such as Media Site) which control the whole flow form recording till broadcasting automatically. The lecturer just had to press the button... The result of such a recording is illustrated below in fig.2 In the left corner: the video of the lecturer teaching (talking head), on the right: the beamer projection, which can be the projection of the powerpoint-sheets, a webpage, a computer simulation, a digital smart board. An important didactical advantage of these software packages is the flexible navigation functionality. The student can scroll by selecting a slide. A huge disadvantage... the cost price ! This makes it for small scale institutions of higher education not realistic.


Fig. 2 A web lecture from TU Delft produced with Mediasite

At present the University of Leuven is designing its own automated recording system and searching for a solution to fulfil the demand for a flexible navigation functionality.

In choosing the production technique for the web lectures of our pilots, we are trying to find a balance between what is optimal for student learning, what is a realistic engagement of the lecturer and what is financially realistic for the school / faculty.

The choice of a specific technique is made also in function of the didactic objective. For repetition and replacement purposes the above illustrated automated recording systems for stand-alone web lectures are recommended. The penning institution of the project, the University College KAHO Sint-Lieven, is designing mobile units to offer a sufficient alternative to this service.

For designing web lectures for remedial teaching, small scale software to make screen casts, can be used. Such as Camtasia or Adobe Captivate, or other freeware software for making screen casts. A screen cast is a recording of everything that you can see and hear on the screen of your computer.


When connecting a document camera or touch drawing path (sympodium) to your computer, you can draw by hand an explanation for students or make an exercise building it up step by step, while also recording your narration. In this way the learner is supported in an audio-visual way as if you are sitting next to him/her. – with the restriction of immediate interaction however – Online interaction can also after viewing the web lecture be organised.

Adobe Presenter is a software program that facilitates adding narration (your voice) and your talking head to your Power Point presentation. In a very easy way a stand-alone presentation is made. By adding feed forwards, and quiz-questions it can almost resemble a real learning path.

Complete learning paths - as in independent all comprised digital learning material with a fixed or flexible/interactive learning path - ensure that the web lecture is properly incorporated in the total learning process. In that way it is explicitly linked to the learning activities necessary to process/apply the provided information in the web lecture. However designing a learning path requires some extensive development work of lecturers. An alternative is incorporating separate web/video lectures in the Blackboard learning community with links to introductions/feed forwards, exercises/assignments, related text or other learning materials and (self-evaluation) tests.

## 7 CONCLUSIONS

A student concern: “Will we only see bad teaching in web lectures ? “

In one of the study days of our University a student representative in expressed his fear that by providing a very usable automated recording system for recording lectures, lecturers would be invited to even give more of ex-cathedra style of teaching. Moreover because of technical restrictions lecturers are often advised not to move around too much, making the lesson less dynamic. Also audio recordings are technically very demanding, therefore sometimes seducing lecturers not to take the risk of too much dynamic interaction between the lecturer and his students and students amongst each other.

This project focussing on “a good use of web lectures” wants to counteract these developments. We do not restrict our research to the type of web lectures that are recordings of non-interactive lectures. We want to promote the use of web lectures whereby the effects on learning are optimized, by stressing the importance and possibilities of stimulating an active and reflective learning process.

We do not only describe the didactic scenario’s for use of web lectures as a repetition tool for what has not been remembered, heard or understood during the lecture. We focus mainly on the use of web lecture as a preparation tool for the in- class- contact time, as well for theory lectures as for labo/practica. The saved time for providing information by using a web lecture makes it possible to guide the individual learning process of the student during the in-class- contact-time. Thereby we

contribute to the paradigma shift of perceiving teaching as “saying what I have to say” into “how can I support my student into learning what he wants to learn.”

In our educational concept of guided independent learning web lectures can contribute tremendously when used effectively and targeted towards a specific purpose . We can incorporate them in a blended learning environment. We can also design some for remedial teaching. The main didactical challenge is to support, train and guide our students into self-regulation of their learning process. We have to give special attention in the design of our web lectures to specific techniques to support this self-regulation and reflection on learning: feed forwards, self-evaluation questions, feedback mechanisms, and in gradually moving from extrinsic motivators to intrensic.

Not only for regular students in a blended learning environment also for distance education students and other students mainly learning by means of online courses, these instructional design principles in supporting the meta-cognition on the learning process apply.

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