Web Lectures for Authentic Workplace E-Learning

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Abstract—This paper reports from a study aiming at formulating a prescriptive design theory to support the development of scholastic/formal work-integrated e-learning systems. A framework for authentic learning, developed and evaluated in a school setting has guided the instructional design of a web lecture application. Adapting authentic learning to a formal work-integrated e-learning context calls for a simplification of the framework where some elements of authentic learning become peripheral whereas others become more central.

Index Terms—Authentic learning, Design science research, Web lecture application, Work-integrated e-learning

I. INTRODUCTION

When discussing learning in the workplace a distinction is often made between informal learning e.g. when colleagues tell stories about and discuss their daily practice [1] and more formal learning e.g. attending a course in a subject of relevance for the work practice [2]. These learning activities might or might not be supported by technology. Supporting formal learning at work is hereafter referred to as formal work-integrated e-learning.

This paper reports from the initial steps of formulating a prescriptive design theory to support the development of formal work-integrated e-learning systems. The setting is within the county administration in Sweden. The county administration has initiated a corporate university called the academy of the county administration, aiming at delivering courses for all employees on a national basis. For this purpose an application for delivering web lectures (web lecture application) was designed using the design research cycle by Vaishnavi and Kuechler [3]. We make a distinction between web lectures and web courses, web lectures are shorter efforts than web courses. In our case the web lecture is around one hour and seeks to develop the employees search skills on the WWW, although the content of a web lecture application could be of any topic. The instructional design was guided by the authentic learning framework by Herrington and Herrington [4] (rooted in the socio cultural view on learning [5]) and the graphical user interface was based on theories from the field of Human Computer Interaction (HCI) [6-8].

In the two following sections the first and second version of the web lecture application is presented and the final sections discuss and conclude how authentic learning can be adapted for formal work-integrated e-learning.

II. WEB LECTURE APPLICATION, VERSION I (PILOT)

Embedding authenticity in the learning methods i.e. anchoring learning in real-world situations and problems, is essential the learning process [9]. This is the base for the authentic learning framework by Herrington and Herrington [4]. The authentic learning framework has 9 central components, namely authentic context, authentic activities, expert performance, multiple perspectives, collaboration, reflection, articulation, coaching & scaffolding and integrated assessment (see section F for a more detailed description and how it is applied). An early version using Synchronized Multimedia Integration Language (SMIL) was developed and dismissed since it demanded a SMIL player to be installed before the web lecture application could be used. Therefore a pilot version using HTML and streaming video was developed. This section presents the pilot version of the web lecture application and the result of the first design research cycle which indicated that support for, above all, articulation, assessment and collaboration from the authentic learning framework [4] needed to be addressed (figure 1). The assessment would also deepen the reflection.

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Figure 1. The Design Research Cycle adapted from Vaishnavi and Kuechler [4]

From the main navigation scheme (figure 2) the users can reach the streamed videos, a discussion board, information on how to contact the teacher and a list of links with additional resources on how to search the WWW. The users can also get back to the starting page (Home) of the web lecture application where the web lecture objectives and the main navigation scheme are explained.
A. The home section

Here the users are informed about the overall purpose and content of the web lecture application and that the time to finish the web lecture is estimated to approximately one hour.

B. The web lecture section

The web lecture section is made up by streamed videos embedded in XHTML pages (figure 2). The videos are either narrated slides or narrated screen captures. The video consists of an introduction, search techniques and search strategies with 4 assignments in between. In all there are nine modules ranging from 3 to 8 minutes each.

1) Introduction

The introduction gives a short history of the Internet, the different services Internet provides (e.g. WWW and e-mail) and what an intranet is. Then WWW as an information resource is discussed in relation to validation of information and meta data. The introduction concludes with a basic explanation of how the web browser connects to the web server when fetching the web pages and how the XHTML pages are parsed and interpreted by the web browser.

2) Search techniques

The module on search techniques uses Google as example and starts with a presentation of the different categories to search within: Web, Images, Groups and Category/Classification. A simple search for the Beatles home page is shown followed by a demonstration on how to use the minus sign for excluding words and quotation marks to search for phrases. Advanced searches, such as searches within a certain domain, from a certain date and so on are also elaborated upon. It ends with different ways of searching (free text searching vs classification systems) and the issue of getting relevant search results.

3) Search strategies

The module on search strategies starts by discussing alternative sources for information retrieval such as the county administrations own intranet and libraries. Strategies on when to use free text searching or classification systems are discussed. Different strategies on how to use the right set of key words and equivalent terms are also discussed along with the importance of critical consideration of the sources to information found on the WWW.

C. The Discussion section

In the discussion section the users where encouraged to post difficult searches, successful or not, that they have had and/or about the web lecture application in general.

D. The contact the teacher section

Here information about the teachers e-mail where available and a text stating that they were welcome to contact the teacher about anything related to the web lecture application.

E. The read more section

This section with links to resources on the WWW about searching on the WWW was divided into two parts, one with links to Swedish resources and one with links to English resources. The links where:

In Swedish

- Vilseledning på Internet (Deluding on the Internet) (http://www.psycdef.se/templates/PublicationItem___279.aspx)
  A publication about critical consideration of the sources by Gunnar Sjöstedt, assistant professor in political science and Paula Stenström, phil.cand. in political science.
- Stora sökguiden (The big search guide) (http://stora-sok.bth.se/)
  An interactive course in how to search, value and process information by Blekinge Institute of Technology.
- Lilla sökguiden (The little search guide) (http://www2.bibliotek.hv.se/sogkuiden/)
  The big search guide in a smaller format adapted by University West.

In English:

  A step by step guide on how to find information on the Internet by Berkeley University.
- Searching the WWW: Tutorials, Techniques, Tips (http://keithstanger.com/search.htm)
  A collection of links with over 30 links to web sites relating to “searching the Internet”.
- Evaluating Internet Research Sources (http://www.virtualsalt.com/evaluslt.htm)
  An article by Robert Harris on how to search for and validate information on the Internet.

F. Design rationale for the instructional design

In this section the design rationale for the instructional design is outlined using the elements of the authentic learning framework [4].

1) Authentic Context
An authentic learning environment should provide an authentic context that reflects the way the knowledge will be used in reality [4]. In a similar way Hung and Chen [10] promote that e-learning environments should create a situation where there is continual interest and interaction embedded in the environment. The web lecture uses the Google search engine when exemplifying the different search techniques. The Google search is engine the most commonly used within the organization as well as search techniques. The Google search engine when exemplifying the different search techniques does not differ radically when it comes to the essential ways of searching. Most probably, they will use Google in the same way as in the web lecture and at the same computer.

2) Authentic Activities
An authentic learning environment should also provide an ill-defined authentic activity that encourages the students to find and solve problems [4]. The examples used when exemplifying the different search techniques are not from their everyday work practice and they are encouraged to use examples from their work practice in the different assignments. Manipulating with the material also enhances learning rather than just passively observe others manipulate the material [11] which is why there are four assignments where they use the different search techniques on their own. This is also stressed by Hung and Chen [10] when they state that e-learning environments should facilitate the activities and processes in which the learners are engaged.

3) Expert Performance
Authentic learning environments provide access to expert performances by letting the student observe the task before they try themselves [4]. In the web lecture the teacher demonstrates the different search techniques to the students by recording actual searches with screen captures that are shown to the students. As mentioned above the students then attempt to use these techniques on their own.

4) Multiple Perspectives
An authentic learning environment provides the learner with the opportunity to investigate multiple roles and perspectives [4]. In the web lecture different ways of searching, e.g. free text searching vs classification systems and searching the WWW vs going to the library are discussed. Furthermore the students are provided with online resources where they can go into depth and read about the subject from other perspectives.

5) Collaboration
An authentic learning environment supports the collaborative construction of knowledge [4]. The flexible character of the web lecture makes it difficult to support and promote real time collaborative learning since it is very uncertain how many students will take the web lecture simultaneously. Collaborative learning could to some extent be supported and promoted via a threaded debate board where students could be asked to post difficult “searches” of interest for their work and how they solved the problem. Then others could be invited to comment or even help if the problem is not fully solved.

6) Reflection
Students learn better when they are given the opportunity to reflect during the meaning-making process (Moreno 2006), hence an authentic learning environment promotes reflection to enable abstractions to be formed [4]. By using examples that are not from their daily practice, in our case a search for the Beatles on the WWW (see figure 2), and then encouraging the students in the following assignment to use the techniques with search words that mirrors their own work practice we help them reflect on what they have learned and how it can be used in their daily practice. In this way the e-learning environments focus on real tasks and enables learning through doing and reflection-in-action [10].

7) Articulation
An authentic learning environment promotes articulation to enable tacit knowledge to be made explicit [4]. In e-learning environments this is often supported by debate boards where students groups are to reflect on a subject and give substantial comments on other students’ comments as a part of the examination [e.g. 12]. Again the flexible nature makes it hard to create working groups for the students but a debate board where the students can evaluate and self assess what they have learned during the web lecture could be a possibility.

8) Coaching and Scaffolding
An authentic learning environment provides for scaffolding of support and coaching at critical times [4]. The students will during the web lecture be able to e-mail the teacher if there is something that is unclear or if they have questions in general. During the period of time when the web lecture is being tested the students will receive feedback within 24 hours and often sooner. Hung and Chen [10] argue that e-learning environments should have scaffolding structures that utilizes the genres and common expressions used by the community. In our case the teacher is not from the Scandinavian public body, so that could pose a potential problem. Being aware of this problem the teacher will check any uncertain questions with the case representative at the county administration.

9) Integrated Assessment
An authentic learning environment should provide for integrated assessment of learning within the tasks [4]. Here the debate board could also serve as a way of assessing their learning outcome by reviewing and getting reviewed by their peers.

G. Evaluation of the web lecture application version 1
The first version of the web lecture application was evaluated through an online survey with 15 participants alongside with web logs. The survey was designed to explore two major concepts:

1. User behavior, i.e. how often did they visit the web lecture application, did they view parts of it multiple times, at what pace did they participate, did they engage in the assignments and the read more section?
2. User satisfaction, i.e. where they satisfied with the length and the content, did they learn anything new and if so do they apply this new knowledge in their everyday work?

1) User behavior
Web log data from a two and a half month period where compiled and analyzed with Nihuo Web Log Analyzer 3.25. During that period the 15 participants had visited the web lecture application 74 times and stayed there for a total of 12 hours and 37 minutes. The average stay per active day (24 days in total) lasted 31.5 minutes. According to the survey ¼ visited the web lecture
application once while the rest visited the web lecture application two times or more. 44% claimed that they went back to the web lecture application to view parts of the web lecture a second time.

The activity statistics from the web logs show that the most active day of the week was Thursday, although the activity was quite evenly spread throughout the work days of the week with no activity during the weekends. On average over a day the activity was higher in the midmorning than in the afternoon and peaking before and after lunch (Figure 3).

![Figure 3. Visits by hour of day.](image)

According to the survey they all felt they could interact with the web lecture application on times and intervals at their convenience. 80% did two or more of the four assignments in the web lecture application and more often than not in connection to the video clip leading up to the exercise. The majority did not feel it important to collaborate or discuss the subject of study with others and none of them contacted the teacher.

2) User satisfaction

The majority of the users found the content of the web lecture application to be relevant and where satisfied with the web lecture application as a whole. All the users learnt something new (ranging from not so much to a lot) and all but one had changed the way they searched after finishing the web lecture. The respondent who did not change the way he/she searched used the computer 10 hours a day, whereas the response average on that question was 6.20 hours. 67% would like to participate in a similar activity on another subject of interest for them and whereas 27% where uncertain.

H. Implications for re-design

Collaboration promotes reflection and critical thinking and in order to obtain that a debate board was incorporated in the web lecture application where the users asynchronously could discuss difficult and problematic searches and how they solved them. If a search problem was unsolved others could suggest a solution. In this way they could reflect on their own learning while giving or receiving feedback or just by reading others discussion. Since it would be closely connected to their work practice these lessons learned would also be interesting from an organizational learning point of view.

Despite this, the debate board was unused and they expressed in the survey that they did not feel collaboration as an important aspect. All though the users all expressed that they had learned something new and the changed ways of searching indicate reflection at some level, it could be argued that the learning outcome would be of more relevance if they were encouraged and coached to reflect even more. To address the shortcomings of the unused debate board an assessing assignment was developed, giving the teacher/instructor a more active role. In order to further motivate the completion of the assignment rendered in a certificate.

Assessment is not only a way of measuring the learning outcome, but assessment is probably what affects how students learn the most [e.g. 13]. If reflection is deemed to be of importance for the learning process the assessment should consequently focus on reflection. In the re-design of the web lecture application, an assessment based on peer-review and expert feedback is incorporated into to web lecture application (figure 4).

![Figure 4. The assessment process](image)

The assessment is two folded one part where the employees receive feedback from their peers and one part where they receive feedback from an expert. For the assessment the employee describes a search they have done relating to their work practice on which they get expert feedback. They are also to comment on a search description handed in by another peer to actively reflect upon and apply the knowledge they have gained. This addresses the potential lack of articulation, collaboration, assessment and reflection which are central for authentic learning [4].

The survey concurs that the web lecture application sufficiently provides the flexibility demands concerning time, place and pace a formal work-integrated e-learning setting puts forward. The web lecture application is available everywhere there is a computer and an Internet connection which satisfies the time and place aspect. The video parts are divided in logical sections ranging from 3 to 8 minutes, which gives the users the opportunity to return at a pace that suites them, when they take a break or get interrupted.

III. WEB LECTURE APPLICATION VERSION 2

This section presents the second version of the web lecture application and the result of the second design research cycle. In the second version the assessment module was incorporated into the web lecture application under a section named “certificate” that replaced the “contact the teacher” section. Information on how to contact the teacher was moved to the “home section”. In that section the assignment was described and it was estimated that it would take 15 to 30 minutes to complete. The web lecture application was the evaluated through interviews and a survey and a simplification of the authentic learning framework [4] for formal work-integrated learning is suggested (figure 5).
A. Evaluation of the web lecture application version 2

The web lecture application was evaluated through web logs, an online survey with 11 respondents and 10 interviews. The web log data is from an eight month period and during that period the web lecture application was visited 109 times and the users stayed for a total time of 20 hours and 44 minutes. The average stay per active day (46 days in total) is 27 minutes. The users where mostly active at the beginning of the week with a big dip in activity on Fridays. Contrary to the pilot study there was some activity during the weekend, although very little. In conformity with the pilot study the activity where lower in the afternoon than before lunch. However, in the 2nd round there where a clearer pattern of activity at the beginning of the workday and in connection to lunch with a break around 9 and 10 AM (figure 6).

![Figure 5. The Design Research Cycle adapted from Vaishnavi and Kuechler [4]](image)

During the test period none of the 20 participants chose to do the assignment in order to get the certificate. When asked about the reason for this in the interviews the most commonly answer was lack of time and no real interest in a certificate. The debate board was still unused and when asked about collaboration with other learners they still felt no need for that although some of the employees had discussed the content with local colleagues or members of their family. They expressed that it made more sense to discuss with their local colleagues, even if the colleagues did not participate in the web lecture:

“because it is more spontaneous at the coffee break and yes, sometimes when I visited someone. I’ve even made suggestions during meetings.”

![Figure 6. Visits by hour of day.](image)

The employees also pointed out the importance of easily being able to continue the web lecture after a break or an interruption. Another aspect that came out of the interview process was the fact that some needed a push to get started. When some of the employees’ where contacted for the interview they said that they have not had time to do the web lecture yet although they would very much like to. They asked us if we could get back to them in a couple of months and when we later contacted them, they had all finished the web lecture.

IV. Simplification of Authentic Learning

Herrington and Herrington [4] intended their framework to guide the design of effective and immersive learning environments both for face-to-face and technology mediated courses. Looking at the implications for design when authentic learning is mediated by technology in a formal work-integrated setting, some elements of authentic learning becomes peripheral whereas others become central. This is not to say that the peripheral elements are peripheral in the learning process as a whole. E.g. collaboration and articulation promotes reflection and critical thinking which is central to the learning process. The employees did not feel the need to collaborate with others participating in the same course, but some of them had discussed what they have learned with colleagues and friends. Even if the employees to some extent felt the need to collaborate, they did not feel the need for the collaboration to be mediated by the web lecture application.

Often when students are assessed in a school context, it is the extent to which they are able to reflect upon and apply what they learned. Providing for the opportunity to be effective performers with the acquired knowledge should also be the natural goal for practioners. To seamlessly integrate assessment with this activity is sensible in a school context but in a work-integrated context it is more of a self-regulating process. The fact that the majority of the employees in both evaluations state that they have learned something new and have changed the way they search for information points to them having reflected upon and applied what they have learned to their work practice.

Bloom identified six categories or levels of educational goals within the cognitive domain; knowledge, comprehension, application, analysis, synthesis, and evaluation [14]. Usually university courses aim at the low and intermediate levels of Blooms taxonomy in the first years to end up at the higher levels in the final years. Content bearing the characteristics like that of searching the WWW does not need to reach the higher goals of Bloom’s taxonomy (Analysis, Synthesis, and Evaluation) to be valuable for the individual learner in a work-integrated context. Being able to apply the new knowledge and techniques from the web lecture (e.g. using quotation signs for searching for the lyrics of a song as used as an example in the web lecture) to their own work setting (e.g. searching for information on chemicals) is satisfactory if this makes the task at hand easier and is carried out more efficient.

A. Peripheral elements of authentic learning for formal work-integrated e-learning

The peripheral elements to be supported by technology in formal work-integrated e-learning are; collaboration, articulation and integrated assessment. Although collaboration and articulation is a well known catalyst for learning and reflection, web lectures aiming at the three first levels in Bloom’s taxonomy does not need to be
supported by the web lecture application. The learners (the employees) in our study discussed it with local peers not attending the web lecture rather than other colleagues also participating in the web lecture.

The integrated assessment is taking place even though it does not leave digital trails. When the employee tests what has been discussed in a module, e.g. how to use the minus sign when doing a search, they assess what they have learned and get feedback from the task. When an assignment was added to the web lecture application none chose to do it even when it was connected to a certificate.

B. Core elements of authentic learning for formal work-integrated e-learning

The core elements that should be supported by technology in a formal work-integrated e-learning setting crystallized by the study are; authentic context, authentic activities, expert performance, coaching and scaffolding, multiple perspectives, reflection.

Providing an authentic context, i.e. the learning content should reflect the context and the way it is to be used. While this might seem obvious the authentic activities, e.g. exercises, should be ill-defined or described at a low level so that the employee is encouraged to find and solve problems from their own work practice. One of the big advantages of e-learning is the possibility engage experts so the employees’ can watch how the expert performs a task before trying it themselves. Having access to multiple perspectives can help employees’ understand better and get a deeper understanding and does not necessary have to be costly. If learning material illustrating the content from different perspectives all have to be created by the developers it could be costly and time consuming, but in our case the WWW was used as an additional resource. Reflection is at the core of all learning activities making it important to create content and interactivity that encourages reflection.

C. Additional elements

In addition to the elements from the original framework, the evaluation suggests that the framework should be extended with the concepts of modularity and push. Modularity in the sense that the web lecture should be divided into logical, smaller modules making it easier to continue where they left off. Push in the sense that some kind of reminder will help pushing the employees’ to get started.

V. CONCLUSION

Adapting authentic learning [4] to the conditions of formal work-integrated e-learning when the learning goals are at the low and intermediate end of Bloom's taxonomy [14] calls for a simplification of the framework. Articulation, collaboration coaching & scaffolding and integrated assessment becomes peripheral, whereas authentic context, authentic activities, expert performance, multiple perspectives and reflection become more central. As suggested by the evaluation, the concepts of modularity and push should also be added to the framework.

REFERENCES