

From crisis to creativity: undergraduates craft their own online learning modules

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Abstract: We investigate the creation of online teaching material by a highly heterogeneous group of undergraduate students using an open source learning management system. The case study is based on a didactic experiment with 144 students carried out over two consecutive semesters teaching a business information systems course. We identify and discuss the conditions under which the students can create valuable online learning modules in terms of didactics, student project management, technology and organisational support. In the course of the self-directed learning and teaching experiment, we follow the students from a state of initial group crisis to the creation of a portfolio of diverse, creative and interesting content, which could form the basis of a modular library of content. We discuss how our approach to blended learning relates to contemporary didactic approaches such as learning through teaching and constructivist/cognitive approaches. The discussion places the learning management results in the context of current debates on diversity in the classroom, in particular with respect to gender mainstreaming. Our conclusions support a greater emphasis on cultural and gender diversity specifically in technology-centered teaching and learning.

Keywords: learning management system, ILIAS, open source, constructivism, learning through teaching, creativity, coaching, e-learning, constructivism, diversity

Biography: Marcus Birkenkrahe got involved in the development of the World-Wide Web in the early 1990s as a graduate student of physics and never looked back. He has been involved in e-learning activities as a learner, a teacher and as an executive for large multi-national corporations. He is currently Professor of business information systems at the Berlin School of Economics, Germany's largest business school, and heads the school's e-learning programme. Matthias Mundt is a graduate student of economics at the Berlin School of Economics. As a teaching assistant he focuses on new course development and e-learning support.

1 Introduction

As a result of the success of general-purpose content management systems (CMS) in the business, learning management systems (LMS) (which are CMS specialised on serving content for learning purposes) have become very popular in the past decade - both in the context of business and academia. One of the things LMS ought to be good at is the creation of modularised content in the form of online learning modules (Baumgartner et al., 2004). There are a number of reasons for this: (1) When content is transferred from the physical teaching session to virtual/online sessions, time is freed up for teacher-learner dialogue and group work. (2) Learning modules can (re-)engage the learner in a different way e.g. through change of media and

use of online sources. (3) The learner gains more flexibility because she can cover material in a self-paced fashion. (4) Learning modules can be used as building blocks of a content library, which might be used in the future for teaching or helping to develop new courses.

In terms of technology, many institutions of higher education offer an LMS capable of creating stand-alone online learning modules (OLMs). With the Sharable Content Object Reference Model (SCORM) (see e.g. Liu et al., 2005), an international standard of information architecture is readily available, which is supported by many LMS with large user communities such as Moodle¹, ILIAS² or Blackboard/WebCT³. In the teaching practice, however, the technical and didactic effort to create OLMs is considered too much for many teachers (see e.g. Scholl et al., 2008). As a consequence, the LMS degenerates to an electronic filing system, and their potential to support physical teaching in a blended learning framework remains untapped.

The question which we asked ourselves as teachers is whether this threshold to create OLMs can be lowered and how. In order to address this question, we executed an experiment with a highly diverse, large group of undergraduates in a course on "business information systems" at the Berlin School of Economics (BSEL). Over a period of two semesters, 28 teams of students were asked to create their own learning modules on self-selected topics related to business information systems. We thought if undergraduates could produce valuable teaching content, then highly trained teachers should have not more and possibly fewer difficulties in doing so.

After a short description of our methodology (section 2), the bulk of this paper is a detailed case study of the setting (section 3), the execution and selected results of this experiment in content creation using the ILIAS open source learning management system (section 4). Since this LMS constituted an important part of the course environment, we give a summary of all e-learning objects offered by ILIAS that we and the students used in the course. We give an overview of four selected student learning modules (section 5) and then offer a discussion of the results (section 6) with respect to didactic value of our experiment, the resulting challenges and requirements for course management, technology and organisation and the relevance of cultural diversity for our case study. The discussion also includes a brief attempt at locating our approach within constructivist educational theory. In our conclusions (section 7) we summarise our main findings and give recommendations for similar student experiments, highlighting the need to foster cultural diversity in order to stimulate higher learning performance by undergraduates.

2 Methodology

We use the case study method as a method of qualitative research, focusing on the learning situation of two undergraduate level university courses. We chose this method because we wanted to gain insights rather than statistically significant evidence. It also allowed us to follow interesting and unexpected events in great detail. The case study method is routinely used in technology learning research (see e.g. Yin, 1994).

At the same time we use methods of systemic action research (SAR) in a teaching environment at an institution of higher education (see e.g. Kolb, 1984; O'Brien, 2001; Burns, 2007). SAR considers human systems as constructed, systemic entities with particular attention to system boundaries, to the relationships of actors within the system, and to the relationships between systems. We interpret SAR as an approach of inquiry helping us to structure interventions in real systems (in this case a university course). It is closely linked to constructivism: "The best way to understand something is to try to change it." (Greenwood and Lewin, 1998). In management, action research became known especially through Argyris (1993) and is

1 Moodle, open source LMS, home page at <http://www.moodle.org> [accessed 15/03/2009]

2 ILIAS, open source LMS, home page at <http://www.ilias.de> [accessed 15/03/2009]

3 Blackboard (formerly called WebCT), commercial LMS, home page at <http://www.blackboard.com/> [accessed 15/03/2009]

founded on social-psychological research principles first articulated by Kurt Lewin (see e.g. Lewin, 1946). Here, we have a similar situation as in teaching, because we cannot create a purely experimental situation - instead we must deal with many overlapping systems being present simultaneously. Also, our primary interest is a meta question about the usability of LMS in a classroom setting where students become teachers themselves. Hence, the different methods we employed to answer the meta question were also teaching interventions influencing the learning process of our students. In SAR, this phenomenon is well known and is used to ground research results in real life.

For our research, we followed 144 male and female undergraduate students in two different group settings over a period of six months, or two consecutive semesters, between April 2008 and March 2009. For the case study, we describe the events in class month-by-month covering one semester. Our data come from several sources: student term papers; final presentations of student teams; online learning modules (OLMs) created by student teams; and a survey filled in by the students regarding their own impression of other students' OLMs.

Since the events in each semester turned out to be similar, we decided to describe the course of events during the second three-month period, even though we had in fact recorded events in three different groups over six months. The course content remained the same for each three-month period, only the number of students in the second test group was larger. Since the results of the survey completed by the smaller first test group were unfortunately lost due to a server crash, we only present a selection of the cumulated results of the survey for the second test group in those categories relevant to our research question.

3 Boundary conditions

3.1 The School

The Berlin School of Economics and Law (BSEL) is one of Germany's largest business schools with ca. 8,000 students and ca. 500 teaching staff offering more than 30 different study programmes. Since 2003, the school offers the ILIAS open source LMS to all lecturers and students. Other e-learning tools used by a small number of lecturers in class include the Moodle LMS, Mediawiki⁴ installations, WordPress⁵ blogs and the Wiziq⁶ telelecturing platform. Compared to ILIAS, none of the other tools command large number of users at the BSEL at the time of writing.

Training and didactic support for the ILIAS installation is provided by a team of 7 students (hours equivalent to nearly 2 full time staff) and a team coordinator working half-time. Technical support is provided by two professional staff operating from within the school's computer centre. The entire effort is led by one of the authors, a full-time professor of information systems with an official time allotment of 2 days per month. The e-learning team communicates widely with the school and its members using an e-learning blog, a semi-annual newsletter, an annual report for the president, articles in relevant school journals, and various introductory training events spread out over the year, for both teaching staff, administrative staff and the student body.

BSEL operates a successful equal opportunities policy execution, for which it has repeatedly been recognised nationally: about half of the teaching staff (including permanent professors) is female. We find the same ratio among the students. At the school, e-learning is considered an active contribution to gender mainstreaming and, compared to other schools, the willingness of female students to engage with technology is not

4 Mediawiki, open source Wiki software system, home page at: <http://www.mediawiki.org> [accessed 15/03/2009]

5 WordPress, open source Weblog software system, home page at: <http://www.wordpress.org> [accessed 15/03/2009]

6 Wiziq, free web-based virtual classroom system, home page at: <http://www.wiziq.com/> [accessed 15/03/2009]

noticeably lower than that of the men. This is indirectly relevant to our case study, because male and female students participated equally in our experiment even though female students traditionally show greater reluctance to engage in topics judged to be more technical.

3.2 The Course

The experiment was undertaken with two test groups, first in the summer term of 2008 with 39 students and then again, because of the very encouraging results of the first group, with a larger test group of 105 students during the winter term of 2009.

The initial test group (summer term 2008) was comprised of 39 students in the second semester of the bachelor programme “International Business Management” (IBMan). This 4-year programme is special because it is taught entirely in English and because the students spend 1.5 years at the end of their studies abroad, including a practice semester and one year of study at one of BSEL's over 70 partner universities. The programme is in its second year and hence relatively recent. Half the group was male and the other half female. Noteworthy, though not unusual for the school, is that one fifth of the students had nationalities other than German. It would be interesting to look into possible influences of both national background and gender for our research question, but we have not yet done this.

The second test group (winter term 2008/2009) consisted of two subgroups: one was the follow-up cohort in the IBMan programme, with 39 students. The other was a pool course with a total of 66 students from different courses of study. This course had 27% foreigners, including students with 18 (!) different nationalities, which was unusual even for the BSEL. At the school, students must take two courses conducted in English, while most courses are taught in German. For the majority of students, the requirement to follow a course in English for an entire term, including discussion, homework and other graded tasks, was a considerable stretch.

The course topic “business information systems” is the second of two courses for undergraduates on information technology in modern enterprises, usually offered and taken in the 2nd semester of studies. It covers a wide range of subjects including business process management, business process modeling, database management systems and ERP systems, as well as a general introduction to digital enterprises. The course was taught by one of the authors and continuously supported by the other author as his teaching assistant. The students were told at the outset of the course that they would have to create an ILIAS online learning module as part of a semester-long project on a self-chosen topic, and that they would have to report on their experiences and results both as a team (through a group presentation) and as individuals (through a term paper written like an executive summary). The student grade was composed in equal parts of the grade for the group presentation and the grade for the individual term paper. In the second test group, students could further improve their grades by participating in optional online tests and by giving an additional short presentation on a topic of their choice.

In order to select a topic for their learning module, the students grouped themselves in teams of varying sizes (between 3 and 7 members per team). In the first test group, there were 10 teams, in the second test group, there were 18 teams, so that 28 online learning modules were created altogether by the first and second test group between April 2008 and March 2009.

3.3 The Support

All students already had experience as users of the ILIAS LMS from various courses in the previous semester. This experience was limited, however, to accessing course materials provided by a lecturer, which is the way in which most lecturers at the school use the LMS. Students of the IBMan classes had also gained some experience in the use of Mediawiki through one lecturer's private wiki installation used for teaching

purposes⁷. An unknown part of the second test group had also worked on another lecturer's wiki⁸.

The student test groups were trained in sessions with exercises by members of the BSEL e-learning support team on different aspects of the LMS: (1) Creation of student groups, creation and use of forums and wikis, followed by ILIAS online test for self control; (2) creation of ILIAS learning modules, and (3) creation of ILIAS online tests. The first test group received about 2 hours of classroom training at the beginning of the term. After feedback from the first test group, the second test group was given three training sessions of 1.5 hours per session.

The session trainers were available to the students outside of class, to answer detailed questions and sort out technical issues when needed. Most student teams made use of this offer, especially as the term drew to a close and they were working on their own learning modules.

In addition to the classroom training and the online tests, the student project teams could participate biweekly in coaching sessions of 20 minutes' duration with the lecturer. These sessions were initially used to get the projects going and help the teams work through sometimes difficult group dynamics. Gradually the focus of the coaching sessions shifted from discussing the working method to discussing the work itself, to the content and finally to the didactic goals, structure and value of the learning modules as the teams' key deliverable.

A discussion forum was created in the general course area to make questions from individual students available to the entire group, make answers from the lecturer immediately available to all with the possibility of discussing these, and encourage students to discuss among themselves and solve each other's problems. Lastly, the students in both test groups had access to the teacher's Mediawiki installation⁹ where they could create content collaboratively. Only the second test group had access to, and could create, their own wiki within ILIAS (which first became available with ILIAS version 3.10 in October 2008).

In the first test group (April to July 2008) a clear pattern emerged in the course of the term, which was confirmed when the experiment was continued with the larger second test group (October 2008 to January 2009). For each of the three months, we present this pattern in section 4 by explaining the different activities and issues that emerged, using one month as an observation interval.

3.4 The technology

Though the technology of LMS in general, and the LMS that we used in particular, are not at the center of our research questions, we think it important to summarise the possibilities of ILIAS, to give an idea of what kind of technology the students were facing. In the last few years, most commercial and non-commercial learning management systems (e.g. Moodle, Blackboard, etc.) have been rapidly converging. As users increasingly get used to social networking and collaborative tools, most LMS creators seem to find it necessary to integrate these tools. A discussion of the pros and cons of integrated learning management systems vs. a more diversified electronic learning infrastructure is beyond the scope of this article.

ILIAS is an open source web-based learning management system. It supports content management and various tools for collaboration, communication, evaluation and assessment. The software is published under the GNU General Public License (GPL) and can be run on every server that supports PHP and MySQL. The first prototype of ILIAS was developed in 1997 at the University of Cologne, Germany. Version 1 of the software was published in 1998 and labelled open source software under the GPL in 2000. In 2004, it became the first open source LMS that reached full compliance with the SCORM 1.2 standard for LMS. Currently in version 3.10, ILIAS is also the first open source LMS worldwide that has reached SCORM 2004 (3rd

7 Private Wiki installation of Prof. Dr. Axel Benz at: <http://www.axelbenz.de/wiki>

8 Private Wiki installation of Prof. Dr. Heike Wiesner at: <http://www.heike-wiesner.de/wiki> [accessed 15/03/2009]

9 Private Wiki installation of Prof. Dr. Marcus Birkenkrahe at: <http://wiki.birkenkrahe.com> [accessed 15/03/2009]

edition) compliance. There are several hundred known installations of the system in industry and higher education institutions.

Table 1 presents a number of e-learning objects that are offered by the ILIAS LMS and that were used in the course. We give a brief description of each object and an application scenario in class.

	E-learning object	Application scenario in class
1	File - any file (image, document, presentation, movie of the file type PDF, JPG, DOC, SWF, WMP etc.)	Class material can be uploaded as Files so that they are readily available to all course participants.
2	Folder - place for Files and other e-learning objects (e.g. tests, wikis, web resources).	Web links, video clips, presentation slides or administrative documents (e.g. cover sheets for presentations, a syllabus etc.) can be moved to a Folder for each of these categories, e.g. "admin", "slides", "tests" and "exercises" to maintain order and ease navigation.
3	Group - with a Group you can create own areas in ILIAS and freely change permissions to control access to your area.	A Group provides a protected space for activities of a group, such as discussions (via Forum), collaboration (via Wiki), creation of Tests and Surveys and to share information.
4	Web Resource - links within ILIAS or to the World-Wide Web	Web Resource objects can be placed in any Folder or Group and point to Internet resources, such as videos, podcasts or blogs.
5	Mail - an e-mail system within ILIAS which can be used to send E-mail to ILIAS users.	Automated Mail is used to communicate with course participants while avoiding the administrative overhead of manual e-mail distribution lists. Can be restricted to ILIAS or with a redirect to student's Internet Email.
6	Forum - a news forum to exchange and archive information and opinions and to discuss threaded topics.	A Forum provides a repository and a virtual meeting place for discussion, e.g. on grading or ways of working. It also stimulates discussion among the students.
7	Glossary - collection of terms like a dictionary, in alphabetical order	The Glossary lists brief entries with definitions or questions with answers like a FAQ ("Frequently Asked Questions") list on the Internet. Useful as a repository of issues to be used across semesters..
8	Test and Exercise - objects to control learning progress (the Survey object is very similar to the Test object)	Tests and Exercises contain problems with solutions for student self-assessment or to engage students outside of class. They are highly customizable with respect to grading, (automatic) feedback and problem type.
9	Wiki - object for collaboration on texts in a group	The Wiki is an extremely versatile tool for group work, (including the collaborative creation of rich documents with different media types), for session protocols or for document annotation by students.
10	Mediacast - object containing podcasts or mediacasts	A Mediacast is a container for different media objects gathered on the World-Wide Web, or for instructor-created podcasts and videocasts as an addition to class instruction.

Table 1: ILIAS e-learning objects used in the course and application scenarios in class

4 The road towards online learning modules (OLMs)

4.1 First month protocol: basic skills and team formation

In the first month, students learnt to create and administer an ILIAS group within the student area of the ILIAS installation at BSEL. All project teams created their own groups (upon request) and protected them

against intrusion from users not on their team (not upon request). The lecturer was added as a group member to give him an opportunity to comment on the work progress.

Students were asked to complete their first online test. This test was constructed to show a maximum number of different test types (single choice, multiple choice, image type, text insertion etc.) so that the students would early on understand which options they had when designing online tests. Since the test solutions were conditionally linked to the test text, students could only look at the solutions if they had previously completed the test.

The lecturer began to communicate offline with the students using both the internal ILIAS e-mail and the discussion forum. At this point, most forum topics were created by the lecturer and related to information sharing. A few discussions were already started and focused on issues of navigating and administering e-learning objects.

Students received basic training on how to create an OLM in ILIAS and were, as an exercise, asked to create a simple (empty) learning module, export it to their computers as a ZIP file and import it as an answer to an ILIAS online exercise. Several students already used this opportunity to create interesting mini learning modules, often exhibiting their own flavour of humour.

For many students, this was the first project management experience and first team experience. The team coaching by the lecturer focused on overcoming typical team dynamic issues (see e.g. Schein, 1998) during the "forming" and "norming" phases. Several students expressed fears regarding the IT tools they needed to use in order to pass the course. At this time, students perceived the different learning objects that are supported by the LMS as different tools altogether. Once they understood that e.g. the internal editor is the same no matter which tool (forum, wiki, test, course etc.) is currently in use, their fears dispersed.

The course concept, especially the request to create an OLM, caused confusion for many students. The concept was perceived to be considerably more complex than content delivery and grading scenarios of other courses. At the end of the first month, this confusion had largely disappeared - not least because of continuous offline communication with us, and because the syllabus was altered a couple of times with respect to deadlines and details after dialogue with the students.

At the end of the first month, all students had joined teams, each of which had its own team coordinator. The teams (10 in the first test group, 18 in the second test group) had chosen topics for their online learning modules (see table 2). Most of these topics were chosen by the students themselves and negotiated with the lecturer with respect to practicality, usability and relevance for the course. Interestingly, in those cases where we were not initially convinced about the quality of the OLM resulting from a specific topic, our suspicion was proven wrong: where depth of content was lacking, the students would more than compensate for it by giving a topic a particular creative spin. (See section 5 for a selection of featured OLMs).

Each team had also created their own group (as an e-learning object) within the general student area. The team administered this group by itself, using it for information sharing (by file upload), discussion (through news forums) or collaboration (via wiki).

First test group (summer term 2008)	Second test group (winter term 2008/2009)
Surveillance in a logistics company	Information society: living online from home
E-government	Music Piracy
Three social networks in the Web 2.0 world	Car navigation Systems
Nanotechnology in medicine	Steam - the nexus of PC gaming
Music compression technology	DELL - online PC production and sales
Green Information Technology	Google analytics & adwords
Artificial Intelligence	Online shopping

Ordering on the Internet	E-Commerce
BEadoRable - online shop for teddy bears	My MySpace
Metro Future Store and RFID technology	Google Extensions
	The Social Bill initiative
	Guiding Eye - Web support for the visually impaired
	Social Networks
	Supply Chain Management
	Second Life - Future of Learning?

Table 2: Online learning module topics of the first and the second test group - duplicate topics not listed

4.2 Protocol of second month: design and editing skills

Central to the coaching sessions of the second month was to guide the students towards changing their point of view from learner to teacher. The students were beginning to understand the potential of online learning resources and stand-alone OLMs and had seen different examples of finished OLMs. There was a clear spike in motivation once they understood that this was a unique experience and more: that they could provide a unique experience for others who might use their OLMs.

The students received another training session focusing on the creation of tests. The test creation as such did not pose serious technical difficulties for the students (who were used to juggling a multitude of different applications, especially with regard to social networking activities). However, to devise tests which engage the learner, and which are not simply memory tests, was difficult for a majority. As part of the course, students had to complete online tests, which would also teach them how to design tests themselves for their OLMs. In these tests, a question or a problem would never simply refer back to course material. Instead the problems were presented with some context, e.g. a current news item or a short scenario description. The test question would also offer the possibility to branch out via web links in order to gather further information. In an online exercise following the training, the students were asked to create a small set of engaging test questions.

An example: one student had an interest in Marvel comics. He created a small story about a company that wants to turn a Marvel comic into a Hollywood movie. All questions were related to this story and at the same time to the then relevant topic of our course, namely business process management.

The discussion forum showed significant changes with respect to the previous month: most articles now dealt with technical issues related to the creation of OLMs, and questions were increasingly answered by students rather than by us.

Since there was no time for further training, one of us created a small HTML tutorial in response to the students' need to make their first attempts at learning module pages prettier and alter the layout. It was a challenge to dissuade the students from dedicating too much time at this stage to lower-order layout issues (such as choice of fonts or background colour). One reason was that the students had not yet finished the research and content creation phase of the OLM creation - their content was mostly still pretty thin on the ground, and toying with layout offered a welcome distraction.

A couple of groups wanted to gather primary data for their OLMs. Since, technically, the creation of tests in ILIAS is not very different from the creation of user surveys, they were able to create such surveys easily - the evaluation of the survey data is automatic. One issue with the surveys concerned the proper setting of permissions, which is not very intuitive in ILIAS. When the permissions are not set correctly, the targeted

users cannot open it, or the survey is sent to the wrong group of people.

Since we wanted to have the opportunity to use the student OLMs as the basis for a library of learning modules, which both teachers and students could build on in the future, copyright of the OLMs was an issue. This led to interesting discussions among students and staff. Using the GNU Free Document License (GFDL)¹⁰ was our first option. We dismissed it later because of the rather complicated wording of the GFDL. Also, ILIAS supports copyrighting learning modules as part of the OLM settings with a simple click using Creative Commons (CC) licenses¹¹, CC licenses are widely used for online resources and offer a range of copyright terms, from "all rights reserved" to "some rights reserved", including restrictions on commercial use that are similar to the GFDL. The debate and the decision in favor of CC led to visibly increased document rights consciousness among the students. This attitude was further shaped by coaching the students to make sure that all images, graphs, quotes etc. were attributed properly, as befits a proper scientific education. Of course, this is a demand made on the student for every term paper - but since the modules were going to be made available to the world at large, there was considerably more pressure on getting it right.

Towards the end of month 2, the students were nearing the completion of the content creation and research phase for their respective topics. They were now seriously turning towards design and layout issues. In the first test group, one team ("Three social networks") was exploring the use of HTML within an ILIAS learning module and an imported tag cloud. In the second test group, a number of teams went even further. One team used the freely available SCORM editor eXe¹², producing a module that was independent of ILIAS and could be imported into any SCORM-compliant LMS. Another team used WordPress blogging software to create an OLM on "Google Analytics & Adwords", making it available on the Internet. These design choices were partly motivated by the desire to have more layout choices, but also by the need for flexibility and for higher didactic value. Higher didactic value for the students in this case translated into "engaging and interesting to look at".

Some of the teams now experienced serious "storming" episodes. In all cases, these were caused by the uneven distribution of workload within the teams, or by situations which caused single students to lag behind the work of their team members. Through intensive team coaching, these conflicts, in both test groups, could be resolved so that all students and all teams reached the finishing line with something to show for. Another important ingredient to the success of the teams was the clear definition of roles and responsibilities within the team. In their term papers, many students emphasised the need for coordination and planning. Those teams which had responsible, active coordinator(s), generally achieved the best results.

4.3 Protocol of third month: final touches and student evaluation

One of the positive sides of working on OLMs during the semester was the possibility to finish the main deliverables for this course before the exam period. In both test groups, students worked very hard in the third month on the finishing touches for the OLMs. In practice, this meant designing and implementing the online tests which were part of the OLM. A large number of teams kept the details of their work to themselves in order to achieve a surprise effect during the final presentation. Almost all teams delivered their work well ahead of schedule - they had reached the "performing" stage of group dynamics.

The discussion forum shows even more detailed questions and, of course, notifications and discussion on exam and grading issues, which at this point in any course are drifting to the foreground of students' minds. Based on the student questions and forum discussions, another ILIAS e-learning object was established: a

10 GNU Free Document License, home page at: <http://www.gnu.org/copyleft/fdl.html> [accessed 15/03/2009]

11 Creative Commons Copyright Licenses, home page at: <http://creativecommons.org> [accessed 15/03/2009]

12 ExE, open source authoring application, home page at: <http://exelearning.org/>[accessed 15/03/2009]

course FAQ consisting of a number of issues that had come up in the course of the term around the creation of OLMs.

At the end of the summer term, in July, a serious server crash destroyed data from the survey for the first test group: each team was supposed to evaluate the OLMs of two other teams with respect to several categories - including content quality, usability, creativity etc. The survey was repeated successfully at the end of the winter term 2008 for the second test group. Table 4 includes the most interesting results, which show that a majority of students valued the content and the creativity that went into the OLMs of other teams, felt inspired by them to learn more, and thought that the creators "really cared about what they were presenting". Also, at the end of their experience, most students were satisfied with ILIAS as a learning management system.

1. On a scale from 0 to 10 (0 being the worst, 10 being the best rating), how would you rate the quality of the content of the learning module? Quality of content means whether the learning module is complete, clearly structured, entertaining, engaging, accurate etc. (83 respondents, 2 skipped)										
0	1	2	3	4	5	6	7	8	9	10
0%	0%	0%	2.41%	1.20%	4.82%	6.02%	16.87%	25.30%	30.12%	13.25%
2. On a scale from 0 to 10 (0 being the worst, 10 being the best rating), how useful is the learning module content for you? (88 respondents, 2 skipped)										
0	1	2	3	4	5	6	7	8	9	10
1.14%	1.14%	2.27%	6.82%	9.09%	13.64%	12.5%	17.05%	13.64%	14.77%	7.95%
3. On a scale from 0 to 10 (0 being the worst, 10 being the best rating), how much does the learning module inspire you to find out more about the topic? (92 respondents, 2 skipped)										
0	1	2	3	4	5	6	7	8	9	10
4.35%	3.26%	5.43%	3.26%	5.43%	14.13%	10.87%	25%	11.96%	9.78%	6.52%
4. Please comment on the following statement: <i>"I felt that the authors of the learning module really cared about what they were presenting."</i> (100 respondents, 3 skipped)										
Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		Don't know
40%		42%		14%		3%		0%		1%

5. Please comment on the following statement: <i>"I am satisfied with ILIAS as a learning environment."</i>					
Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
8.6%	61.29%	21.51%	6.45%	1.08%	1.08%

Table 4: results from survey among students evaluating each other's learning modules and their experience

Another major source of information at the end of month 3 was the short individual term paper, which students had to write about their experience and hand in at the end of the course. Table 4 quotes exemplary statements (see discussion in section 6 for an evaluation):

1	"I enjoyed being forced to work on several different platforms [...]: we used Wiki to schedule and [...] report on our team meetings. Creating the learning module in ILIAS [...] was challenging and a good experience because we learned how to create tests." (Student A, female)
2	"I think that ILIAS is limited in its functions with regards to design. It would be a good idea to oblige each team to create an own home page instead." (Student A, female)
3	"I liked that [...] it did not take more than a few days to start working on the first work packages [so that] we could concentrate on [...] developing a general structure and agreeing on goals." (Student B, male)
4	"Critical thoughts can be bundled and targeted at ILIAS. It is not advanced, not convenient to use and above all, not fun to play with. Period." (Student C, female)
5	"I got used to ILIAS and realized that the implementation itself was not difficult at all - but extremely time consuming. As the information for the learning module changed or was corrected so often, many times I felt I lost hours for nothing." (Student D, male)
6	"I realised that in order to implement the desired visuals and didactical aspects in ILIAS, I needed to become an expert in HTML or Javascript." (Student D, male)
7	"Strengths: improvisation, distance, spontaneous communication. Opportunities: culture, structural issues, self-esteem, indifference, inefficient communication, secretiveness, lack of transparency. Incentives: experience, self-reflection, 'self-transcendation' in the sense of evolution and progress. Improvements: conceptualising, reflecting and transcending the opportunities." (Student E, male)
8	"Our project idea came to our mind spontaneously and quickly and we had no idea how much work we were facing. [...] Our project was characterised by challenge, tension and never decreasing interest. (Student F, female)
9	"Originally I was not expecting to learn much from this task as the topic our group deciding on was relatively elementary, but as the project went on I found myself learning relatively a lot not simple through the topic but more because of the task of creating a learning module which is a new concept for me. Overall it has giving me a different view on teaching and has given me a greater respect for my teachers. It is not as easy to teach a topic effectively and while still making it interesting as well the amount of time that is needed to prepare a lesson." (Student G, male)
10	"To put the website online was very problematic. We created an [...] account [...] and tried to upload the website with the programm WS FTP, but this did not work out. We got help by an IT expert

[another student], who then put the website online." (Student H, female)

Table 3: sample statements from students' term papers.

5 Sample Online Learning Modules

To give the reader a better idea of the final student online learning modules, we will briefly describe interesting features of four OLMs, which are typical in terms of the amount of creativity and effort invested by the students. These modules are also remarkable as audio-visual experiences: interested readers can view the students' OLMs themselves in the public area of the ILIAS system at BSEL¹³.

5.1 E-Government

Created by a small team of three female students in the first test group, this module is noteworthy for its creative approach in managing the transition between different parts of the OLM: the students created and drew a fictitious character whom they named "Caroline" and who would speak to the students at the beginning, the end and in between different blocks of the module. The texts were spoken by one of the students, inserted in the OLM as mediacasts, and had a very upbeat, positive sound to them.

The module was particularly content rich, featuring three different case studies (on the topic of E-government implementations in Germany, in Estonia and in Africa) as well as a solid introduction to the topic. As one student said in her term paper:

"We felt that having this fictitious character 'Caroline' would be a good anchor [...] as a chapter guide [and] would also relax the learner in between [chapters]."

The comment shows an understanding of relaxation as an important ingredient to successful online learning.

5.2 Guiding Eye - web support for the visually impaired

This module was created by a medium-sized group of five female students in the second test group. They initially gave themselves the task of finding out *"how can everybody, no matter if blind or not, have the possibility to use the internet also creatively without limitation?"* (Team member).

"Blind people used to be mysterious to me. I saw them on the streets and felt pity for them and their situation and most of the time I tried to forgo them, so I wouldn't stand in their way when they were trying to find their way. Even if I saw them looking for help within a bulk of people, I wasn't sure if I was supposed to help or rather not, because I didn't want to expose them in public. But the work in this project showed quickly, that we would have forgotten important things without the help of people actually affected by blindness or impaired sight." (Team member)

The students developed a simple tourist information site for the blind, with information on Berlin tourist attractions, which could be navigated easily by impaired users, and which they also tested under real conditions. By accident they ran into a blind 25-year old business student at Berlin's central station, and

¹³ Sample learning modules in ILIAS public area of BSEL at <http://tinyurl.com/brx4n9>

filmed an interview with him¹⁴. The 3 minute video interview paints an accurate picture of the situation of a young blind person trying to find his way in a large city. The interview gave them the idea to redesign the route finder for the Berlin public transport, which was not usable for heavily visually impaired users because of the drop-down menus. One team member wrote:

"The goal of this new site was to offer blind and strongly visually impaired people in our society the possibility to be able to define their current location and destination portably via PC, Mobile Phone or Blackberry and have screen reader read aloud the fastest and easiest directions."

In the course of completing the OLM, students were forced to leave their comfort zone:

"[Our] Learning Module was becoming a solid piece of work. My task in this context was not only to show that there many people who are blind but also show reasons how they became blind. When researching the different eye diseases which apart from inherited blindness can also lead to blindness, I consulted professional literature, asked an eye specialist and an optician."

The team also created their own logogram for the project and the learning module. For the final presentation, all students appeared in front of the class wearing black and the logogram, which made a strong positive impression on the class.

5.3 Information Society - living online from home

This module was created by a large group of seven male students. After some deliberation, they settled on using their OLM to answer the question: *"Is it possible to stay at home for the rest of your life without leaving the house"* (team member). The students broke the question down in manageable parts by taken an average student's day including sport, daily grinds, food, health, psychological, social and work. However, they did not want to create an OLM based on the textbook metaphor. A team member said:

"Our team decided to make a movie out of that topic and we chose Charlie Chaplin as the main character. We thought the "Old" with the "New" is something special and all of us wanted to created a learning module which is funny and interesting together, because if you always just hear facts and facts you will get bored pretty fast and loose concentration. The message you actually wanted to present wouldn't be noticed at all because nobody is listening anymore."

The team ended up creating 11 different short silent movie sequences of several minutes' length, sticking to the look and feel of Charlie Chaplin's movie classic "Modern Times", eventually producing a DVD with cover and a film poster drawing on the Chaplin original. The following quote from one of the students demonstrates how the students managed to change from a learner's to a teacher's perspective:

"We decided to build up an interactive learning module, which should not be boring because you just have to click and read one slide after another. We had the idea that we could cut our movie into several parts, so that every part is linked with one chapter in the learning module. The idea behind this structure was that if one sees one of our clips and finds it funny and interesting, will look up some further information which we included in an extra chapter at the end of the learning module, accessible by a link on every chapter's page. We also decided to include a lot of links, because the theme we speak about is heavily linked to the internet and if someone is interested in anything we said he can look it up directly with our links."

14 3 min video interview "Matze and the Guiding Eye", available on the Internet at <http://tinyurl.com/c8jooj>

5.4. E-Commerce

This medium-sized team of five students consisted of three female and two male students and included a student each from Africa, North America, Europe, and two students of Asian origin. Their OLM set out to *"inform you about the origins, the trends and future perspectives of e-commerce, and [...] more specifically the new trends that are being established on a business-to-consumer (B2C) level."*

While most of the learning module uses a textbook metaphor, there is a special section inserted at the end titled *"Take it to the next level"*. On the page, we read: *"Customize your baby for only €199 and have it delivered to your door in 9 months! Special deals on multiply orders!"* The link which is provided leads to an external web site created by the team during the project: "Babies 'R Us"¹⁵ leads to a fake site where the user can "customize and order" a baby for only €199. Over several pages, the illusion of dealing with an actual e-commerce shop is maintained beautifully. After clicking his way through a number of choices the user is led to a pretend "bio-metric eye scan" that checks his identity and is linked to a PayPal account for easy payment. After the identity check, a page informs about "specials", e.g. "Buy one girl and get a boy for 40% off". For the final presentation of the work, the team wrote a funny 5 minute skit, which they enacted to great acclaim. This OLM is a prime example for the use of humour in the learning context. Almost all of the students' learning modules contained some portion of humour because the creators knew that they had to be funny in order keep their audience interested and engaged - especially in an online learning situation.

6 Discussion

6.1 E-Learning

The goals of e-learning, especially in the form of blended learning (see e.g. Garrison and Kanuka, 2004), where physical teaching is supported by virtual teaching materials, are "to help in building learner motivation, emulating the real world in the information technology systems, drawing the existing knowledge of the learners and engaging in their senses through narration." (Hubbard, 2009). Let us take this definition, which we find useful in particular with respect to our group of business students, as a starting point for our discussion.

We found that the motivation of the students was consistently high throughout the course - despite a high complexity of the task given to them in several dimensions: (1) technologically, the students dealt with an LMS that was barely known to them and whose advanced functions they had to learn before they could even think about creating content. Simon (2009) asserts that "today's e-learning lessons are light years ahead of the old 'page turner' lessons. However, there is not a standard interface, so even an experienced online learner may struggle with [the] electronic controls." (2) Conceptually, the students were asked not simply to do research and create presentations of their results - they had to leave their comfortable position as learners-only and adopt the attitude of a teacher. They succeeded gloriously in doing this for the majority of the OLMs - though few of them did it without initial complaints. (3) Procedurally, the task was not given to individuals, but to teams of students. In order to perform, each team had to undergo the cycle of forming, norming, warming and storming. (4) Practically, as many students asserted, this course felt like a considerable burden much of the time in a semester already filled to the brink with other courses. This did not, however, lower their enthusiasm or stop any of the teams from reaching the finishing line and turning in

15 Fake personalised online shopping site for babies, on the Internet at <http://babiesrus.webs.com/>

a usable OLM.

The task forced the students to draw on their existing knowledge, and pushed and inspired them to go further. Because of the character of a learning module as a stand-alone unit of learning, "narration", or the telling of a story, was a must. Many OLMs contain a beautiful sense for the narrative, whether through film sequences or the invention of fictitious characters (as in the featured examples), or by some other method. The students know what it takes to engage their own kind and fearlessly experimented with different approaches, ideas and applications, while at the same time remaining true to their mission to build a small repository of knowledge and share it effectively. This is why a majority of the OLMs were judged by other students to show "that the authors [...] really cared about what they were presenting."

We made another observation, which is interesting in the context of the student and the student team as a living system within a larger environment. The various offers of continuous support not only by us, but also by the BSEL e-learning team, were widely used. And when a number of teams could not resolve their (mostly technical) issues within this support framework, they went further and organised their own support: "We got help by an IT expert [another student], who then put the website online." (cp. Table 4).

The toolset available within the ILIAS LMS was considered an opportunity by a majority of students, though not by all, and they expressed satisfaction with ILIAS as a learning environment. Our assumption that most students today are often far more capable of sorting out technical issues related to their virtual work place was confirmed. This was true not just for students with an affinity for IT, but also for the majority of the business students, who entered the course with a strong prejudice against IT.

6.2 Course Didactics, Technology and Management

We can summarise the lessons learnt in the course of this experiment in three different categories, which we already introduced earlier when we described the basic setting of our experiment. The issue of diversity, which emergent as an additional dimension in the course of this work, will be discussed at length below.

Didactics	Taking the teacher's perspective enriched the students' learning experience and led to a higher degree of self-reflection and engagement than usual at this level of study.
	The OLMs created by the students were of high quality and could form the core of a modular content library.
	The support of students creating OLMs requires non-traditional teaching abilities like team coaching
Technology	Even a moderate amount of technical training goes a long way - students are used to picking up where the training left off and to solving technical problems by themselves or with the help of others. Teachers need more help than students
	The LMS is not considered an obstacle to learning content creation. The multitude of different e-learning objects available help students structure project work and research, and they are willing to pay the price of learning how to use the tools.
	A focus on OLM creation may stretch an organisation's service capability because undergraduates still need a lot of support.
Management	Project management coaching is essential to the effectiveness of the student teams and to help students deal with the complexity of their task.

	Roles and responsibilities within a student team are important to complete the task in a timely and structured fashion.
	The communication among students and between teacher and students is of extremely high value and is well facilitated by online forums.

Table 4: Summary of lessons learnt on course didactics, technology and management

6.3 Web 2.0

Even though we limited ourselves to the discussion of OLM creation, some of our findings are relevant for the more general question of how to best use social networking media in the Web 2.0 context (O'Reilly, 2007). Musser and Martin-Wolfe (2007) looked at the use of blogs as CMS for students. They found that "the students desire to control their own blogs design and layout is one of the reasons that a blogging system is a powerful teaching tool" (p.1), and conclude that blogs can be useful basic educational tools. There is only a marginal difference between an OLM as introduced here and a blog, one of the most prominent Web 2.0 tools. We also find that the students were interested in having more influence on the design and layout of the OLMs than the ILIAS LMS allowed. We conclude that the threshold to the creation of online learning material by students would be even lower with blogging software.

6.4 A constructivist approach

Tinto (2003) remarked that "the experience of learning in higher education is, for most audiences, still very much of a spectator sport." To refocus activities of teachers and learners alike, "problem-based learning" emerged recently as a powerful new teaching paradigm. Students who operate in a problem-based context in learning communities are found to be more effective than students who operate alone (Brzovic and Matz, 2009). The creation of OLMs as demonstrated by our students confirms this assumption.

The process which we described is akin to the "Learning by teaching" (LdT) method pioneered by Jean-Pol Martin since the 1980s (see e.g. Martin and Oebel, 2007) and since then applied with good results both in schools and higher education institutions (Grzega und Schöner, 2008). LdT is a constructivist approach that aims at putting the learner in control of her learning, whereby the teacher acts increasingly as a coach. This is exactly the direction in which we were going with our students. Schroeder and Spannagel (2006) call such a learner-centered pedagogical concept "action-oriented". This concept "emphasizes the importance of students' activation where learning takes place while solving complex tasks based on the students' interest". In our example, the students' interest was a key factor in deciding both their path in the course and the character and content of their OLM. Hence, the positive outcome of our experiment supports the general assertions of action-oriented learning.

6.5 Diversity

The results which we discussed here were obtained in a business information course at a German business school. The issue of cultural and gender diversity as a possibly important issue only became clear to us after we had completed our data collection. The heterogeneity is an outstanding feature of our control group enabling us to make some interesting inferences. In the following discussion, we will look at ways to generalise our findings and investigate to which extent the course considered adhered to gender mainstreaming rules postulated by Zorn et al (2004).

One question is whether our experiences with asking students to create online learning modules, and our inferences above, can be generalised to other course topics in other countries and in other academic disciplines. Though we cannot give a conclusive answer to this question, we have some confidence that it can, because of the described diversity of the students, their interests and the paths they took during the course. Recent research into the impact of cultural diversity in teaching seems to support this conclusion (Mitry, 2008).

A study from Australasia states that "The cultural diversity of students in a virtual [online learning] classroom is likely to be greater than in a physical classroom." (Goold, Craig and Coldwell, 2007). The authors suggest that, in order to overcome communication difficulties as a result of cultural diversity, technical training is not sufficient. Students "also need to develop an understanding of the diversity in communication styles and develop the sensitivity for other cultures". With respect to our own control group, we saw (cp. table 3) that the creation of learning modules challenged the students' traditional views of collaboration and encouraged them to reflect on the quality of their communication as well as on the issue of mutual respect. We can therefore confirm the suggestions by Goold et al. (2007) and assert that, given sufficient time, space and opportunity for reflection, the students will in fact develop the understanding necessary to master communication across cultural barriers.

Gender mainstreaming is a globally accepted term for a strategy to achieve gender equality in areas of society where equality is not much discussed, not reflected upon and hence stereotyped: "Technical [...] education is probably the subsector within the education system that suffers most from gender stereotyping" (UNESCO). In a study on the role and scope of digital media at German institutions of higher education, Zorn et al. (2004) proposed ten criteria for the evaluation of e-learning modules, which is exactly the situation we described in our case study. The rules of Zorn et al. refer to the structure and content of e-learning modules themselves – in other words, they judge the value of a module for gender mainstreaming by the quality of the end result. Table 5 lists the criteria (column A) and summarises the extent to which we addressed these criteria for the duration of the course (column B), and the extent to which the resulting student online modules themselves satisfy the criteria (column C):

A. Gender mainstreaming criteria for E-Learning modules	B. Addressed during the course through instruction and coaching	C. Regarding the student online learning modules themselves
1. includes gender sensitive language	Not explicitly addressed.	Modules do not explicitly include gender sensitive language.
2. offers comprehensive "(socio-) technological support"	Within the ILIAS environment, support was given through e-mail, FAQ, news forum, and specific appointments with technical support staff (including availability via telephone) on four days of the week.	All modules offer online support to the learner via e-mail of the authors.
3. has a clear (and time-saving) navigation	Importance of clear navigation stressed throughout classroom sessions and team coachings.	Most modules demonstrate structural thinking and reflection on navigation.
4. accounts for different levels of knowledge of learners (with respect to technology and content)	Different skill and information levels of students were explicitly addressed through training in all content object categories relevant to the learning modules. Team coaching focused on getting all team members on the same level.	Through structure and planning, most modules allow learners to jump to the appropriate learning level, often after passing a short online test. There are no additional technological barriers since all modules are web browser based.
5. provides clear insight into all and within all learning modules (learning target meta plan)	Student teams were asked to develop a project plan including learning targets for potential learners of the finished module including an analysis of the learner target	Learning plans and targets informed the final version of all modules.

	groups.	
6. gives advice about the length of time required to work through a learning module	Not addressed – students were not given targets or advice with respect to the size or extent of a learning module other than “appropriate to your content”.	Explicitly addressed in many learning modules by the authors.
7. has got a gender-aware and didactic learning concept.	Gender-awareness not explicitly positioned or required. Simple didactic concept part of required project and online module concept.	In all cases, students designed their learning modules from the standpoint of a learning student. Gender-awareness was not explicitly addressed.
8. contains versatile, flexible, interactive offerings drawn from life	Students were encouraged to connect to their own experiences and maximise interactivity and new media experiences for the learner.	All modules include online tests to varying degrees of sophistication, some integrated surveys. Many designed the module around a story line, and most offer learner interaction and new media experience.
9. offers diverse and interactive (moderated) suggestions for communication	No particular instruction or coaching on this criterion.	Varying degrees of interaction with learners – most modules revert to the “book metaphor” with respect to learner communication.
10. gives away a “certificate” for successful participation	Not used.	Not used.

Table 5: Adherence to gender mainstreaming criteria following Zorn et al (2004)

Drawing on the analysis in table 5, the resulting online learning modules are lacking as gender mainstreaming tools in the following areas:

- Explicit gender awareness, especially with respect to the language used and distinguishing the gender of the online learner. Our learning here is that this kind of awareness needs to explicitly be fostered in class and during the team coaching sessions.
- Interactivity and moderated communication with the learner, e.g. in order to improve accessibility of certain content and/or help learners master technological challenges. In subsequent courses, this lesson has already been applied since we moved from ILIAS as an environment to WordPress¹⁶, a widely used open source blogging software, and to Drupal¹⁷, an open source CMS with much improved possibilities to build and maintain learner communication, and even build learner communities around a topic.
- Issuing a specific certificate in order to acknowledge the learner's effort. This is an absolute must when the issue is motivating both the authors of the learning modules, and learners. Certificates also require application of higher professional standards as a quality management tool. We will build this into future courses as a requirement.

We should not forget that the authors of the learning modules evaluated in table 5 are not teaching professionals, but undergraduate students at the beginning of their own university learning careers. Given this boundary condition, the degree to which they (in some cases intuitively) adhered to the criteria laid out, is astonishing. This result is also encouraging with respect to further application of this “method” - letting students develop their own learning modules.

In summary, we find that this method of teaching and learning would benefit from a careful cultural and gender diversity analysis as well as a modified instruction approach that takes diversity explicitly into account.

16 See WordPress Home Page at <http://wordpress.com>

17 See Drupal Project Home Page at <http://drupal.org>

7 Conclusions

Our initial research question was whether it would be possible for undergraduate students to overcome the barriers towards creating online learning modules that are usable in class, i.e. which would engender a valuable e-learning experience. In our case study, we described how 144 undergraduates of a course on business information systems collaborated successfully to create online learning modules within an open source learning management system.

A review of implementations of constructivist theories in education shows that we described a learner-centered, action-oriented learning process, which also drew on problem-based learning strategies executed in a learning community.

To achieve this positive result, the students needed relatively little training but considerable support in terms of technical services and team coaching. They also had greater needs for communication, both among themselves and with the teacher, than we have previously encountered in our teaching practice.

We can recommend the creation of online content by students for students also as training to prepare the students for learning conditions in the world outside the school, and to practice learning in a community. We believe that the complexity involved in using LMS for action-oriented learning is too high and we will next look into using blogging software, but with the same goal of letting students create their own content. While we have not found cultural diversity of our control group to have hindered student communication or negatively affected the quality of the learning modules, further possible improvements to online content creation include adoption and checking of gender mainstreaming criteria.

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