Some remarks on the methodology and e-learning tools used in the TQM course

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ABSTRACT

Purpose: In the present paper the process of preparation and delivery of an on-line course on Total Quality Management has been described. The course was created using various rapid e-learning tools. It has been delivered since 2004 in the Institute of Metal Forming, Quality Engineering and Bioengineering of the Częstochowa University of Technology.

Design/methodology/approach: The paper presents the impressions and findings from the 6 years of teaching the TQM course with support of on-line tools and techniques. Up till now over 1200 regular, extramural and post-diploma students have taken the course, all of them on a voluntary basis. Open Source Moodle has been used as the Learning Management System. Some remarks on the authoring tools, including rapid e-learning tools, as well as the methodology and didactics of e-learning have been given.

Findings: The use of rapid e-learning tools caused a significant decrease in time and workload during the preparation of e-content as well as an increase in their visual and methodological value. Students surveyed in questionnaires clearly indicate the need to use distance learning in the study process. Combining face-to-face and distance learning is called blended learning and the literature recognizes it as the most effective way of study.

Research limitations/implications: The application of rapid e-learning tools resulted in a shorter time and a smaller amount of work needed for preparation of an e-course. Yet, none of the tools can replace a proper methodological construction of a course. Further research aims at developing a set of good methodological practices for e-teachers.

Originality/value: The use of e-learning tools and techniques in the TQM course has made studying more attractive. It also made it available to a greater number of students. Rapid e-learning tools allow teachers to create visually attractive e-materials in a reasonably short period of time and without too much strain on their part.

Keywords: E-learning; Computer aided teaching; Rapid e-learning; Moodle

1. Introduction

Today there is no doubt that distance learning is destined to become a rightful form of education in Polish higher education institutions. Numerous conferences, journals and academic publications dedicated to online teaching and learning at all levels of education emphasize significance of the issue.

Simultaneously we observe the commercialization of the academic education. Competition of many organizations delivering similar or almost the same services makes the market and client to verify and evaluate higher education institutions. Moreover, the predicted, unfavorable demographic trends and terrifying perspective of empty lecture halls and abandoned classes allow us to believe that universities and schools will compete and fight for students and pupils in more offensive and aggressive way [15, 16].

Although online tools and distance teaching techniques undoubtedly benefit education, we have become more aware of their flaws and insufficiencies. The present paper discusses a number of key issues and potential solutions. The issues are: the time and special skills required to prepare e-content, interactivity and visual appeal of e-courses, active participation on the part of e-teacher and e-student as well as the cost of implementation.

2. Background information

2.1. Virtual environment

When the decision was taken to support traditional education with online teaching, an analysis was performed to compare the software available on the market. Having reviewed the literature and conducted a needs analysis, it was decided that an e-leaning platform should meet the following requirements:

- be an Open Source platform,
- use free server solutions (Linux, PHP, MySQL, Apache, etc),
- enable publication and content management,
- enable user management,
- ensure security for teachers and students,
- have at least basic authoring tools,
- be intuitive, clear and transparent,
- be up to standard recognized in Poland and whole Europe,
- be a developing platform with good and efficient support.

After studying the existing solutions in respect of the criteria mentioned above, the Moodle platform was selected. Now, having used the platform for 9 years, it seems that it was the right decision. The analysis carried out with use of Google Trends (Fig. 1) indicates that, out of the analysed LCMSs, the Moodle and Blackboard platforms prove most popular worldwide, with the later being a commercial and therefore costly product. It seems interesting to observe how the platforms are used from a geographical point of view: while in Europe Moodle is undoubtedly most popular (the most popular language is Catalonian, with Polish taking the 8th place), in North America it is Blackboard, in South America Claroline, and in Asia Sakai.

A conducted comparative study also proves that Moodle is no worse than the existing commercial products. It is also worth noting that one of the world's largest and oldest online universities, the Open University in Great Britain, likewise has chosen Moodle as its LCMS platform [1, 2]. As the review of literature shows, the platform is popular in Poland too [4, 5].
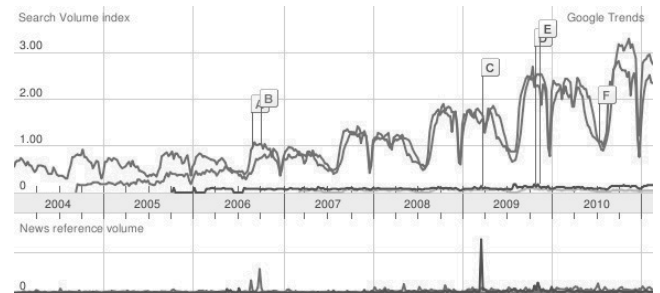

Fig. 1. Comparison of the most popular e-learning platforms in the world - Moodle, Blackboard, Sakai, Claroline - since 2004 to 27-02-2011

The Moodle platform is also widely used as a workspace in European projects to exchange experience and know-how as well as to supplement various forms of education [6-10].

Popularity of the Moodle platform unfolds in the following statistical data [10]:

- Number of registered installations: 50 082 (210 countries);
- Number of courses: 4,302.303;
- Users: 40,587.748;
- Users with teacher rights: 1,147.084;
- Enrolled students: 18,464.233;
- Forum posts: 69,846.654;
- Resources: 37,340.072;
- Number of questions in quizzes: 68,104.928.

Moodle is an Open Source tool used to run online trainings and to supplement traditional education and has been made accessible at no cost under GNU GPL licence. The software was written in the PHP language and is available for Open Source databases (MySQL, PostgreSQL etc). It can also be installed in any operating environment (MS Windows, Unix, Linux). The platform provides a suitable and reliable system of logging, securing and managing its users, here teachers and students. It also offers a variety of authoring tools which enable an online didactic process. Thus, we can develop, organize, deliver and manage didactic materials (in any text, graphic or even multimedia rich format), monitor the way in which these materials are used by students and teachers, and assess the effectiveness of online education with tests, surveys or assignments. The platform also makes it possible to run interactive classes by means of discussion forums (asynchronic communication) and chats (synchronic communication). Furthermore, it provides tools to run statistics and analyses of the didactic process.

Moodle was developed by Martin Dougiamas from Curtin University of Technology, Perth, Australia in 1999. At the time being, the platform, similarly to other Open Source solutions, is further being improved by its creator and hundreds of voluntary programmers all round the world. At the Second Polish MoodleMoot 2010 conference, Martin Dougiamas presented the latest version of Moodle, which proves that the LCMS is constantly being developed, tested, and refined.

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The Moodle platform undergoes continuous alterations so as to meet the demands of the constructivist model of learning. Following its premise, a range of tools have been developed to enable student/student and student/teacher interaction. These encompass over 35 activities, e.g. lesson, choice, survey, chat, journal, forum, assignment, standard and Hot Potatoes quiz, SCORM, glossary, workshop, and wiki. The tools offered by Moodle can be used to provide and/or test knowledge as well as to encourage interaction and/or collaboration among course participants.

The ability to integrate communication tools such as a forum or chat with the content of lectures and tutorials and to supplement those with quizzes and tests assessing the progress of education can allow a teacher to develop and conduct an effective online course.

2.2. The target group

In the winter semester 2010/2011 the course was offered at Czestochowa University of Technology by three faculties: Mechanics and Machine Construction (43 students – regular studies), Mechatronics (17 - regular studies) and Management and Production Engineering (25 extramural students). So far over 1.200 regular and extramural students participated in the course on Total Quality Management. For instance, in the winter semester 2007/2008 the course was visited 65.000 times, while in the winter semester 2010/2011 over 50.000 times. Parallel to that, part of the classes was conducted traditionally – in a lecture room and computer lab. Although no considerable differences were observed either in results or the quality of provided solutions, the students of Computer Sciences and Mechatronics, in comparison to those of Mechanics and Machine Construction, were definitely more active in discussion forums and other additional and optional activities (such as a wiki). Drawing from that, it seems that the level of computer literacy may be of significance for the success of online teaching/learning. There were no salient differences between regular and extramural students.

2.3. Description of the course

The Moodle course contains of 30 hours of lectures and 30 hours of tutorials on Total Quality Management ('hours' as understood in traditional teaching). The materials have been arranged in the following way: students have unlimited access to all lectures but assignments open every week with two weeks for students to complete the tasks. The reasons for such arrangement are twofold: on one hand we wanted to comply with the basic rule of distance education, i.e. any place, any time, any pace; on the other, we tried to facilitate regular and consistent learning throughout the whole semester. Although the aforementioned rule (any place, any time, any pace) is often claimed to be fundamental for e-learning, the authors' experience proves that too many 'any' often lead to 'no': no place, no time, no pace. Therefore we insist on regular and prompt work. The students still have the option of place (any place), but the time and pace have been determined to some extent (Fig. 2).
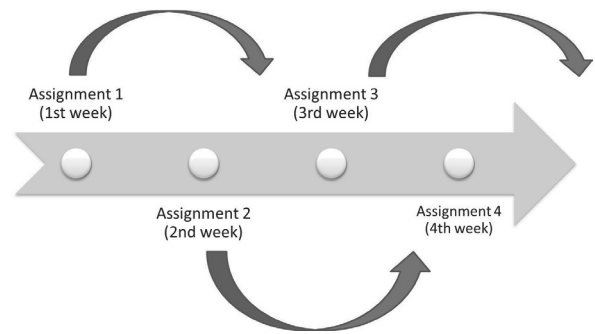

Fig. 2. Schedule of course assignments. Each assignment is available for two weeks. Subsequent assignments open every week

3. Multimedia lectures

All the lectures are in a form of a multimedia presentation and have been saved as Flash format (swf) for the following reasons:

- format swf (flash) is universal –SWF files can be run in most operating systems (Windows 2000, XP, Vista, Linux, Unix, Apple) on most devices,
- it can have audio – it is very easy to add audio to a lecture, e.g. to comment on the slides or to play background music,
- easy access –SWF files open with no additional software. All modern Internet browsers (Internet Explorer, Mozilla Firefox, Opera, Safari), after installing a free plug-in, run a SWF presentation with no problems at all. This is a very important feature considering the abundant range of formats available for saving a multimedia presentation,
- mobility – the format is read by most mobile devices such as palmtop, smartphone and tablet, (lately even iPad),
- there are lots of program solutions (free and commercial) for converting PPT format to SWF,
- SWF files are usually much smaller than their Microsoft Power Point equivalents. They are substantially compressed, which does not hinder the way in which the end user makes use of them. Furthermore, smaller files take less time to download from the Internet, which matters as far as multimedia files are concerned,
- independence from screen resolution – SWF files can be opened on a screen of any size and any resolution. This allows to provide a presentation of the same quality on various devices,
- Flash is also the most popular format to deliver streaming media (flv). This allows the student to watch a presentation, film or listen to a recording while it is being delivered by a streaming provider. In case of long or 'heavy' presentations, the user has an opportunity to watch a video without the need to wait till the whole file has been downloaded to the hard disc,
- SWF files are highly secure – while Power Point or Open Office presentations can easily be edited, flash format (swf) ensures considerably higher security of the materials. It is much more difficult or even impossible to edit them. Moreover, SWF files are usually recognized by antivirus or firewall programmes as safe. Thus, the delivery to the end user is trouble free.

3.1. Macromedia Flash

At the first stage of developing the e-content, the SWF presentations were done from the scratch with the Adobe (former Macromedia) Flash or Swish. The materials prepared in this way were diverse and highly attractive visually. Yet, the implementation took a lot of time and did not provide a chance to swiftly and easily alter or update the materials. For example in a table of contents for one of the lectures done with the use of Adobe Flash one word was accidently omitted. As the correction would have consumed too much time, it was abandoned. It was also difficult to keep homogeneous and standardized look of individual lectures.

3.2. Rapid e-learning tools

All the problems discussed in the first part of the paper made the authors look for solutions which would allow them to swiftly publish e-content in the flash format. The conducted research revealed a wide variety of software known as Rapid E-learning Tools. The most user-friendly tools are able to convert the content done in the Microsoft PowerPoint (Open Office Impress), which is regarded by many teachers and academics as a standard, to the flash format.

The list below shows examples of such programs (free and commercial):
- Articulate Rapid e- Learning Studio
- ProForm (Flashform) Rapid e- Learning Studio,
- AuthorPOINT,
- QuickLesson,
- FlashPoint,
- Wondershare PPT2Flash,
- Camtasia Studio,
- Impatica,
- PresentationPro PowerConverter,
- OpenOffice.

Characteristic features of rapid e-learning tools are as follows:
- time needed to prepare a resource amounts to a few weeks,
- e-content is prepared by experts in a given field, not a specialist in computer science, graphics or distance learning,
- preparation of an e-course takes place in a well-known and user-friendly environment of Microsoft PowerPoint (OpenOffice Impress) or with the help of ready-made templates,
- it is easy to monitor and assess progress as well as to provide feedback,
- they can supplement the course with simple multimedia elements (audio, video, animation) which enhance the process of learning but do not create technological barriers,
- the course consists of reusable learning objects, where each object constitutes an almost self-contained unit,
- learning objects, which normally take from 20 to 60 minutes, can be used in various configurations,
- synchronous (live) or asynchronous model of e-learning can be employed.

After the experience with developing multimedia lectures with the Adobe Flash and testing trial versions of various programmes, a decision was taken to purchase the Articulate Presenter. The program turned out to be a brilliant tool for rapid conversion of lectures done with the use of the Power Point or Open Office Impress to the SWF format. It also makes it possible to add audio. Apart from the obvious fact that the time needed to prepare materials is decreased to just a few minutes, the application also offers a very interesting and functional interface for ready presentations.

The left-side bar shows a picture of the author and a brief note about him. Underneath there are three bookmarks: table of contents (outline of the lecture), miniature slides (thumbnails), and a search tool. Below the main window there is a navigation menu with buttons for viewing, pausing, forwarding the presentation etc. Additional options are also available, so that we can view notes prepared by the lecturer, see a slide without the side menu or enlarge the main slide with no menu on view. It seems noteworthy that the program is intuitive and retains all the animations and recordings done in the Power Point.

Bearing in mind that the most common complaint voiced by e-teachers is a huge amount of time spent on preparing e-content, the authors assure that the use of rapid e-learning tools significantly saves the time. Most contemporary teachers are able to do, without any difficulties, a multimedia presentation in one of the two most popular programs: Microsoft PowerPoint or OpenOffice Impress and they usually already have their lectures and teaching materials prepared in this way. Thanks to the tools discussed in the present paper, the conversion to the flash format and, consequently, making the materials more attractive and suitable for distance learning takes only a few moments, and this should be highly appreciated by all interested teachers.

4. Online tasks and assignments

All the activities appearing in the TQM course were prepared using Moodle functions. The theoretical background for each activity as well as the instructions are usually provided in Lesson, in which a given topic can be clearly presented and supported with short monitoring questions. As for the tasks, students are asked to do them in the Microsoft Excel or Open Office Calc spreadsheet and send them in by means of another Moodle activity – Assignment - Upload a single file. More complex tasks were divided into parts and monitoring questions in Lesson permit students to assess if their solution is correct. The finished task is sent to Moodle, where the teacher marks it. The grade appears in the Moodle database accessible by a given student and a message is sent to the student by email with the grade and feedback. Additionally, a forum was set up for each task to let the students discuss the problem, ask questions and share ideas about a possible solution. The forums, although moderated by the teacher, were based mainly on students' participation. Moreover, the most active students could earn extra points to improve their final grade.

The students were also offered a social forum to discuss issues not directly related to the course. It was interesting to observe very stormy debates and discussions which took place there. Drawing on that, the authors believe that, while preparing an e-course, one cannot disregard the social aspect of e-classes which could or even should substitute for informal conversations among students during a break in a traditional school.

5. Conducting e-classes

Let us now carry out a quantitative analysis of the course in the winter semester 2010/2011. The course was offered for three majors: Mechanics and Machine Construction, Mechatronics and Production Engineering and Management. Statistical data from the course regarding the majors are shown in Table 1. The largest group of 43 students came from Mechanics and Machine Construction and they were divided into three sub-groups, then Management and Production Engineering with 25 students and Mechatronics 17. Each course was tutored by three teachers. Table 1 shows the number of students' and teachers' logs to the system. The course for MaMC was most frequently visited - 19389 students' logs and 3762 teachers' logs, while in the other two courses the activity was smaller. A similar situation was observed in forum posts. Two forums were graded while the others were used for communication when the tasks were being done. It should be noted that the most interesting posts could earn 20 points which equalled to the maximum number of points for four completed tasks. This was an incentive to encourage thought-provoking and stimulating discussions and, in fact, it made the courses more interactive and engaging and students participated in them more eagerly with comparison to traditional classes.

Let us now consider the absolute data with reference to a single student and teacher in individual courses (Table 2). The analysis of data in Table 2 shows that participation in discussions in the three courses was not equal. The most active students came from Mechatronics. Each of them published 92 posts on average. Respectively in MaMC it was 68 posts - 27% less, in MaPE - 44 posts i.e. 52% less. Such division only partially corresponds to the frequency of logs to the course, where Mechatronics students were again most active with 738 logs per student on average. In MaPE the average was 510 logs (69%) and in MaMC - 451 (61%). It should be noted that these differences do not correlate with the activity of a statistical teacher in the course. There were three tutors in each course. Each of them wrote from 8 (MaPE) to 11 (Mechatronics and MaMC) posts per one student. Such differences are not of much significance. However, when we look at logs in individual courses, we see that the absolute number of teacher's logs in Mechatronics per single student was 30% and 57% higher than in other cases (Fig. 3).
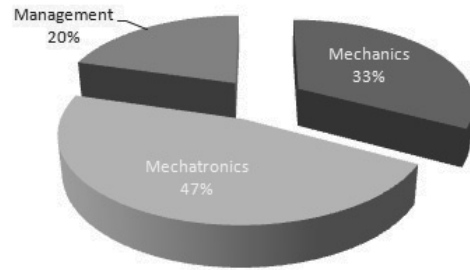

Teacher's log/student

Fig. 3. Teacher's logs/student ratio in individual courses

The teacher, even though he did not write any posts himself, had to read all the posts for at least two reasons:
- responsibility for the course and students' posts; forum moderation,
- the need to know all the posts to be able to award extra points for the most interesting comments.

The above facts imply that the time of teacher's work strictly depends on the level of students' activity in the course. It is the authors' belief that a properly constructed course should, on one hand, provide appropriate level of interaction and, on the other hand, secure the teacher's work time.

6. Findings and conclusions

The need to incorporate distance learning in the educational process at higher education institutions should not raise doubts. In most cases, the students enthusiastically voiced their support for the 'new' form of education. The teachers also do not underestimate didactic and administrative advantages of e-learning. However, the way in which 'virtual' hours as well as the time spent for developing online teaching materials will be remunerated makes an issue.

Table 1.
Logs of students and teachers in the TQM course for three different groups of students

Major	Number of students	Logs to system (students)	Posts to forums (students)	Logs to system (teachers)	Posts to forums (teachers)
MaMC	43	19389	2114	3762	462
Mechatronics	17	12547	1243	2122	181
MaPE	25	12756	1185	1371	194
Total	85	44692	4542	7255	837

Table 2.
Absolute data: students'/teachers' logs per single student/teacher

Major	Logs/student	Post/student	Logs/teacher	Post/teacher	Teacher post/student
MaMC	451	68	1254	154	11
Mechatronics	738	92	707	60	11
MaPE	510	44	457	65	8
Total	526	65	2418	279	10

The most common complaint voiced by the students concerned the promptness of grading assignments. The assignments opened every week (similarly to traditional classes) and the students had two weeks to complete them. As it could have been foreseen, most completed tasks were sent in on the very last day, which resulted in accumulation of work for the teacher who, at the same time, had other duties to fulfil.

The most disturbing issue on the teacher's part was time management. The workload required to prepare and conduct a course (which is annually updated and often refined with new teaching materials) as well as to assess and grade students' work is a few times higher with comparison to preparing and running traditional classes. The use of rapid e-learning tools saved the time needed to prepare an e-course to a significant extent and made it possible to provide quick tutorials and other learning aids for students enrolled in the course.

Over these years, no failures of the Moodle platform or the server were observed. The latter definitely due to the model work of the server administrator and adopted server solutions.

The surveyed students favourably reported their acceptance for such a way of conducting classes and appreciated the availability of electronic lectures as well as the opportunity to complete tasks at the most convenient time.

In the discussed case, the knowledge was not passively provided. The students' task was to build their knowledge upon given information, discussions and shared reflections. Such a way of education is closer to the constructivist rather than behaviouristic model of learning.

The basic advantage of distance education is the independence from the place, time, and pace of learning. Such approach, however, requires from students self-discipline, ability to efficiently organize work and to manage the time. In the discussed case, the adopted schedule aimed at forcing regular and consistent work throughout the whole semester. Yet, the two-week deadline for completing the assignments left the students some freedom.

There were very few students who made a decision to complete the tasks in the university computer room justifying their decision with lack of a computer or access to the Internet. It was observed, though, that the success of online education is often determined by the students' level of computer skills.

The conducted experiment proved the usefulness of blending traditional education with e-learning. So far this was only an experiment offered to students who expressed their interest in such a way of studying, so traditional classes were run simultaneously. This happened due to the lack of legal grounds for such a way of teaching. In September 2007 (with changes in October 2007 and May 2008) Ministry of Science and Higher Education [14] issued a directive determining the conditions which must be met by universities to conduct e-classes. The directive, although still imperfect and controversial, enables universities to legally offer online courses as a supplement to traditional education. The directive has opened the door for higher education institutions and it seems inevitable for them to go through this door to meet the needs and expectations of contemporary students and educators.

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