

# Distance Education at Silesian University of Technology

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## ABSTRACT

This paper presents Distance Learning Platform used by Silesian University of Technology. Distance Learning Platform is based on modular object-oriented dynamic learning environment, represents LMS (Learning Management Systems) technology, a software package designed to help educators create quality online courses. Currently on Distance Learning Platform at Silesian University of Technology are available over 520 online courses created for students of twelve University's faculties. Number of Distance Learning Platform users exceeds 12000. Distance Learning Platform works as typically asynchronous e-learning service, but in the future more synchronous e-learning services will be added. Distance Learning Platform has great potential to create a successful e-learning experience by providing a plethora of excellent tools that can be used to enhance conventional classroom instruction, in hybrid courses, or any distance learning arrangements.

**Keywords:** Distance Learning, Distance Education, E-Learning, Learning Management Systems, Internet ,

## 1. INTRODUCTION

Division of Telecommunication, a part of the Institute of Electronics, Faculty of Automatic Control, Electronics and Computer Science, Silesian University of Technology, since many years specializes in advanced fields of telecommunication engineering. One of them is e-learning, distance learning using worldwide area network - Internet. Main research area on this field is: Distance Learning Platform as an e-learning service for all twenty faculties of Silesian University of Technology.

## 2. HIGHER EDUCATION AT SILESIA UNIVERSITY OF TECHNOLOGY

The Silesian University of Technology, being one of the biggest technical universities in Poland and the first founded in Silesia has successfully been pursuing its mission of education, research and development on the one hand maintaining academic tradition originating from the Lvov Technical University and on the other hand, adjusting itself all the time meets new challenges of the future.

The Silesian University of Technology is a big university teaching approximately 33 000 of students. The University consists of 12 faculties which are based in Gliwice, Katowice and Zabrze (Fig. 1):

- Faculty of Architecture,
- Faculty of Automatic Control, Electronics and Computer Science,
- Faculty of Civil Engineering,
- Faculty of Chemistry,
- Faculty of Electrical Engineering,
- Faculty of Mining and Geology,
- Faculty of Energy and Environmental Engineering,
- Faculty of Mathematics and Physics,
- Faculty of Mechanical Engineering,
- Faculty of Materials Science, Metallurgy,
- Faculty of Organization and Management,
- Faculty of Transport.

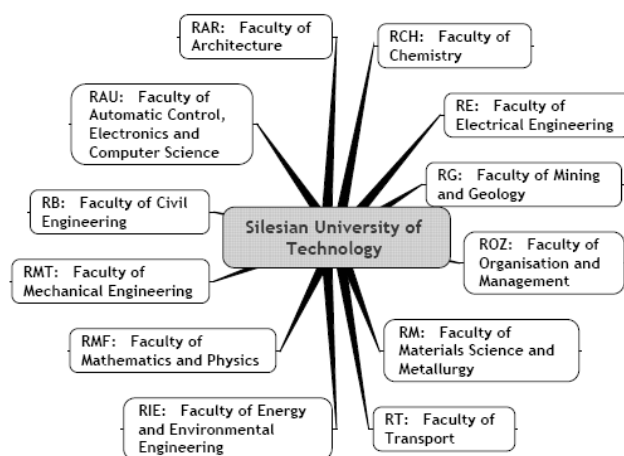


Figure 1. Faculties of Silesian University of Technology

The first 9 faculties are situated in Gliwice, 1 in Zabrze and the remaining 2 in Katowice. The significant role is played by Engineering Education Centre in Rybnik which offers full-time and part-time BSc courses in studies run by the Faculties of: Civil Engineering, Electrical Engineering, Mining and Geology, Energy and Environmental Engineering and Organization and Management.

The Silesian University of Technology is a self-governing state university managed by the elected bodies, including: Rector - who constitutes the supreme one-person body and Senate - a collective body of academics. The Rector is assisted by three Vice-Rectors responsible for: Education, Research, Organization and also by the Administrative Manager.

During the 60 years of the Silesian University of Technology the function of the Rector has been performed by 15 professors.

The University has the right to confer academic degrees:

- PhD in Technology - in 17 disciplines,
- PhD in Physics - in 1 discipline,
- PhD in Chemistry - in 1 discipline,
- PhD in Economics - in 1 discipline,
- DSc in Technical Sciences - 14 disciplines,
- and DSc in Chemical Sciences.

Restructuring of the 60 years of the University has been accompanied by changes in the syllabi. This process is by no means completed. The Silesian University of Technology, aiming at receiving the status of technical university, has widened the educational offer with non-technical studies: Administration and Sociology run at the Faculty of Organization and Management.

Integration with the European Union and recent changes in the educational and work market have influenced the increased interest in the quality of education. The Silesian University of Technology applies actively European standards for higher education. Flexibility of syllabi, giving each student the possibility to adjust the subjects to his interest including the interests overlapping different disciplines, courses and specializations, is a modern model of education we are aiming at.

Main and still valid goal, which the University authorities have been striving for during their consecutive terms, is to combine harmoniously good academic traditions with sustained development in every field of activity to keep the Silesian University of Technology distinguished reputation of a modern European technical university.

### 3. INTERNET IN HIGHER EDUCATION

Distance education, or distance learning, is a field of education that focuses on the pedagogy, technology, and instructional systems design that are effectively incorporated in delivering education to students who are not physically "on site" to receive their education. Instead, teachers and students may communicate asynchronously (at times of their own choosing) by exchanging electronic media, or through technology that allows them to communicate in real time (synchronously). Distance education courses that require a physical on-site presence for any reason including the taking of examinations is considered to be a hybrid or blended course or program [3].

Development research on creating integrated distance learning system for Silesian University of Technology was started in 2001, but Internet was practical used in education since nineties. Technical possibilities using Internet in education are in existence since 1991, the year of connection polish academic networks to world-wide Internet. Silesian University of Technology was one of several first polish universities connected to Internet in 1991.

For next years Internet application in education has been more and more popular, especially at Faculty of Automatic Control, Electronics and Computer Science and other faculties, where using personal computers in education is necessary [6,7]. For many years systematizing and regularization all activities in distance learning at whole University are necessary. It is the main purpose of Distance Learning Platform at Silesian University of Technology.

Distance education using Internet, named E-Learning is based on three fundamental activities presented on Figure 2 [2]:

- **Creating** e-learning content by instructors,
- **Offering** e-learning content by servers,
- **Access** to e-learning content by students.

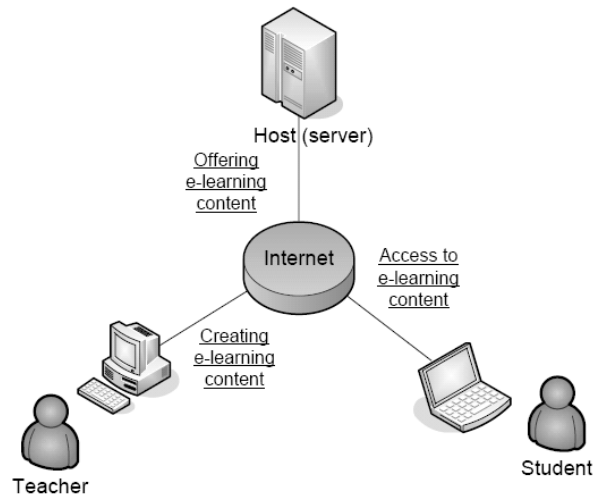


Figure 2. Three Fundamental Activities in E-Learning

### 4. DISTANCE LEARNING PLATFORM

Development research on creating integrated Distance Learning Platform for Silesian University of Technology was started in 2001, at Institute of Electronics, Faculty of Automatic Control, Electronics and Computer Science. Research on this area was based on:

- testing several application useful for distance learning,
- checking possibilities of adaptation distance learning software to University requirements,
- attempting to choose one (several) of them to construct distance learning service for whole University.

Tested applications can be differed to three categories:

- authoring applications : The web authoring tools, course authoring tools, media editors, content creators - software to creating and integrating e-learning content (courses, web-pages, multimedia files),
- LMS (Learning Management System), web servers, database servers, media servers – software to making e-learning products (courses) available over a network, hosting, administrating, maintaining, supporting,
- access applications: e-learning client applications, web-browsers, media players, communication tools – software to locating and experiencing e-learning products.

Classification of tested e-learning software is presented on Figure 3.

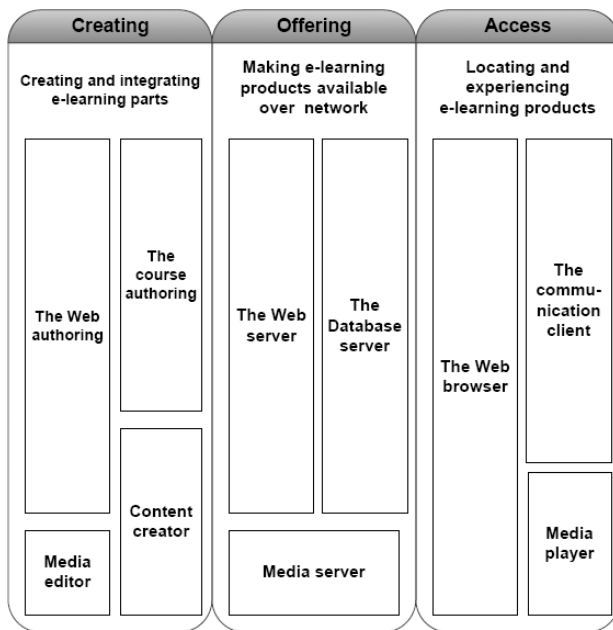


Figure 3. Classification of E-learning Software

Table 1. Virtual servers of Distance Learning Platform at Silesian University of Technology

Nr	Destination	URL
1	Silesian University of Technology (main server)	http://platforma.polsl.pl
2	Faculty of Architecture	http://platforma.polsl.pl/rar
3	Faculty of Automatic Control, Electronics and Computer Science	http://platforma.polsl.pl/rau
4	Faculty of Automatic Control, Electronics and Computer Science, Institute of Automatic	http://platforma.polsl.pl/rau1
5	Faculty of Automatic Control, Electronics and Computer Science, Institute of Computer Science	http://platforma.polsl.pl/rau2
6	Faculty of Automatic Control, Electronics and Computer Science, Institute of Electronics	http://platforma.polsl.pl/rau3
7	Faculty of Civil Engineering	http://platforma.polsl.pl/rb
8	Faculty of Chemistry	http://platforma.polsl.pl/rch
9	Faculty of Electrical Engineering	http://platforma.polsl.pl/re
10	Faculty of Mining and Geology	http://platforma.polsl.pl/rb
11	Faculty of Energy and Environmental Engineering	http://platforma.polsl.pl/rie
12	Faculty of Mathematics and Physics	http://platforma.polsl.pl/rmf
13	Faculty of Mechanical Engineering	http://platforma.polsl.pl/rmt2

14	Faculty of Materials Science, Metallurgy	http://platforma.polsl.pl/rm
15	Faculty of Organization and Management	http://platforma.polsl.pl/roz
16	Faculty of Faculty of Transport	http://platforma.polsl.pl/rt

As results of this research Distance Learning Platform was created, as effective, integrated e-learning service for all faculties of Silesian University of Technology. Distance Learning Platform has been working at Silesian University of Technology since September 2005 (<http://platforma.polsl.pl>). About 16 virtual servers are integrated to one e-learning service for twelve faculties of the University. Individual links to these servers are presented on Table 1.

Currently on Distance Learning Platform at Silesian University of Technology are available over 640 online e-learning courses Number of users exceeds 17500. Statistics of each virtual server is presented on Table 2.

Table 2. Statistics of Distance Learning Platform at Silesian University of Technology

Nr	Destination	Nr of users	Nr of courses
1	http://platforma.polsl.pl	20	10
2	http://platforma.polsl.pl/rar	698	29
3	http://platforma.polsl.pl/rau	-	-
4	http://platforma.polsl.pl/rau1	1548	41
5	http://platforma.polsl.pl/rau2	2264	110
6	http://platforma.polsl.pl/rau3	4600	117
7	http://platforma.polsl.pl/rb	1506	53
8	http://platforma.polsl.pl/rch	436	18
9	http://platforma.polsl.pl/re	610	20
10	http://platforma.polsl.pl/rg	-	-
11	http://platforma.polsl.pl/rie	889	20
12	http://platforma.polsl.pl/rmf	3672	150
13	http://platforma.polsl.pl/rmt2	651	33
14	http://platforma.polsl.pl/rm	361	10
15	http://platforma.polsl.pl/roz	307	26
16	http://platforma.polsl.pl/rt	4	4
<b>TOTAL</b>		<b>17566</b>	<b>641</b>

Distance Learning Platform works as typically asynchronous e-learning service, but in the future more synchronous e-learning services will be added. The most important features of Distance Learning Platform are:

- Easy creation of courses from existing resources,
- Course content which can be re-used with different learners, including content from other vendors (Blackboard, WebCT etc.),
- User-friendly environment,
- Students enrollment and learner authentication are simple and secure,
- Intuitive online learner and teacher management features.

## 5. TECHNICAL DETAILS OF DISTANCE LEARNING PLATFORM

Distance learning systems are sometimes also called Learning Management Systems (LMS), Learning Content Management Systems (LCMS), Virtual Learning Environments (VLE), education via computer-mediated communication (CMC) or Online Education [2]. A Learning Management System (LMS) is a software package that enables the management and delivery of online content to learners. LMS are web-based to facilitate "anytime, any place, any pace" access to learning content and administration. The characteristics of LMS include:

- Manage users, roles, courses, instructors, and facilities and generate reports,
- Course calendar,
- Learner messaging and notifications,
- Assessment/testing capable of handling student pre/post testing,
- Display scores and transcripts,
- Grading of coursework and roster processing,
- Web-based or blended course delivery.

Architecture of Distance Learning Platform as a Learning Management System is presented on Figure 4.

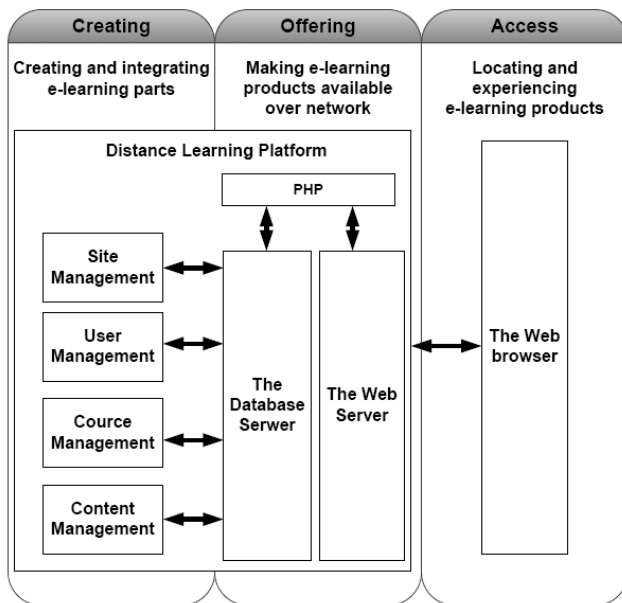


Figure 4. Architecture of Distance Learning Platform

Distance Learning Platform is based on following software configuration:

- Unix operating system : FreeBSD 6.1-RELEASE [4],
- HTTP Server : Apache [1],
- PHP language interpreter [5],
- Database server : MySQL [5],
- Learning Management System: Moodle [12].

Distance Learning Platform is based on modular object-oriented dynamic learning environment named Moodle (www.moodle.org), represents LMS (Learning Management

System) technology, a software package designed to help educators create high quality online courses [8]. Distance Learning Platform runs without modification on Unix, Linux, FreeBSD, Windows, Mac OS X, NetWare and any other systems that support PHP, including most webhost providers. Data is stored in a single database: MySQL.

Moodle is an alternative to proprietary commercial online learning solutions, and is distributed free under open source licensing [12]. Silesian University of Technology has complete access to the source code and can make changes if needed. Moodle's modular design makes it easy to create new courses, adding content that will engage learners. Moodle's intuitive interface makes it easy for instructors to create courses. Students require only basic browser skills to begin learning. Front page of Distance Learning Platform and interface of typical e-learning course are presented on Figure 5 and 6.

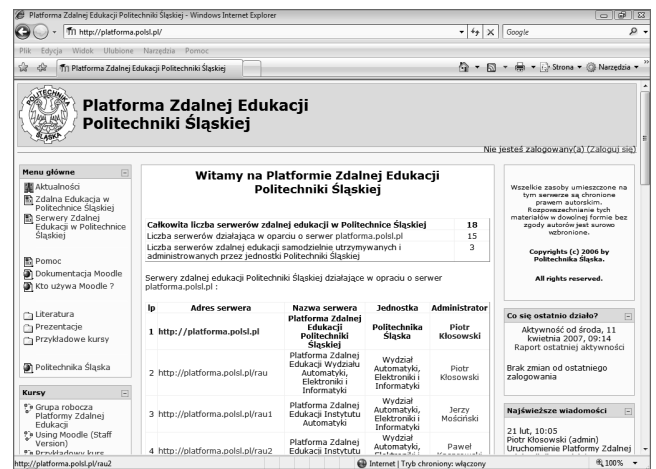


Figure 5. Front Page of Distance Learning Platform available at <http://Platforma.polsl.pl>.

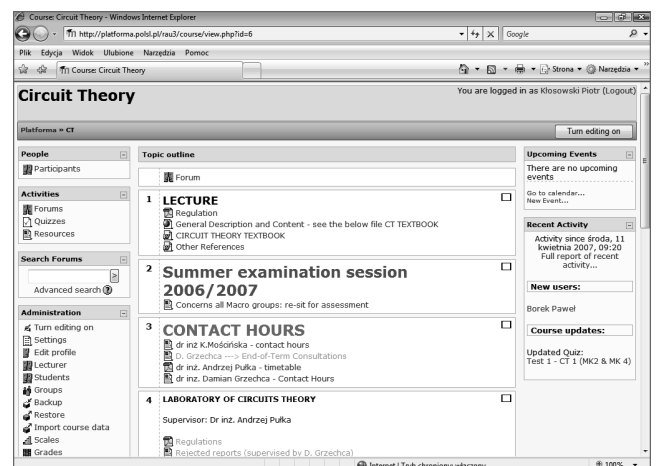


Figure 6. Typical Interface of e-learning Course

The main advantages of Distance Learning Platform are:

- Promotes a social constructionist pedagogy (collaboration, activities, critical reflection, etc),
- Suitable for 100% online classes as well as supplementing face-to-face learning ,

- Simple, lightweight, efficient, compatible, low-tech browser interface ,
- Easy to install on almost any platform that supports PHP. Requires only one database,
- Full database abstraction supports all major brands of database ,
- Course listing shows descriptions for every course on the server, including accessibility to guests,
- Courses can be categorized and searched - one Distance Learning Platform can support thousands of courses ,
- Emphasis on strong security throughout. Forms are all checked, data validated, cookies encrypted etc.,
- Most text entry areas (resources, forum postings, journal entries etc) can be edited using an embedded WYSIWYG HTML editor.

Working of Distance Learning Platform is based on four kinds of tools: site management tools, user management tools, course management and content management tools (Fig. 4). All functions are implemented in separate modules. The most important management features of Distance Learning Platform are presented in next sections.

## 6. COURSE AND CONTENT MANAGEMENT SYSTEM OF DISTANCE LEARNING PLATFORM

Course management system is designed to facilitate teachers in the management of educational courses for their students, especially by helping teachers and learners with course administration. The system can often track the learners' progress, which can be monitored by both teachers and learners. While often thought of as primarily tools for distance education, they are most often used to supplement the face-to-face classroom.

Content management system is used for storing, controlling, versioning, and publishing e-learning content and course component such as: electronic files, image media, audio files, electronic documents and other web content.

The main course and content management systems features are:

- **Assignment** - Used to assign online or offline tasks; learners can submit tasks in any file format (e.g. MS Office, PDF, image, a/v etc.)
- **Chat** - Allows real-time synchronous communication by learners.
- **Choice** - Instructors create a question and a number of choices for learners; results are posted for learners to view. Use this module to do quick surveys on subject matter.
- **Dialogue** - Allows for one-to-one asynchronous message exchange between instructor and learner, or learner to learner.
- **Forums** - Threaded discussion boards for asynchronous group exchange on shared subject matter. Participation in forums can be an integral part of the learning experience, helping students define and evolve their understanding of subject matter.
- **Glossary** - Create a glossary of terms used in a course. Has display format options including entry list, encyclopedia, FAQ, dictionary style and more.
- **Journal** - Learners reflect, record and revise ideas.
- **Label** - Add descriptions with images in any area of the course homepage.

- **Lesson** - Allows instructor to create and manage a set of linked "Pages". Each page can end with a question. The student chooses one answer from a set of answers and either goes forward, backward or stays in the same place in the lesson.
- **Quiz** - Create all the familiar forms of assessment including true-false, multiple choice, short answer, matching question, random questions, numerical questions, embedded answer questions with descriptive text and graphics. Instructors have granular control in defining course assessments, and can import quiz questions from popular formats like Blackboard, IMS QTI and WebCT. Support embedding audio into a quiz is also possible.
- **Resource** - The primary tool for bringing content into a course; may be plain text, uploaded files, links to the web, Wiki or Rich Text (software has built-in text editors) or a bibliography type reference. Adding math expressions to a Resource activity, using the built-in HTML editor is also possible.
- **Survey** - This module aids an instructor in making online classes more effective by offering a variety of surveys (COLLES, ATTLS), including critical incident sampling.
- **Workshop** - An activity for peer assessment of documents (Word, PP etc.) that students submit online. Participants can assess each other's project. Teacher makes final student assessment, and can control opening and closing periods

## 7. SITE AND USER MANAGEMENT SYSTEM OF DISTANCE LEARNING PLATFORM

Creating learning content is only part of what a good Learning Management System (LMS) must do. The CMS must *manage* learners in a variety of ways. Learner management includes:

- Access to information about learners in a course,
- Ability to segment participants into groups,
- Site, course and user calendar event scheduling,
- And so much more: applying scales to different learner activities, managing grades, tracking user access logs and uploading external files for use within the course etc.

One click and learner can view activity from all participants enrolled in the course. Learners create a personal profile that can include a picture, helping connect students socially in the online learning community. Learners complete a personal profile page that helps build the online learning community. Adding a picture and details to the profile creates a social connection. Assigning learners to a group is a common practice in education. Software allows the course instructor to easily create group categories, and determine how members will interact with each other and within various activities. Keeping a calendar of events is important to both the learner and course instructor. Events can be created for different categories, including:

- Global events that appear in all courses (system admin),
- Course events set by an instructor,
- Group events set by instructor relative only to a group,
- User events set by learner (e.g. due dates, personal etc.).

Upcoming Events appear on the course homepage, alerting the learner across all courses they are enrolled in of different category events. Alerts are colour-coded by category.

The Administration control panel puts all important learner management functions a single click away. Teachers and students can be manually enrolled or removed from a course. Configuration of course backup and restore is achieved on a single screen. Instructors may define custom scales to be used for grading forums, assignments and journals. Standard scales include assigning a value from 1-100% for each submission (or no grade), and indicating whether the learner was demonstrating one of three characteristics in the activity. Monitor shows when and what course resources the learner has accessed. Systems Logs provide detailed learner activity

Courses include a teacher only forum, where colleagues can collaborate on tasks and share ideas. Learners find it easy to navigate a course homepage in their browser; intuitive “breadcrumb” links are always present. Login occurs on a familiar screen. Initial account set up may be handled by the learner or administrator.

Instructors can require an “enrollment key” to allow participation in a course. Enrollment keys are provided to learners separately from the log in process. Courses requiring an enrollment key are indicated in “Course categories” description. Learners can login any time, anywhere to interact with coursework, and can specify the time zone and language they wish to use. When learners “subscribe” to forums they are notified by e-mail of new postings. Additionally, instructors can set e-mail notification for private dialogues.

## 8. CONCLUSIONS AND SUMMARY

This paper presents Distance Learning Platform used by Silesian University of Technology. Platform is constantly developed. New interesting features are added as new modules to source code. New Platform modules implements the most modern technology appears in web-based e-learning and Internet services. Example of them is: Web 2.0 technology [10].

Web 2.0, refers to a perceived second-generation of web-based communities and hosted services — such as social networking sites — that facilitate collaboration and sharing between users [9]. While interested parties continue to debate the definition of a Web 2.0 application, a Web 2.0 web-site may exhibit some basic characteristics [10]. These might include:

- "Network as platform" — delivering (and allowing users to use) applications entirely through a browser (web operating system).
- Users owning the data on the site and exercising control over that data.
- An architecture of participation and democracy that encourages users to add value to the application as they use it. This stands in sharp contrast to hierarchical access control in applications, in which systems categorize users into roles with varying levels of functionality.
- A rich, interactive, user-friendly interface based on Ajax (Asynchronous JavaScript and XML) or similar frameworks [11]
- Some social-networking aspects.

Majority elements of Web 2.0 technology listed above, are currently implemented to Distance Learning Platform. Platform has great potential to create a successful e-learning experience by providing a plethora of excellent tools that can be used to enhance conventional classroom instruction, in hybrid courses, or any distance learning arrangements and

significant contributes to increase efficiency of students' education at Silesian University of Technology.

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