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An analysis of selected e-learning systems

Summary: Nowadays technologies influence our work and private life and this requires constant changes. It also concerns education. To be well educated you should still act effectively and efficiently using modern technological developments. The development of ICT (Information Communication Technologies) has led to the Internet gaining the status of the main channel of distribution of all information. New processes of distance education (e-learning) are penetrating education, the public sector and businesses. The aim of this paper is to analyse and compare selected e-learning systems using software with the implemented AHP method.

Keywords: e-learning, AHP, ICT, education.

Analiza i porównanie wybranych systemów e-learningowych
Streszczenie: Obecnie technologie informatyczne wpływają na naszą pracę i życie prywatne. Dotyczy to również edukacji, gdzie proces uczenia i nauczania może być skutecznie i wydajnie realizowany przy użyciu nowoczesnych rozwiązań technologicznych.
Rozwój ICT (Information Communication Technology) doprowadził do rozwoju Internetu, który zyskuje status głównego kanału dystrybucji wszystkich informacji. Nowe procesy kształcenia na odległość (e-learning) przenikają do edukacji, sektora publicznego oraz firm. Celem niniejszej pracy była analiza i porównanie wybranych systemów e-learningowych. Analizę przeprowadzono z wykorzystaniem systemu MakeItRational, który posiada zaimplementowany algorytm wielokryterialnej metody AHP.

Słowa kluczowe: e-learning, AHP, ICT, edukacja.

1. The idea of distance learning

The origins of remote education are more distant than the Internet. In the eighteenth century, the first correspondence courses using mails were conducted. Later this approach appeared on radio and television as new channels of communication. But the biggest breakthrough was the discovery of the Internet because of the ability to communicate

using various methods of communication. The term e-learning covers all processes related to learning and teaching thanks to ICT solutions. This interactive process of learning helps to build relationships between the lecturer and the student [2].

Forms of e-learning

Multiple forms of distance learning can be specified. Their division is the result of different modes of learning and communication tools.

The basic division is in terms of the communication channels:

- CBT (Computer Based Training) as an external storage media such as CD or DVD;
- WBT (Web Based Training) as a channel of communication. You can use here the Internet or LAN (Local Area Network), MAN (Metropolitan Area Network) network.

WBT platform can operate in two modes of access: asynchronous and synchronous. The asynchronous model of communication does not occur in real time. To achieve the objectives of teaching, there are other methods, such as forums, mailing lists and e-mail. In the synchronous model, users can communicate in real time, which is the closest to the traditional teaching methods. This method is used for voice communication, video conferencing, and virtual whiteboards. Currently, modern systems offer both of these methods. In terms of the mode of access, e-learning systems can be divided into offline and online. Those that do not require a permanent connection to the Internet allow you to download the whole content of the training in its entirety.

Another option available in this type of training is the trekking option, which can support teaching and control academic progress and the results of training.

Advantages and possibilities of e-learning

The method of remote education is profitable for both universities and students (See table 1).

Tab. 1. Advantages of e-learning. Own elaboration.

Benefits for the University	Student benefits
Reducing organisational costs of training	The opportunity to study at any place and time
Elimination of preparatory activities for classes which there are in the traditional mode	Adapt training to the user profile
Increasing efficiency through the preparation of effective teaching materials	Adjusting the level of difficulty and speed to the ability of students
Easy and fast modification, expansion and upgrade training offer	Permanent access to the knowledge base which increases the possibility of self-education
Easy users monitoring of their progress and the whole educational process	

Unfortunately, distance learning systems have also disadvantages (See table 2).

Tab. 2. Disadvantages of e-learning. Own elaboration.

Disadvantages for the University	The disadvantages for the students
The high costs associated with the purchase of an e-learning system and its implementation	Lack of direct interaction with other course participants and professors
The necessary cost of IT infrastructure	Problems with self-discipline and internal motivation
The lack of „face to face" contact with students	

2. Information systems for distance learning

E-learning system is a combination of technology and learning which allows you to create training, manage and stimulate the communication between trainers and course participants. The distance learning can be divided according to their use as follows: LMS (Management Learning System); LCMS (Learning Content Management System), VCS (Virtual Classroom System);

LMS is a system that allows you to manage people in the training process, monitor progress and evaluate the results of the training and report all the information from administrators. Applications of this class, above all, help to carry out the same training, create training plans and make them available to users. These are applications necessary in large educational projects. Moreover, they can also be used in the traditional method of teaching..

LCMS is a class of applications used to design and develop e-courses. They allow you to collect and share your content to users. These systems are designed exclusively to manage the training process based on the remote teaching approach. The system allows for the introduction of information in all its forms: from traditional media to various forms of electronic materials. These applications contribute to the reusing of the same content in different pieces of training. Users are directed to individual training after passing another test. Access to the materials is prepared and used using many online and offline methods.

VCS (Virtual Classroom System) is a presentation system which enables the training in the synchronous method and supports the process of remote communication through the synchronous transmission of sound and image. They handle all communications in real time with users through chat rooms, virtual arrays and other interactive material.

The idea of Open Source e-Learning

E-learning systems also use an open source to create modern systems of education. Open source software - so that which is developed by a large community of users - provides us with reliable, continuous access to updates and reduces the overall costs of the project. The academic community is often the source of creation of e-learning projects, which are then available to all users on the principles of free software. Tests in the project were based precisely on such systems, which are available to all users free of charge [3].

Methodology

To analyse and to evaluate existing e-learning systems, the method AHP [1] (Analytic Hierarchy Process) has been used. AHP represents the field of science called MCDA (Multi - Criteria Decision Analysis), which is intended to assist the users in making decisions, defined as a subjective measurement of various preferences [4].

AHP method was developed by Thomas L. Saty. It is used in many areas of businesses and organisations. The main goal of the AHP method is dealing with complex decisions by giving them a rational structure, calculating the weight of individual components, the objectives and alternatives [5].

The application of AHP focuses on kinds of rankings, evaluations and supports strategic decisions. In this research AHP method has been used to choose the best e-learning system for educational purposes.. The AHP algorithm provides for two basic phases of operation: creating a hierarchy and assessment [6].

In AHP four stages can be identified: creating a hierarchical structure of decision-making; identifying the preferences of the decision maker; creating matrix preferences; making of the final ranking.

An important advantage of the AHP method is its flexibility as to the subject matter which it deals with. This allows problem-solving in many areas. The strong side of this solution is to eliminate the risk and biases in decision-making. By using this solution, we can reasonably explain the decision. Sorting criteria allows for a clear view of the test problem. An important aspect of the use of AHP is the not needing to know the mechanism of the action of the decision- maker because the process is carried out directly by the application. A positive element is the ability to achieve the results in graphic form [7].

To carry out the comparison of e-learning systems the makeitrational software with the implemented inside AHP method has been used. The makeitrational application is recommended for teachers and students to use in the didactic [8].

Comparison of Selected Information Systems

According to the objectives of the study, selected Open Source and WBT e-learning systems have been compared. In this research, the most popular systems such as Moodle, Claroline, Ilias and Atutor have been selected and analysed.

The characteristics of the Moodle system

The Moodle[1] system (Modular Object-Oriented Dynamic Learning Environment) is a free system to manage Intranet courses [9]. The platform is intended for both large educational units and small companies and institutions.

The features of the system Moodle [10]:

- full support for training;
- multiple communication options;
- a large number of active users and contributors to the system;
- the creation of uniform assessing methods of the knowledge of the course participants;
- creating tests, quizzes, tasks, and other items related to knowledge;
- the most popular LMS with Open Source license;
- well prepared multi-language documentation;
- a lot of training materials for use in the system;
- high student-lecturer interaction;;
- the possibility of interference from Administrator graphic templates;
- ease of use for new users;
- generating PDF files;
- a short journey from the design to the final course;
- design technology drag-and-drop;
- a large number of additional plug-ins;
- not very fast in functioning.

System Claroline

The Claroline[2] is another system to help teachers in the implementation of educational activities. It is now controlled by the non-profit Claroline Consortium.

The distinguishing features of the system Claroline:

- supports SCORM certified;
- uses pedagogical principles;
- 35 language versions;
- comprises communication and supervision modules;
- good multilingual documentation;
- ease to install and manage;
- recommended for training and exchange of information;
- good interaction among users;
- the creation of online courses;
- SCORM license;

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[1] Project site is available at www.moodle.org

[2] Project site is available at http://www.claroline.net/

- a clear source code developed for the mobile tool as well;
- targeting science;
- aiming to learn more than communication;
- used worldwide;
- simple operation and clear interface.

System Ilias

The Ilias[3] (de. Integriertes Lern-, Informations- und Arbeitskooperations-System) is an LMS system based on Open Source license.

Distinguishing features of the Ilias system:

- own asynchronous communication modules;
- modules for publishing multimedia content;
- well developed system;
- intuitive navigation through the modules;
- SCORM certificate;
- Polish language version;
- flexible module for creating tests;
- personalised user's desktop;
- the possibility of group work;
- various forms of communication with users;
- RSS feeds;
- flexible application platform;
- a security NATO certificate;
- good control of broadcasting rights and accesses;
- a long history in the market;
- problems with mobile modules;
- the modern system of e-learning;
- mainly used by German-speaking users;
- for full installation a dedicated server is required;
- advanced management and multimedia document functions;
- opportunity to contribute to the knowledge base;
- working with OpenOffice.org documents.

System Atutor

The ATutor[4] system was created by the Adaptive Technology Resource Centre at the University of Toronto. The ATutor platform enables the creation of courses based on learning with reusable objects. It is recommended for people with disabilities.

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[3] Project site is available at http://www.ilias.de/

[4] Project site is available at http://atutor.ca/.

The distinguishing features of the system ATutor:

- easy creation of courses;
- readable code with the ability to create their modules;
- easy installation of the system;
- easy access to the system and its adaptation to different solutions;
- the ability to import SCORM and IMS packages;
- dedicated to persons with disabilities;
- storage files keep history of changes;
- the ability to track the navigation of the user;
- clear but not intuitive interface;
- there are problems with scalability.

System Dokoes

The Dokoes[5] system was created in France by Thomas De Praeter at the University of Leuven. Dokeos is an LMS Open Source access platform.

The distinguishing features of the system Dokoes:

- the possibility of building graphics for training without extensive knowledge about graphics;
- converting office files in presentation materials;
- print certificates;
- SCORM certificate;
- synchronisation with HR systems;
- videoconferencing module;
- training live module;
- extended module adds content copyright;
- the module with information on the progress the participants of course;
- many ways of communicating;
- multilanguage versions;
- the system developed by users;
- well-designed visual system;
- version for mobile devices;
- easy installation;
- errors in the code;
- problems with encoding Polish characters;
- a few additional plug-ins;
- difficult to administrate;
- emphasis on the use of commercial solutions.

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[5] Project site is available at http://www.dokeos.com/.

3. Overview of the compared systems

Table 3 contains general information about the selected systems, requirements for the operating system and server [11]. You can notice that requirements are similar and quite flexible.

Tab. 3. Comparison of overall e-learning systems. Own elaboration.

Name system	Version	Release date	Database	Operating system	Programming language	Web server
Moodle	2.7	Apache	Mysql 5.5.31, oracle 10.2, Postgres 9.1 ,	Any	Php 5.3.2+	Any php enable
Atutor	2.2	Php 43.0+	Mysql 0.2+	Linux, mac	Php4+	Apache
Claroline	3.4	Apache	Mysql	Linux	Php	Apache, ii
Dokeos	1.6.5	Apache 2.2+	Mysql	Any	Php, javascript ,xml	Any php enable
Ilias	4.4.5	Apache	Mysql 5.1.32,oracle 10+	Any	Php 5.3+	Apache

The criteria of evaluating e-learning systems

Evaluation of distance learning should take place according to certain criteria. See table 4 below. Moreover, you should determine the weight of each criterion.

Tab. 4. Criteria of evaluation.

Criteria index ratings
Security
Performance
Support
Interoperability
The flexibility
Easy to use
Course management
Communication tools
Administration tools
Delivery
Content creating
Popularity of use

Security of e-learning systems

This criterion is characterised by ten criteria (table 5). Login History allows the user to see logins and transaction history. Audit Trial allows you to obtain more information about the changes made by the user and the data on all its activities. Email Verification via electronic messages can avoid the creation of fictitious accounts. GranularPrivileges can assist in creating different user privileges. Some Authentication allows for the safe operation of users and administrators. The Problem Notification reports about problems occurring in the system. SANbox module allows for the separation of space on the server for each user and application. Versioning describes the rules that you need to keep creating the next version of the system. Session Command Management allows for efficient control of the user session. Advanced Caching lets you minimise the load of the server during the delivery of new data. All the above features determine the safety of the e-learning system.

Tab. 5. The security of e-learning systems. Own elaboration

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Audit trail	Yes	Yes	No	Yes	Yes
Email verification	Yes	Yes	Yes	Yes	Yes
Granular privileges	Yes	Yes	Yes	Yes	Yes
Login history	Yes	Yes	Yes	Yes	Yes
Some authentication	Yes	Yes	No	Yes	Yes
Problem notification	Yes	Yes	No	Yes	Yes
Sandbox	Yes	Yes	Yes	Yes	Yes
Session command management	Yes	Yes	Yes	Yes	Yes
Versioning	No	Yes	No	Yes	Yes
Advanced caching	No	Yes	No	Yes	Yes
Summary	8/10	10/10	5/10	10/10	10/10

Performance of e-learning systems

Criterion performance describes features related to the efficient operation of the system in use by multiple users. Database Replication controls the optimum division and duplication of data between servers. Load Balancing allows a balanced allocation of the resources operating system. Page Caching allows the quick use of the data that are stored in the cache. Static Content Export facilitates the sending of content to other training systems.

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Tab. 6. Performance Evaluation of e-learning. Own elaboration.

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Database replication	No	No	No	Yes	Yes
Load balancing	No	No	No	No	Yes
Page caching	No	Yes	No	Yes	Yes
Static content export	No	No	Yes	Yes	No
Summary	0/4	1/4	1/4	3/4	3/4

Support of e-learning systems

The Support criterion concerns the range of help which you can receive from the supplier of the system. Sub-criterion Skeleton Programing makes it easier for administators to recognise the code of system. Manual Support Training concerns the availability of various types of training materials.

Developers Community concerns a group of communities working on the project guaranteeing its further development. Online Help allows access to the online support on the project to solve urgent problems. Pluggable API adapts the e-learning system to different databases. Public Forum is an open forum for educational units. Users Conference can support in organising conferences for the community.

These attributes describe the majority of the activity exhibited by the creators of the software and the community that uses it. Comparing the data systems can be seen in the assessment of the balance of its support (table 7).

Tab. 7. Rating systems of support e-learning. Own elaboration.

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Skeleton programming	Yes	Yes	Yes	Yes	Yes
Manual, support, training	Yes	Yes	Yes	Yes	Yes
Developers community	Yes	Yes	Yes	Yes	Yes
Online help	Yes	Yes	Yes	Yes	Yes
Pluggable API	Yes	Yes	Yes	Yes	Yes
Public forum	Yes	Yes	Yes	Yes	Yes
Public mailing list	Yes	Yes	No	Yes	Yes
Users conference	Yes	Yes	Yes	Yes	Yes
Summary	8/8	8/8	7/8	8/8	8/8

Interoperability of e-learning systems

The criterion Interoperability can be treated as an ability to work with other systems, technologies and solutions. FTP protocol supports the two-way exchange of files between the server and the client. ICalendar is an information exchange standard which allows transfer of data associated with calendars of users. Web Accessibility Initiative is an another standard that helps in accessibility to websites for example by people with disabilities. Web-based Distributed Authoring and Versioning is an expansion of HTTP, which extends it with the means to manage and control versions of files on the web server. Extensible Hyper Text Markup Language is a standard XHTML which allows for efficient generation of the content, its exchange and link between programming languages. The set of all these standards helps in the exchange and cooperation between systems and within them. See table 8.

Tab. 8. Interoperability of e-learning systems. Own elaboration

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Ftp support	Yes	Yes	Yes	Yes	Yes
Calendar	No	Yes	No	No	Yes
Wai compliant	Yes	Yes	No	Yes	Yes
WebDAV SUPPORT	Yes	Yes	No	Yes	Yes
XHTML compliant	Yes	Yes	No	Yes	Yes
NIST standard compliant	Yes	Yes	Yes	Yes	Yes
Summary	6/7	7/7	2/7	6/7	7/7

Flexibility of e-learning systems

Criterion Flexibility describes the features that allow administrators and tutors more possibilities in the use of the e-learning platform. Common Gateway Interface (CGI) enables effective communication between the client and the server. With the Reuse (recovery options) you can reuse content on the platform. Extend User Profiles is an option expanding the range of user profiles, whereas Metadata extends data description for better organisation and positioning of resources. Multi-Lingual Content is an important feature allowing the use of a e-learning platform by a bigger group of users. Multi-Site Deployment guarantees the security and flexibility of multilingual content. See Table 9.

Tab. 9. Flexibility of e-learning systems. Own elaboration.

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Cgi-mode support	Yes	Yes	No	Yes	Yes
Content reuse	Yes	Yes	Yes	Yes	Yes
Extent.user profiles	Yes	Yes	Yes	Yes	Yes
Metadata support	Yes	Yes	Yes	Yes	Yes
Multi-lingual content	Yes	Yes	Yes	Yes	Yes
Multi-site deployment	Yes	Yes	Yes	No	Yes
Summary	6/6	6/6	5/6	5/6	6/6

Ease of use of the e-learning systems

The criterion Ease of Use collects all the elements that facilitate the work of users and teachers. Drag And Drop is an option which allows easy creation of content for an e-learning platform, while options such as Email To Discussion and groups and Image Resizing facilitate the work of users and teachers. Macro Language automates and simplifies a process of data entry. The Mass Upload option easily delivers information to users.

Tab. 10. Ease of use of e-learning systems. Own elaboration.

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Drag and drop content	Yes	Yes	No	No	Yes
Email to discussion groups	Yes	Yes	Yes	Yes	Yes
Image resizing	Yes	Yes	Yes	Yes	Yes
Macro language	Yes	Yes	No	No	No
Mass upload	Yes	Yes	No	Yes	Yes
Server page language	Yes	Yes	No	Yes	No
Site setup wizard	Yes	Yes	No	Yes	No
Spell checker	No	Yes	No	No	No
Style wizard	Yes	Yes	No	Yes	Yes
Subscriptions	Yes	Yes	Yes	Yes	Yes
Template language	Yes	Yes	No	Yes	No
User interface throttling	Yes	Yes	No	Yes	Yes
Undo	Yes	Yes	Yes	Yes	Yes
What you see is what you get editor	Yes	Yes	Yes	Yes	Yes
Zip archives	Yes	Yes	Yes	Yes	Yes

The option Server Page Language is an option which dynamically creates courses which shorten the time of preparing the course. Thanks to the Site Setup and Style Wizard it is easier to manage the application. Spell Checker corrects user mistakes. Members are regularly informed about changes in courses using the Subscription option. Thanks to dedicated Template Language courses can be more easily customised. Based on the function of User Interface Throttling actions of this interface can be controlled. The Undo often can undo your wrong steps. The functionality of the direct preview affects the constructed course (What You See Is What You Get Editor) and accelerates the work on the introduce content and zip archives allowing for efficient archiving. See table 10.

Management of e-learning systems

The criterion management of e-learning systems concerns aspects of management. None of the tested systems has added the functionality to manage your ads (called. Advertising Management). Asset Management can help efficiently manage courses. Clip Board Button Located At allows storage of useful content. Users and administrators can plan the publication of new elements and can be realised by the Content Scheduling option allowing for efficient control of content by users and administrators. Based on the administration tool (called. Inline / Online administration) you can easily change the content of courses and other items of the training. Page Packed Deployment can easily update packages. Skins Themes At allows to attract courses. Trash option can control deleted items. The administrator controls the attractiveness of the page by analysing statistics (and. Web Statistics). Webstyles and Templates make the project more attractive to others using the same software. See table 11.

Tab. 11. Management of e-learning systems. Own elaboration

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Advertising management	No	No	No	No	No
Asset management	Yes	Yes	No	Yes	Yes
Clipboard button	Yes	Yes	No	Yes	Yes
Content scheduling	Yes	Yes	Yes	Yes	No
Inline Administration	Yes	Yes	Yes	Yes	Yes
Online administration	Yes	Yes	Yes	Yes	Yes
Package deployment	Yes	Yes	Yes	Yes	Yes
Themes Skins	Yes	Yes	Yes	No	Yes
Trash	Yes	Yes	No	Yes	No
Web statistics	Yes	Yes	Yes	Yes	Yes
Webstyle, template	Yes	Yes	No	Yes	Yes
Summary	10/11	10/11	6/11	9/11	8/11

Communication tools of e-learning

The criterion Communication Tools is related to the basic tools for communication with a team. They are used to communicate and exchange an opinion with other users in different forms: blog, chat, forum, website, an electronic message. File Distribution allows file transfer or facilitates the work of the group (Group ware). See table 12.

Tab. 12. Rating communication tools of e-learning. Own elaboration.

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Blog	Yes	Yes	Yes	No	Yes
Chat	Yes	Yes	Yes	Yes	Yes
Forum	Yes	Yes	Yes	Yes	Yes
Mail form	Yes	Yes	Yes	Yes	Yes
Mypage	Yes	Yes	No	Yes	Yes
File distribution	Yes	Yes	Yes	Yes	Yes
Groupware	Yes	Yes	Yes	Yes	Yes
Summary	7/7	7/7	6/7	6/7	7/7

Administration tools for e-learning systems

The criterion Administration tools describe the useful elements for the administration system. Contact Management organises and presents the contact information associated with users and teachers. Database and Reports can efficiently obtain information from the database according to the required queries. Helpdesk Organises Bug Report allows for cooperation with the authors of the system to improve it. HTTP PROXY assists in communication. Each user can express their opinion about the training system through the Guest book. An important function in the administration of the e-learning system is control of users and time of access to the system (In/Out Board). See Table 13.

Tab. 13. Administration tools for e-learning systems. Own elaboration.

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Contact management	Yes	Yes	Yes	Yes	Yes
Data entry	Yes	Yes	No	Yes	Yes
Database reports	Yes	Yes	Yes	Yes	Yes
Helpdesk organises bug report	Yes	Yes	No	Yes	Yes
Http proxy	Yes	No	No	No	No
Guest book	Yes	Yes	Yes	Yes	Yes
In/out board	Yes	Yes	No	No	Yes
Summary	7/7	6/7	3/7	5/7	6/7

Delivery e-learning courses

Criterion Course Delivery concerns functions related to actions such as events, sending newsletters. Option Document Management allows for attaching documents to the course. Events/Events Management allows for efficient communication with course participants and planning the next meeting. Newsletter is a popular option to send various information on courses. Product Management allows for personalization for a specific user and course. Project Tracking allows you to monitor the courses and identify the most popular. Search Engine is useful to find desired content. Test modules (Tests/Quizzes) checks the knowledge of users and acquaint the time by the user with the course (and. Time Tracking). User Contributions allows users to add new content to the course. Content can be extended through external sources thanks to Link Management. See table 14.

Tab. 14. Easy to use e-learning systems. Own elaboration

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Document management	Yes	Yes	Yes	No	Yes
Events	Yes	Yes	Yes	No	Yes
Events management	Yes	Yes	Yes	Yes	Yes
Faq management	Yes	Yes	No	Yes	Yes
Newsletter	Yes	Yes	Yes	Yes	Yes
Product management	Yes	Yes	No	Yes	Yes
Project tracking	Yes	Yes	No	No	Yes
Search engine	Yes	Yes	No	Yes	Yes
Tests/quizzes	Yes	Yes	Yes	Yes	Yes
Time tracking	Yes	Yes	No	Yes	Yes
User contributions	Yes	Yes	Yes	Yes	Yes
Link management	Yes	Yes	Yes	Yes	Yes
Summary	12/12	12/12	6/12	9/12	12/12

Content Extension Tools of e-learning systems

Criterion Content Development defines the content expansion tools and concerns additional elements that can be used to create courses and content of educational portals. Graphs and Charts are next options enriching the content. Job Postings allows you to apply for new jobs. Photo Gallery allows you to add photo files.

Site Map function allows for efficient operation throughout the educational portal and it is especially important with more available courses on the website. Creating RSS enhances the ability to communicate with users. See table 15.

Tab. 15. Creating content in e-learning. Own elaboration.

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Graphs and charts	Yes	Yes	Yes	No	Yes
Job postings	Yes	No	No	No	Yes
Photo gallery	Yes	Yes	No	Yes	Yes
Site map	Yes	No	Yes	Yes	No
Syndic.content RSS	Yes	Yes	No	Yes	Yes
Summary	6/6	4/6	2/6	4/6	5/6

Popularity of e-learning systems

The popularity of the Using category reflects the popularity of the solution. The Number of Users illustrates the number of users and similarly Number of Installations reflects registered installations. A Number of Languages concerns the number of translations into other languages. See table 16.

Tab. 16. Popularity of e-learning systems. Own elaboration.

Feature criterion	Atutor	Claroline	Dokeos	Ilias	Moodle
Number of users	1200.000	3500.000	4500.000	900.00	73000.000
Number of installations	58.000	10.000	6.000	5.000	85.000
Number of languages	41	36	20	16	80
Summary	4/6	4/6	2/6	0/6	6/6

The results of comparison analysis conducted by the AHP method

In this part of the paper, the results of comparison analysis conducted by the AHP method have been described. In research the significance of the criteria have been appropriated by comparing each using a point Saaty scale. See figure 1 below.
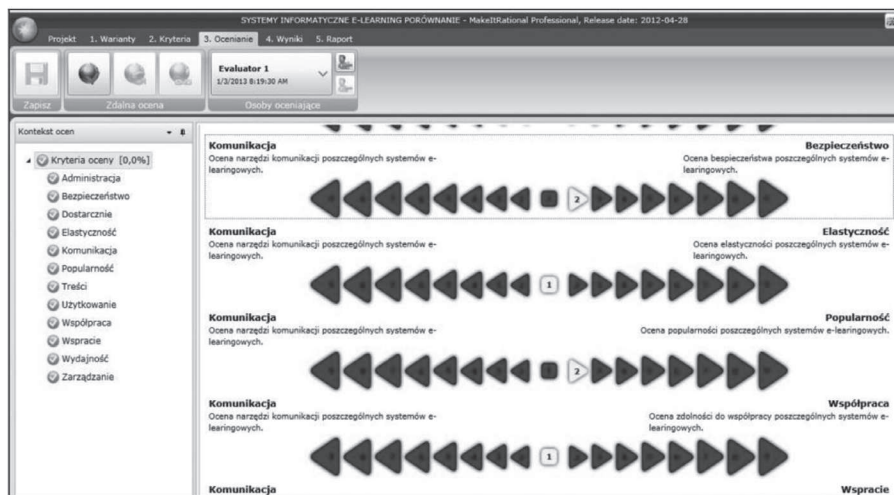
Fig. 1. Application makeitrational.com - Scales Criteria. Own elaboration using Makeitrational.com

Another result of the analysis is a radar chart presenting a comparison of e-learning systems. You can see the difference among checked systems in certain categories.
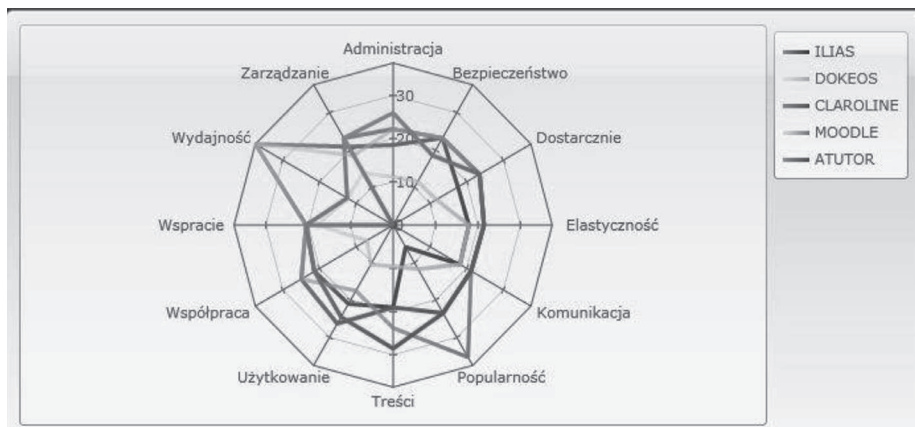

Fig. 2. Application makeitrational.com - Comparison of Variants. Own elaboration using Makeitrational.com

Administracja - administration

Bezpieczeństwo - security

Dostarczanie- delivery

Elastyczność - flexibility

Komunikacja- communication

Popularność- popularity

Treści - content

Użytkowanie- use
Współpraca - cooperation
Wsparcie- support
Wydajność- efficiency
Zarządzanie- management

The most important chart in this research is the final ranking of alternatives. You can observe that the Moodle e-learning system seems to have the best outcome (Figure 3).
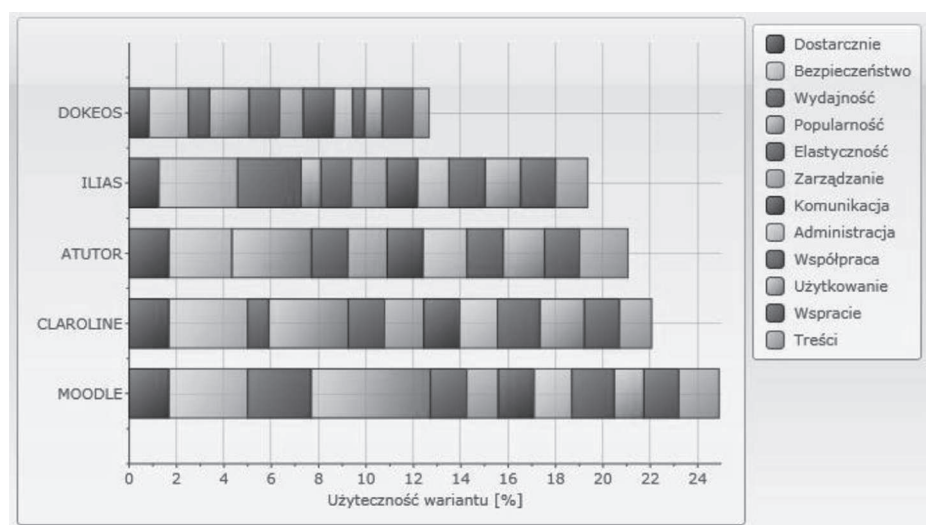
Fig. 3. Application makeitrational.com - Final ranking Variants. Own elaboration using Makeitrational.com

The results of analyses had an influence on the decision to choose an e-learning system to build an education portal during the realisation of the DIMBI project. One of the authors is the scientific manager of this project.

The aim of the DIMBI project is the improvement of the quality of education through modernising curricula in the field of Business Informatics and creating new innovative solutions in the area of teaching, possible to be implemented at Universities inside the country and abroad. The project meets the needs of the universities and offers access to the ready-made, innovative tools. It also contributes to the modernising of higher education in Europe and complies with the strategies and policies of the EU. The aim of the Partnership is to introduce innovative practices leading to high quality teaching and learning.[6]

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[6] http://projects.paragoneurope.eu/projectss/?p=47

The future of e-learning

New solutions such as Web 2.0 and the extensive use of mobile devices are changing the distance learning system significantly. It results in the fact that users have opportunities to become content creators and e-learning systems creators. Moreover, suppliers of information in such systems are also users. Portals such as Slideshare or Wikipedia show that their effectiveness is possible thanks to the user's activity. This approach develops a new field of distance learning - Learning 2.0, which reduces alienation, which until now was the disadvantage of e-learning systems. The key to the development of this type of platform is a community that becomes the main capital of new educational projects.

In the future, you can expect an increase in the role of the blended learning method. Blended Learning is a method that combines the advantages of traditional and electronic training methods. As mentioned earlier, the disadvantage of distance learning is the lack of the direct presence of listeners in the lecture hall. This is particularly important for science and technology education. Shortly you will be able to admit that Blended Learning is a combination of practical activities with another form of teaching and learning (e.g e-learning).

M-learning (Eng. Mobile learning) is a new type of electronic learning using mobile devices. By using these, users have constant access to knowledge, they can develop it, and they can be in touch with professors [12].

4. Conclusion

Management and building e-learning courses on the principles of Open Source are a good counterbalanced approach. By minimising costs, more and more enterprises and educational institutions are implementing this type of solution. It has been shown that the tested e-learning systems were suitable in all the tested categories.

Ready systems that were studied do not take into account the specifics of each entity. That is why it is so important to carry out all types of comparisons, presenting the strengths and weaknesses of different solutions. The presentation of this knowledge gives a chance for a better selection system that will integrate distance learning with traditional methods of knowledge transfer. The results of tests are presented in graphical form through the deployed tools.

According to the AHP method the best solution seems to be the Moodle system, which was the leader in most categories. According to the latest rankings and studies, the most popular open access LMS system is the Moodle [13]. It has a large group of followers, but also opponents.

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