D2.4

Technical, legal and scientific feasibility of an online course for primary care staff

1st Reporting period
WP2 New challenges and new methods for outbreak communication

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Contributing partners: CSSC, UEMO

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TELL ME - Transparent communication in Epidemics: Learning Lessons from experience, delivering effective Messages, providing Evidence.
Project co-funded by the European Commission within the 7th Framework Programme – HEALTH theme

PROJECT FULL TITLE	Transparent communication in Epidemics: Learning Lessons from experience, delivering effective Messages, providing Evidence.
PROJECT ACRONYM	TELL ME
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DURATION	36 months

D2.4 "Study of feasibility of an online course for primary care staff"

Task: **2.4**

Leader: **ZADIG** – Other contributors: **CSSC** , **UEMO**

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EXECUTIVE SUMMARY

The aim of Tell Me Project is to develop an E-learning tool for health workers to rapidly disseminate information in case of a pandemic situation.
To achieve this goal has been made a research on three levels:

- Legal: collect information about the Continuing Medical Education (CME) system in the 27 European Union countries;
- Technical: identify the best open-source LMS system for the development of a prototype of E-learning that could be implemented across all 27 countries of the European Union;
- Scientific: identify the best training approach to deliver to health workers of all the 27 countries of the European Union the information necessary to coordinate a timely response to a critic event (pandemic).

The results of the first part of research (Legal) suggest that it could be possible to develop a protocol of E-learning, such as the Tell Me Project, that could be consistently applied in different countries. Most of European Union countries have CME systems with similar accreditation systems, recognize distance learning and have mutually recognized credits because they belong to a common system (UEMS).
The results of the second part of the research (Technical) show that Moodle seems to be the open-source LMS platform that best meets the Tell Me Project requirements for the following reasons:

- User-friendly
- Manuals are available in all official languages of the 27 European Union countries
- Availability of material to support the use of the system (tutorials, guideline documents and forum discussions)
- Large and active community of users and developers assisting with problem resolution (e.g., bugs), platform applications and helping to identify strengths and weaknesses of the system
- Availability of numerous functions, plugins and modules to customize the system. These expand the functionality and enhance the adaptive capability of the platform to any technical and/or cultural requirements of the 27 European Union countries involved in Tell Me project.
- Adopted in large-scale training programs as it can support a high number of end-users. This feature is directly related to the aims of the Tell Me Project as it enables a rapid and widespread dissemination of the information across the 27 European Union countries.

The results of the last part of the research (Scientific) support the adoption of a case-based e-learning approach in the Tell Me project as it allows 1) to rapidly and effectively disseminate and update critical information necessary to efficiently react to infectious disease emergencies in Europe, and 2) to promote active learning and skill acquisition by using clinical cases to recreate authentic and realistic clinical learning scenarios, which ultimately enable an effective transfer of the theoretical knowledge into practical problem solving.

1. Legal

1.1 Introduction and background

We conducted a survey to collect information about the Continuing Medical Education (CME) system in the 27 European Union countries. The Ministry of Health's website and CME national website for each country were examined. In addition, Internet searches were conducted using the Google browser with the following acronyms, keywords and phrases: “CME”, “CPD”, “continuing medical education”, “continuing professional development”, “accreditation” and “name of the country”. Internet searches were conducted in the countries’ native language and were translated using the Google Translate tool.

From each country’s Health Acts the most detailed information about regulation of the CME system was taken.

Ferenc Hajnal from the European Union of General Practioners (UEMO) was contacted for further input and additional information on UK, Denmark, Hungary, Germany, Malta, Czech Republic, France, Slovakia and Poland. This data have been integrated into the final report.

Key people were contacted directly for countries where there was insufficient information on their website or from the Internet search. Addresses were found on websites. An e-mail request for information was sent to representatives from 12 countries (two requests sent two weeks apart) including: Denmark, Bulgaria, Cyprus, Estonia, Finland, Greece, Hungary, Latvia, Luxemburg, Malta, Portugal and Sweden.

A table (see below) was designed to collect relevant information including:

	Details of the Information Collected
Country	EU Member State
Presence of CME System	Presence/absence of a CME system (date)
CME compulsory	Mandatory/optional CME system (date)
CME system requirements	Organization and requirements of the CME system
CME credits (unit)	Measurement of credits
Recognised types of CME activities	Recognised types of CME activities such as E-learning
CME target	Target of the continuing education programme (e.g., doctors, nurses)
Participation in the UEMS EACCME system	Whether the system participates in the UEMS EACCME system
Name of the competent CME authority	Details of the CME authority
Website	Weblink

Nomenclature

UEMS

The European Union of Medical Specialists (Union Européenne des Médecins Spécialistes – UEMS) is a non-governmental organisation representing national associations of medical specialists in the European Union and associated countries.

EACCME

The European Union of Medical Specialists (UEMS) set up the European Accreditation Council for Continuing Medical Education (EACCME) in order to harmonise and improve the quality of specialist medical care in Europe by structuring and facilitating the mutual recognition of accreditation of CME/CPD activities through the awarding of European CME credits (ECMECs) to individual medical specialists.

CME

Continuing medical education (CME) can be defined as educational activities that serve to maintain, develop or increase the knowledge, skills and professional performance and relationships that a physician uses to provide services for patients, the public or the profession. All continuing educational activities that assist physicians in undertaking their professional responsibilities more effectively and efficiently are considered as falling into the scope of this definition.

CPD

Continuing Professional Development (CPD) is the educative means of updating, developing and enhancing how physicians apply the knowledge, skills and attitudes required in their working lives. CPD rather than CME is the preferred term, as physicians may perform many roles that indirectly affect the quality of healthcare, such as teaching, research and management.

CME Credit System, type of activities:

External

External credits may be earned by attendance at courses, conferences, lectures, scientific meetings or workshops where the course has prior assessment of content and relevance by the relevant National authority(s).

Internal

Internal credits may be awarded for hospital and locally based educational activities including teaching, audit, and published material as well as self directed learning (e.g., distance learning).

Reading

Specialists should spend on average two or more hours a week reading authoritative medical literature. This is expected in addition to CME credit requirements.

A summary of all the information collected about the 27 European Union countries is listed below.

Country	**Austria**[1]
Presence of CME	Yes, since 1995
CME compulsory	Yes, since 2001
CME system	150 CME credits every three years: – Of these 150 CME credits, a minimum of 120 have to be acquired through clinical CPD and up to 30 credits may be acquired through non-clinical CPD – CPD provided in a hospital setting or by doctors employed by the same legal entity shall not exceed two thirds of credits – Credits collected beyond 150 credits during three years are not creditable to the next collection period – Clinical CPD covers exclusively certified CPD activities in the medical field, based on the disciplines of the curriculum of the Austrian Medical Universities – Non-clinical CPD does not have to be purely patient oriented and can include: courses in medical English, a tax seminar for practice owners, a medical law seminar and any other activities within the scope of CPD
CME credits (unit)	One CME credit is awarded per CPD activity of 45 minutes (without breaks and interruptions); maximum 10 CME credits per day
Recognised types of CME activity	E-learning is allowed and includes interactive articles, online courses and interactive online CPD. This type of CPD has to comply with the general criteria for CPD and answering questions provides evidence of participation. Correct answering of a minimum of two thirds of questions is necessary for earning DFP points by E-learning and professional reading. All CPD events where the medical doctor is present in person (for example, lectures, journal clubs, courses, symposia, workshops, congresses, seminars or Balint groups) and which are not classifiable as any other type of CPD activity mentioned later, are considered (formal) events. Other recognised activities include: – Quality circles (usually under the leadership of a moderator) – Scientific activities: Publications in peer-review, medical journals – Supervisions: A special form of mid- and long-term counselling of teams and organisations aimed at enhancing professionalization of work with customers, clients, patients, team members, contracting parties or different management levels – Traineeship: Is the participation in a practical CPD event involving medical activities in an intra- and/or extramural institution or practice and comprises conclusive discussion, analysis and appraisal of the doctor's participation – Professional (directed) reading
CME target	Licensed doctors, general medical practitioners and specialists of all specialisations
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system. The European CME credits (ECMEC) recognised by the EACCME (European Accreditation Council for Continuing Medical Education) of the UEMS (Union Européenne des Médecins Spécialistes) are recognised to the same extent as DFP (Diplom-Fortbildungs-Programme of the Austrian academy of physicians) credits
Name of the CME competent authority	Arztakademie (Austrian Medical Chamber)

[1] CPD (continuing professional development) Regulations (2010). http://www.arztakademie.at. Accessed April, 2012

Website	http://www.arztakademie.at

Country	**Belgium**[2]
Presence of CME	Yes, since 1994
CME compulsory	No, voluntary. In order to encourage doctors to take part in CPD there exists a financially beneficial system of CPD accreditation
CME system	60 CME credits every three years, at least 20 CME credits per year. Physicians are generally free to choose which CME activities they participate in. However, there are two activities which must be undertaken each year in order to gain accreditation: – At least three credits per year by taking part in some form of CME related to ethics and economics – At least two local medical evaluation group meetings per year (peer reviews), for which they must gain at least two credits
CME credits (unit)	One CME credit point is awarded per hour (for most activities)
Recognised types of CME activity	In 2005 the Institute began accrediting CME E-learning modules for doctors, which include specialty-specific modules. E-learning CME is worth one credit point per hour and doctors must receive individual feedback on their E-learning performance from the E-learning provider. Other recognised activities include: – Workshops – Regional seminars – National symposia – International congresses – Didactic publications – Staff meetings in a hospital – Scientific presentations (courses, abstracts, posters) – Acting as a moderator (of a CME activity)
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system. The Institute has automatically recognised accredited EACCME events since January 2007 and in the same year changed its system of CME credits to align itself with the EACCME
Name of the CME competent authority	INAMI/RIZIV (Institut National d'Assurance Maladie Invalidité)
Website	http://www.inami.fgov.be

[2] Institut National d'Assurance Maladie Invalidité. http://www.inami.fgov.be. Accessed April, 2012

Country	**Bulgaria**[3,4]
Presence of CME	Yes, since 2005
CME compulsory	Yes, since 2005
CME system	150 CME credits every three years, at least 50 CME credits per year
CME credits (unit)	One CME credit point is awarded per hour (1 hour minimum = 45 minutes)
Recognised types of CME activity	Forms of continuous medical education through distance learning are accepted. One point is awarded for one academic hour: 60 points for three years (maximum). Other recognised activities include: – Lectures – Congresses, symposiums, national/international conferences – Forms of continuous medical education such as practical exercises or individual training courses – Training with medical literature such as scientific medical magazines, textbooks and monographs – Authorship of a report, lecture, academic publication (the third co-author), poster, report of adverse reactions or document certified by the Bulgarian Medical Association (BDA)
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system. The points accredited to Bulgarian doctors through participation in EACCME accredited events are not automatically recognized by the Bulgarian Medical Association
Name of the CME competent authority	Bulgarian Medical Association
Website	http://www.blsbg.com

[3] Bulgarian Medical Association. http://www.blsbg.com. Accessed April, 2012
[4] Bulgarian Medical Association CME/SDO Department. E: sdobls@abv.bg

Country	**Cyprus**[5]
Presence of CME	Yes, since 2002
CME compulsory	No, voluntary
CME system	150 CME credits every three years (from which 50% must come from activities related to the doctor's specialty)
CME credits (unit)	One CME credit point is awarded per hour
Recognised types of CME activity	E-learning is accepted
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Cyprus Medical Association, CME Committee of Cyprus Medical Association
Website	http://www.cyma.org.cy

[5] Cyprus Medical Association. http://www.cyma.org.cy. Accessed April, 2012

Country	**Czech Republic**[6,7]
Presence of CME	Yes, since 1991
CME compulsory	Yes, since 2001 Each physician member of the Czech Medical Chamber (CMC) has the obligation to participate in the system of continuous training
CME system	120 CME credits every five years
CME credits (unit)	One CME credit point is awarded per hour (1 hour (minimum) = 45 minutes) Six CME credits per day (maximum)
Recognised types of CME activity	E-learning is accepted. Other recognised activities include: – Educational events organized by the CMC – Educational events organized by other organisations in collaboration with CMC – Educational events organized by recognised entities – Clinical practice – Publishing and lecturing: • Conference attendance (lecture or poster) • Article in a journal with an impact factor • Article in an international peer-reviewed journal • Article in a Czech reviewed journal • Contribution in proceedings (in a foreign language or in Czech) • Scientific monograph • Chapter in a scientific monograph • University textbook – Study of the relevant literature integrated by self-evaluation of learning
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	CMC
Website	http://www.lkcr.cz http://www.eclk.cz/ (distance learning)

[6] Czech Medical Chamber. http://www.lkcr.cz. Accessed April, 2012
[7] Czech Medical Chamber e-learning system. http://www.eclk.cz. Accessed April, 2012

Country	**Denmark**[8,9]
Presence of CME	Yes
CME compulsory	No, voluntary
CME system	200 CME hours every five years, at least 50 CME hours per year (recommendation). In Denmark general practitioners (GP) are organisationally and financially encouraged to participate in CME and outreach visits. Each GP has a personal account that may cover the cost of at least three full days of CME activities a year (including compensation for lost earnings and course fees). GPs also have the opportunity to participate in locally financed CME groups, for which they are paid a small fee
CME credits (unit)	One CME credit point is awarded per hour
Recognised types of CME activity	E-learning is accepted
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Danish Medical Association
Website	http://www.laeger.dk

[8] Danish Medical Association. http://www.laeger.dk. Accessed April, 2012
[9] UEMS. (2008). Dentmark. http://www.ipcaa.org/assets/Denmark86423.pdf. Retrieved April, 2012

Country	**Estonia**[10]
Presence of CME	Yes
CME compulsory	No
CME system	300 CME credits every five years
CME credits (unit)	One CME credit point is awarded per 45 minutes
Recognised types of CME activity	E-learning is not accepted
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Estonian Medical Association
Website	http://www.arstideliit.ee

[10] Estonian Medical Association. http://www.arstideliit.ee. Accessed April, 2012

Country	**Finland**[11,12]
Presence of CME	Yes
CME compulsory	No, voluntary By virtue of their professional activities physicians have both a right to CME and an ethical obligation to participate in it
CME system	Finnish Medical Association (FMA) recommends that every doctor should have at least two weeks each year in external CME/CPD activity. According to surveys by the FMA, the average amount of external CME for Finnish doctors is around eight days per year. *The requirements and responsibilities are as follows:* – Each physician must have a right to external professional CME for at least two weeks (10 working days) per year, at the expense of his or her employer. The CME must meet agreed quality criteria. In establishing quantitative minima for CME, individual practice requirements must be taken into account – Physicians should have the possibility of keeping up with developments in their everyday fields of practice – The weekly working hours of a physician must allow at least five hours for on-the-job-training and personal CME – Physicians must document and assess their CME and learning activities
CME credits (unit)	There isn't a CME system based on credits
Recognised types of CME activity	E-learning is accepted. Other recognised activities include: – Training sessions and literature – Participation in the evaluation of quality projects – Group discussions – Writing articles – Consultation activities – Peer review
CME target	All medical doctors (all specializations)
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Pro Medico
Website	http://www.promedico.fi

[11] Finlex Data Bank. http://www.finlex.fi. Accessed April, 2012
[12] Finnish Medical Association. E: fma@laakariliitto.fi

Country	**France**[13]
Presence of CME	Yes, since 1996
CME compulsory	Yes, since 2009
CME system	250 CME credits every five years – 150 credits in two categories (categories 1 to 3), and 100 credits in category 4 1) Field training with tutoring 2) Individual training and distance learning 3) Situation professional trainers 4) Evaluation of professional practices – Can accumulate up to 50 credits per type of group (in five years) – A package of 100 credits is assigned to each doctor who has met the assessment requirement under the conditions set by the High Authority Health
CME credits (unit)	One CME credit point is awarded per hour (1 hour = 45-60 minutes)
Recognised types of CME activity	1) Field training with tutoring 2) Individual training and distance learning. This category includes individual training and distance learning using any medium (physical or electronic) 3) Situations professional trainers Professional situation trainers are divided into 4 groups: **Group 1:** includes the employees of National Health Service **Group 2:** includes the accomplishment of missions of general interest to the service quality and the organization of care and prevention, including elected office, as part of organized structures **Group 3:** includes activities and teacher participation in juries, in the field of health **Group 4:** includes research and personal publications in the field of health 4) Evaluation of professional practices (mandatory for any physician)
CME target	Medical doctors, dentists and hospital pharmacists
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	National Councils for Continuing Medical Education (CNFMC)
Website	http://www.cnfmc.fr

[13] National Councils for Continuing Medical Education. http://www.cnfmc.fr. Accessed April, 2012

Country	**Germany**[14]
Presence of CME	Yes
CME compulsory	Yes
CME system	150 CME credits every three years (with at least 50 CME credits per year) or 250 CME credits every five years (with at least 50 CME credits per year) For the five years cycle: 150 CME credits must be gained in topics specific to the doctors' specialty, with the other 100 CME credits from topics of their choice. General practitioners and specialists working in ambulatory care do not have any restrictions placed on the CME topics they can cover
CME credits (unit)	One CME credit point is awarded per hour (1 hour (minimum) = 45 minutes)
Recognised types of CME activity	Interactive e-learning education (print and online) is accepted (one point per exercise unit) Other recognised activities include: – Lecture and discussion groups – Congress attendance – Active participation for example at a workshop – Self-study of scientific literature – Author/Referent – Practical training – Curriculum-based content including curricular continuing education measures, specialist training courses prescribed for a specialist qualification under the Regulations Specialist Training or supplementary courses of study
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system. ECMECs credits are recognised
Name of the CME competent authority	The German Medical Association (Bundesärtzekammer) Due to the system of sixteen states (Länder) in Germany there are actually seventeen (two in one of the largest states) primary organizations involved in overseeing CME
Website	http://www.bundesaerztekammer.de

[14] The German Medical Association. http://www.bundesaerztekammer.de. Accessed April, 2012

Country	**Greece**[15]
Presence of CME	Yes
CME compulsory	No, voluntary
CME system	100 CME hours every five years
CME credits (unit)	There isn't a CME system based on credits
Recognised types of CME activity	E-mail and long distance learning is not currently receiving accreditation
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	The Panhellenic Medical Association (PHMA)
Website	http://www.pis.gr

[15] UEMS (2007). Greece. http://www.ipcaa.org/assets/Greece77669.pdf. Retrieved April, 2012

Country	**Hungary**[16]
Presence of CME	Yes
CME compulsory	Yes, since 1999
CME system	250 CME credits every five years, at least 50 CME credits per year.
CME credits (unit)	One CME credit point is awarded per hour
Recognised types of CME activity	Distance learning is allowed. An E-learning program must include at least three questions and has a maximum of 20 CME credits in a year. Other recognised activities include: – Training courses organized outside the workplace (pre-classified) including approved continuing education courses, lecture series or participation in a professional events program (evaluated on the basis of duration) – Training courses organized at the workplace – A professional study tour – Publishing activity: • Scientific papers accepted or published in peer-reviewed journals • Articles in a journal with an impact factor • Scientific conference attendance including presentation or a poster (in Hungarian or a foreign language) • Participation in an international or national scientific conference • PhD thesis • PhD candidate • Scientific textbook, including contributing to a chapter • Chapter for a university, college or other educational materials
CME target	Medical doctors, dentists, pharmacists and clinical psychologists
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system. ECMECs credits are recognised
Name of the CME competent authority	The Association of Hungarian Medical Society – MOTESZ
Website	http://www.motesz.hu

[16] The Association of Hungarian Medical Society. http://www.motesz.hu. Accessed April, 2012

Country	**Ireland**[17]
Presence of CME	Yes, since 1995
CME compulsory	Yes, since 2010
CME system	250 CME credits every five years, with at least 50 CME credits required per year. A common framework for all approved Professional Competence Schemes sets requirements that participants need to meet including: – External (maintenance of knowledge and skills): 20 credits per year (minimum), 100 credits per five year cycle (minimum) – Internal (practice evaluation & development): 20 credits per year (minimum), 100 credits per five year cycle (minimum) – Personal learning (may involve reading journals, preparation for giving lectures or online learning): Five credits per year (minimum), 25 credits per five year cycle (minimum) – Research or teaching: Two credits per year (desirable), 10 credits per five year cycle (desirable)
CME credits (unit)	One CME credit point is awarded per hour
Recognised types of CME activity	Personal learning including journal contributions and participating in journal clubs. E-learning is accepted. Other accepted activities include: – External: International/national meetings, college/society meetings, courses accredited by the training body, medically related advanced degrees or online courses – Internal: Clinical clubs, morbidity and mortality meetings, clinical risk meetings, case presentations, chart reviews, grand rounds, multi-disciplinary meetings or peer review groups – Research or teaching: Accredited postgraduate trainer, lectures, examiner for postgraduate training body, publishing articles, poster presentation, national standards development or question setting
CME target	All medical doctors (all specialities)
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system and doctors who attend international conferences are awarded credit points
Name of the CME competent authority	Royal College of Physicians of Ireland
Website	http://www.rcpi.ie

[17] Royal College of Physicians of Ireland. http://www.rcpi.ie. Accessed April, 2012

Country	**Italy**[18]
Presence of CME	Yes, since 2002
CME compulsory	Yes, since 2002
CME system	150 CME credits every three years, at least 50 CME credits per year (minimum 25, maximum 75)
CME credits (unit)	One CME credit point is awarded per hour
Recognised types of CME activity	Self-learning without tutor (FAD) (including journals and distance learning programs (one credit per hour)) or self-learning with tutor (FAD, 1.5 credits per hour). 90 CME E-learning credits in three years for nurses (maximum), no limits for the other health operators Other recognized activities include: – Residential education: Congresses, conferences, courses, seminars, meetings or symposia – Interactive residential education: Discussion groups, role plays or clinical case discussion – Individual training – Improvement groups: Commissions or guidelines – Research: Design, objectives or study groups finalized – Publishing • Journal with an impact factor • Journal without an impact factor • Book or monography (chapter) – Clinical audit – Teaching and tutoring: • Relations, teaching or accredited residential events • Tutoring • Coordination of training activities • Tutoring for internships
CME target	All health professionals (not only medical doctors)
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system. Credits that health professionals may acquire abroad (EU countries, USA and Canada) are recognized with a value of CME credits equal to 50% of those assigned to the event
Name of the CME competent authority	Agenas
Website	http://www.agenas.it/

[18] National Agency for Regional Health Services. http://www.agenas.it. Accessed April, 2012

Country	**Latvia**[19]
Presence of CME	Yes
CME compulsory	Yes
CME system	250 CME credits every five years with at least 50 CME credits per year
CME credits (unit)	One CME credit point is awarded per hour
Recognised types of CME activity	Distance learning programs are accepted (one credit per hour) Other recognized activities include: – Work in a professional advisory board, working groups, expert – Work certification, exam commissions – Work in the Latvian Medical Association (elected bodies) – Work for international professional associations – Work as regular teacher – Working for continuing education – Lectures and courses – Congresses, conferences, symposia, rallies, roundtable discussions or professional association meetings – Subscription to a relevant magazine about professional specialization – Relator at meetings of professional associations, congresses and conferences (in Latvian) – Participation in Latvian or international congresses, conferences or symposia – Speaking about medical institutions in clinical conferences, clinical case studies and literature reviews or public health topics in mass-media – International congresses and conference reports – Presentations (oral report) at international congresses and conferences – Publications – Research activity – PhD thesis – Full-time/part-time lecturer in universities
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	The Association of Physicians of Latvia
Website	http://www.arstubiedriba.lv

[19] Latvian Medical Association. http://www.arstubiedriba.lv. Accessed April, 2012

Country	**Lithuania**[20]
Presence of CME	Yes
CME compulsory	Yes
CME system	120 CME credits every five years (24 credits per year)
CME credits (unit)	Not available
Recognised types of CME activity	E-learning is accepted
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Ministry of Health of the Republic of Lithuania. The State Health Care Accreditation Agency at the Ministry of Health is responsible for assessing CME certificates to determine CME hours (credits)
Website	http://www.sam.lt, http://www.vaspvt.gov.lt

[20] The State Health Care Accreditation Agency at the Ministry of Health. http://www.vaspvt.gov.lt/node/168. Accessed April, 2012

Country	**Luxembourg**[21,22,23]
Presence of CME	Yes
CME compulsory	No, voluntary
CME system	CME is conducted on a voluntary basis, each physician is responsible for the identification of his/her own needs and participation to local or international events to keep updated.
CME credits (unit)	Not available
Recognised types of CME activity	Not available
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	The Association of Doctors and Dentists (AMMD) Luxembourg Association for Continuing Medical Education (ALFORMEC)
Website	http://www.ammd.lu http://www.alformec.lu/ http://www.institutfmc.lu/

[21] Luxembourg Institute for Continuing Medical Education. http://www.institutfmc.lu. Accessed April, 2012
[22] The Luxembourg Association for Continuing Medical Education. http://www.alformec.lu. Accessed April, 2012
[23] UEMS (2008). Luxembourg. http://www.ipcaa.org/assets/Luxembourg44760.pdf. Retrieved April, 2012

Country	**Netherlands**[24,25,26]
Presence of CME	Yes
CME compulsory	Yes, since 1996
CME system	200 CME hours every five years with at least 40 CME hours per year. Doctors must take part in 40 hours of CME per year and general practitioners (GPs) must take part in at least two hours peer review per year. Doctors have to demonstrate that they have undertaken 16 hours per week of general practice work in each year, over the previous five years. It is compulsory for GPs to undertake at least 10 hours of peer review
CME credits (unit)	One CME credit point is awarded per hour
Recognised types of CME activity	Distance learning (E-learning) is accepted. Every distance learning program lasts from one to four hours, one hour for modules (online system called GAIA) Other recognised activities include: – Continuing education meetings abroad (congresses or symposia) – Writing a thesis – Publication in a scientific journal – Giving a lecture at an accredited meeting – GP Trainers (via BIA GP training) – Editorial membership of a scientific journal – Participation in workgroups for guideline development – Personal Curriculum (PL) – Peer review
CME target	Physicians, pharmacists, physiotherapists, healthcare psychologists, psychotherapists, dentists, midwives and nurses
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Royal Dutch Medical Association (KNMG) GAIA (Joint Accreditation Internet Application, e-learning)
Website	http://knmg.artsennet.nl

[24] Royal Dutch Medical Association. http://knmg.artsennet.nl. Accessed April, 2012
[25] The Accreditation Board Cluster 1. http://www.cvah.net. Accessed April, 2012
[26] UEMS (2008). Netherlands. http://www.ipcaa.org/assets/Netherlands42818.pdf. Retrieved April, 2012]

Country	**Malta**[27]
Presence of CME	Yes
CME compulsory	No, voluntary
CME system	Not available
CME credits (unit)	Not available
Recognised types of CME activity	Not available
CME target	General practitioners
Participates in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	The Medical Association of Malta
Website	http://www.mam.org.mt/

[27] The Medical Association of Malta. http://www.mam.org.mt. Accessed April, 2012

Country	**Poland**[28]
Presence of CME	Yes, since 2004
CME compulsory	Yes, since 2004
CME system	200 CPD credits every five years which must include 140 CME points and 60 CPD points. There are two categories of activities including: – Basic – Additional (100 credits maximum)
CME credits (unit)	One CME credit point is awarded per hour
Recognised types of CME activity	Basic activities: – Implementation of a specialization program – Participation in courses for doctors (out of program) – National or international course of clinical practice – National or international conferences, congresses or scientific symposiums – Scientific society meetings – Internal training organized by the structure in which the physician is employed – Lesson, report (oral) or poster at conferences, conventions or scientific meetings – Test accredited by a scientific society or speciality college – Doctorate in medicine, professor title, assistant title Additional activities (100 credits maximum): – Distance learning (E-learning) – Publishing a book about health, chapters in a textbook or an educational program – Writing and publishing books, a chapter or a multimedia educational program – Translation and publication of professional medical books, chapters in a book or educational multimedia program – Writing and publishing an article – Translation and publication of an article from a medical journal – Postgraduate management experience or acquisition of specialization for doctors or dentists – Specialization title – Subscription to a professional medical journal – Membership to a scientific society or professional college
CME target	All medical doctors and dentists
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Polish (Supreme) Chamber of Physicians and Dentists and Regional Chambers of Physicians and Dentists
Website	http://www.nil.org.pl

[28] Polish Chamber of Physicians. http://www.nil.org.pl. Accessed April, 2012

Country	**Portugal**[29]
Presence of CME	Yes, since 1982
CME compulsory	CME is voluntary, with no plans to make it mandatory
CME system	In the Public Service 15 days paid leave is allowed per year for CME activity
CME credits (unit)	There is no system of credits
Recognised types of CME activity	E-learning isn't recognised
CME target	All medical doctors
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Portuguese Medical Association (Ordem Dos Medicos)
Website	http://www.ordemdosmedicos.pt

[29] UEMS. (2008). Portugal. http://www.ipcaa.org/assets/Portugal81875.pdf. Retrieved April, 2012

Country	**Romania**[30]
Presence of CME	Yes
CME compulsory	Yes, compulsory since 2006
CME system	200 CME credits every five years, at least 40 CME credits per year – More than one third of the minimum score must comprise educational activities not directly related to the basic specialty of each individual – At least one third of the required CME credits must be represented by participation in courses
CME credits (unit)	One CME credit point is awarded per hour
Recognised types of CME activity	Distance learning (E-learning) is accepted: 18 hours per program, 10 questions per six hours (75% threshold require in order to pass the program). Both e-mail and online programs are allowed. Other recognized activities include: – CME courses – Attendance at international, national, regional, local events, congress, conference, symposium/seminar or a work group – Publications: • Articles in a scientific/medical journal • Chapter in a scientific/medical book • Medical/scientific book monograph • Publication of a medical/scientific books • Publishing in a journal with an impact factor – Subscriptions to medical journals (national and international) – Obtaining any of the following titles: • Resident physician confirmed by the Ministry of Public Health • Specialist, including the acquisition of other specialties • A certificate of further education • MD, including a second specialty • Doctor in medicine • Master • Trainer accredited by the Ministry of Public Health • Trainer of trainers, accredited by the Ministry of Public Health • Status of a teacher with university function, lecturer, associate professor with appointments confirmed by the Graduate Institute
CME target	Physicians
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Romanian Physicians Board
Website	http://www.cmr.ro

[30] Romanian Physicians Board website, http://www.cmr.ro [last accessed: April 2012]

Country	**Slovakia**[31]
Presence of CME	Yes, since 1998
CME compulsory	Yes, but voluntary for public physicians, compulsory for private physicians
CME system	250 CME credits every five years, at least 50 CME credits per year – 150 allocated for external officially planned medical education (CME) including seminars, conferences, posters, panel discussions, scientific and exploratory activities – 100 credits for personal study (CPD) – 100 credits per five years is automatically allocated to doctors performing every day practice
CME credits	One CME credit point is awarded per hour
Recognised types of CME activity	Immeasurable components: – Performance of a practice within the discipline – Medical assessment activity Measurable components: • Distant learning (correspondence or implemented via computer networks). E-learning is credited in the same way as autodidactic tests and is not included under "personal study". For 80-100% correct answers doctors collect two credits, for 60-80 % they collect one credit • Not supervised personal learning activities in the area of the specialisation - discipline • Attendance at courses • Attendance at scientific meetings organized in cooperation with educational institutions • Study stays • Local, regional and international professionally oriented meetings • Lecturing including pedagogical activities • Publications • Scientific research
CME target	All medical doctors, dentist, nurses, midwives and assistants in learning activity
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Slovak Accreditation Council for CME (SACCME)
Website	http://www.saccme.sk

[31] Slovak Accreditation Council for CME. http://www.saccme.sk. Accessed April, 2012

Country	**Slovenia**[32]
Presence of CME	Yes
CME compulsory	Yes, since 1992
CME system	75 CME credits every seven years
CME credits	One CME credit point is awarded per hour
Recognised types of CME activity	E-learning courses accepted. Other recognised activities include: – Lectures or passive involvement in seminars and meetings (national and international) – Publication in a medical/peer reviewed journal or book – Participation in peer review – Self-study – Literature study with test – Study trips and visits – Participation in a specific professional lecture
CME target	All medical doctors and dentists
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Medical Chamber of Slovenia
Website	http://www.zzs-mcs.si

[32] Medical Chamber of Slovenia. http://www.zzs-mcs.si. Accessed April, 2012

Country	**Spain**[33]
Presence of CME	Yes, since 2002
CME compulsory	No, voluntary
CME system	There are no recommendations or guidelines as to the number of credits to be collected annually. The CME credits are currently serving for career purposes (e.g., salary of doctors employed by public health services). Doctors may be able to earn more money by taking part in CME programmes
CME credits	1 ECMEC credit (European CME Credits) = 0,12 SACCME (Spanish Accreditation Council for CME) credit
Recognised types of CME activity	Traditional lectures, meetings, training seminars, distance learning activities
CME target	All medical doctors, pharmacists, dentists, veterinaries, nurses
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Spanish Accreditation Council for CME (SACCME)
Website	http://www.cgcom.es/seaformec

[33] General Council of Official Colleges of Physicians of Spain. http://www.cgcom.es/seaformec. Accessed April, 2012

Country	**Sweden**[34]
Presence of CME	Yes, since 2002
CME compulsory	No, voluntary
CME system	Not based on credits. The Institute for Professional Development of Physicians (IPULS) reviews CME/CPD events in accordance with criteria that comply with Swedish regulations and are in agreement with the EACCMEs recently revised criteria for live educational events. Approved events are published in IPULS "Doctors' on-line educational catalogue". The Swedish Medical Association recommends 10 days of external CME/CPD per year for doctors
CME credits	No credits are used
Recognised types of CME activity	E-learning is accepted
CME target	There is no system for CME accreditation of healthcare workers. IPULS certifies educational events and e-learning courses
Participation in the UEMS EACCME system	Yes, participates in the UEMS EACCME system
Name of the CME competent authority	Institute for Professional Development of Physicians in Sweden (IPULS)
Website	http://www.ipuls.se

[34] Institute for Professional Development of Physicians in Sweden. http://www.ipuls.se. Accessed April, 2012

Country	**United Kingdom**[35]
Presence of CME	Yes
CME compulsory	Yes
CME system	250 CME credits every five years, with at least 50 CME credits per year. Of these, at least 125 should be clinical external and at least 25 should be non-clinical external credits. A maximum of 50 personal credits may be claimed, and only 50 RCP (Royal Colleges of Physicians) approved distance learning credits and 60 MRCP UK (Membership of the Royal Colleges of Physicians of the United Kingdom) examining credits may count towards the total external credits claimed. CPD credits can be either clinical or non-clinical and can be derived from personal, internal or external activities. Exemption credits may only be claimed in exceptional circumstances when a physician is unable to meet the annual minimum requirements due to illness, maternity leave or long term absence from work
CME credits	One CPD credit point is awarded per hour
Recognised types of CME activity	Distance learning is accepted. However, only the first 10 RCP approved distance learning credits can be counted as external and the remainder can be claimed as personal. The Federation of the Royal Colleges of Physicians of the UK has an approved distance-learning credit category in order to acknowledge the increasingly available high quality online educational opportunities. Physicians can register up to 10 approved distance-learning credits towards their minimum annual requirement of 25 external credits. Physicians can only register distance-learning credits from distance-learning materials/products that have been approved for this purpose by the Federation. Other recognised activities include: – Unlisted external meetings (external) – Work related MSc (Master of Science) or equivalent activity (external) – Internal CPD meetings (internal) – Internal trust or employer mandatory training (internal) – Participation in audit meetings or morbidity and mortality meetings (internal) – Participation in grand rounds or speciality clinical meetings (internal) – Participation in seminars/workshops (internal) – Internal trust or employer mandatory training (internal) – Undertaking information searches (personal) – Presentations at conferences (personal) – Participation in committees/working parties (personal) – Reading journals and texts (personal) – Refereeing articles and texts (personal) – Undertaking a research project (personal) – Writing examination questions or examining (personal) – Writing review articles and texts (personal)
CME target	All medical doctors who have a licence to practise
Participates in the UEMS EACCME	Yes, participates in the UEMS EACCME system

[35] Academy of Medical Royal Colleges. http://www.rcplondon.ac.uk. Accessed April, 2012

system	
Name of the CME competent authority	Academy of Medical Royal Colleges
Website	http://www.rcplondon.ac.uk

Results of the search:

The tables have been completed for 22 countries including:
Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Netherlands, Poland, Portugal, Spain, United Kingdom, Czech Republic, Romania, Slovakia, Slovenia, Sweden and Hungary.

The tables of Lithuania has been partially completed.

The tables of two countries have not been filled due to a lack of data including:
Luxembourg, Malta.

The following table summarises the results of the research according to six fundamental categories: the presence or absence of a CME system, the CME requirements (compulsory, voluntary), the number of credits per year, the unit of accreditation, the recognition of e-learning and the end-users of the training.

Summary table of the research

Country	Presence of a CME system	CME requirement	Credit/year	CME credits (credits/minutes)	E-learning recognised	CME target
Austria	Yes	Compulsory	150/3	1/45 min	Yes	All medical doctors
Belgium	Yes	Voluntary	60/3	1/60 min	Yes	All medical doctors
Bulgaria	Yes	Compulsory	150/3	1/45 min	Yes	All medical doctors
Cyprus	Yes	Voluntary	150/3	1/60 min	Yes	All medical doctors
Czech Republic	Yes	Compulsory	120/5	1/45 min	Yes	All medical doctors
Denmark	Yes	Voluntary	200/5	1/60 min	Yes	All medical doctors
Estonia	Yes	Voluntary	300/5	1/45 min	No	All medical doctors
Finland	No	Voluntary	Not based on credits	-	Yes	All medical doctors
France	Yes	Compulsory	250/5	1/45-60 min	Yes	All medical doctors, dentists and hospital pharmacists
Germany	Yes	Compulsory	150/3 – 250/5	1/45 min	Yes	All medical doctors
Greece	Yes	Voluntary	100/5	NA	No	All medical doctors
Hungary	Yes	Compulsory	250/5	1/60 min	Yes	All medical doctors, dentists, pharmacists and clinical psychologists
Ireland	Yes	Compulsory	250/5	1/60 min	Yes	All medical doctors
Italy	Yes	Compulsory	150/3	1/60 min	Yes	All the health professionals
Latvia	Yes	Compulsory	250/5	1/60 min	Yes	All medical doctors
Lithuania	Yes	Compulsory	120/5	NA	Yes	All medical doctors
Luxembourg	Yes	Voluntary	NA	NA	NA	All medical doctors
Netherlands	Yes	Compulsory	200/5	1/60 min	Yes	All medical doctors, pharmacists, physiotherapists, healthcare psychologists, psychotherapists, dentists, midwives and nurses
Malta	Yes	Voluntary	NA	NA	NA	General practitioners
Poland	Yes	Compulsory	200/5	1/60 min	Yes	All medical doctors and dentists
Portugal	Yes	Voluntary	Not based on credits	-	No	All medical doctors
Romania	Yes	Compulsory	200/5	1/60 min	Yes	All medical doctors
Slovakia	Yes	Voluntary	250/5	1/60 min	Yes	All medical doctors, dentist, nurses, midwives and assistants in learning activity
Slovenia	Yes	Compulsory	75/7	1/60 min	Yes	All medical doctors and dentists
Spain	Yes	Voluntary	NA	1 ECMEC credit = 0,12 SACCME	Yes	All medical doctors
Sweden	Yes	Voluntary	Not based on credits	-	Yes	-
United Kingdom	Yes	Compulsory	250/5	1/60 min	Yes	All medical doctors

NA = Not Available

1.2 Conclusions

In this report we give an overview of the CME system in the 27 countries of the European Union. Importantly, the 27 countries are full members of UEMS and follow the EACCME directive. Thus, although there are different types of CME systems in each country, with some systems still in their development phase, there exists a common framework (UEMS) to which all countries tend to align. This helps to reduce the heterogeneity across the different CME systems.

All 27 European Union countries have their own CME system except Finland, where the system is still being developed. More than half of countries analyzed (15 countries, 56%) have mandatory participation to their CME system. In the remaining countries participation is voluntary and based on the assumption that continuing medical education is a civic duty and, in some cases, participation is encouraged by either tax incentives or financial rewards.

There is a reasonable homogeneity in the type of CME system across countries and for most of them (15 countries, 56%) it can be divided into two main types:

- CME system with a five years cycle for a total of 200/250 credits (11 countries, 41%)
- CME system with a three years cycle for a total of 150 credits (5 countries, 19%)

The remaining CME systems are somewhat different including for example, a five years cycle for a total of 100/120 credits, and Slovenia whose system requires 75 credits in seven years. Sweden is unique because it has a CME system that is not based on credits. For Luxembourg, Malta, Portugal and Spain full details about CME system were not available through the literature search or via email requests (and reminders) to relevant contacts.

There was large homogeneity on the accreditation unit across countries: 14 countries (52%) award one credit for one hour of activity and six countries (22%) award one credit for 45 minutes of activity. Information on accreditation unit was not available for the remaining four countries with a system based on credits (15%).

Some types of activities were accepted for credit across all 27 European Union countries including: internal/external activities, publications and referee duties. Distance learning (E-learning) was recognized for the acquisition of credits in 22 countries (81%) and not recognized in only two (7%, Greece and Estonia). For the remaining three countries (11%, Luxembourg, Malta and Portugal) information on accepted activities for accreditation was not available.

Most CME systems (17 countries, 63%) are targeted to medical doctors (all specializations). Only seven countries (26%), Italy included, have a CME system also open to other health operators.
Italy in particular is the only country in which all health operators are obliged to carry out the continue medical education.

Overall, based on the similarity across the CME systems of the 27 European Union countries the results suggest that it could be possible to develop a protocol of E-learning, such as the Tell Me Project, that could be consistently applied in different countries. Most countries have CME systems with similar accreditation systems, recognize distance learning and have mutually recognized credits because they belong to a common system (UEMS). However, a potential limitation is that most CME systems are targeted to medical

doctors and, in the case of global events requiring organised actions (which is the focus of the Tell Me Project), different types of health operators would be expected to be involved and each one of them would have to match specific training requirements. However, numerous health training activities are operating across the different countries which may need to be incorporated into each accreditation system and taken into account in case of a coordinated European action.

2. Technical

2.1 Introduction and background

We have conducted a review of the literature and Internet based searches to find comparison studies, reports or discussion about open source Learning Management Systems (LMS), with a focus on their strengths and weaknesses. The aim was to identify the best LMS system to release CME during a pandemic situation across all 27 countries of the European Union.

The analysis focused exclusively on open source technologies that have no limitations on their distribution. Thus, commercial products were excluded from the evaluation. The main criteria for the evaluation of the most relevant distance learning activities are as follows:

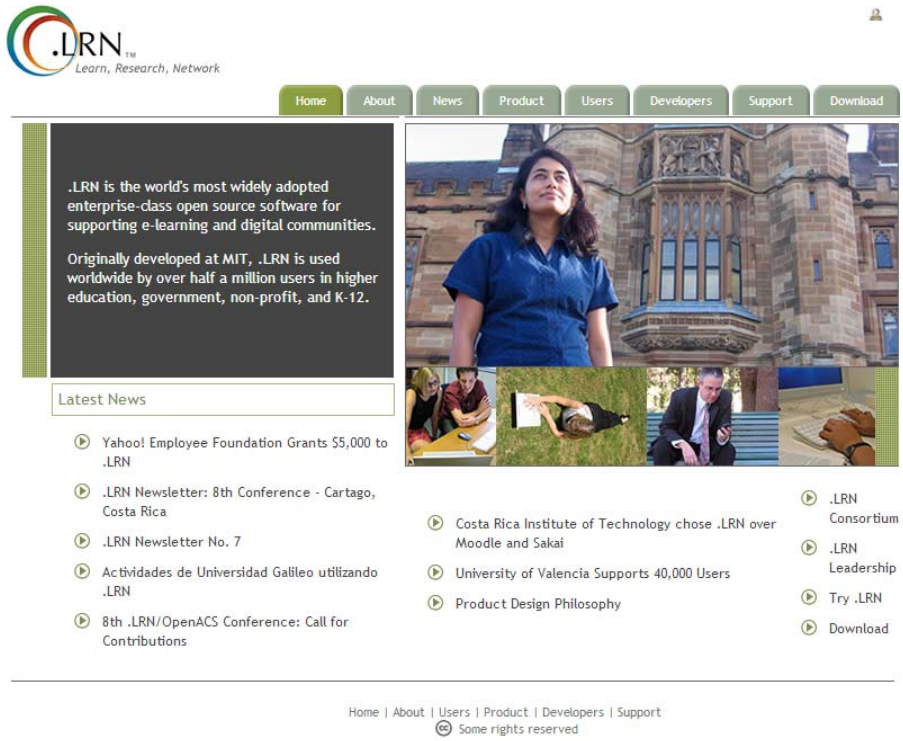
- **Usability** The LMS must be fairly intuitive to use; documentation, how-to guides, support, training and online help have to be available and accessible for administrators, teachers and students
- **Adoption** Both a consistent development community and a fair number of similar institutions using the LMS have to be documented
- **Number of languages (localisation, translation guidelines and manuals)** The system has to support the official languages of the 27 European Union countries
- **Scalability** The program has to be suitable for both small and large installations; the LMS needs to transparently follow the increase of users, contents and functionality

If one or more of these criteria was not reached the software was excluded from further review. Secondary criteria were also considered including:

- **Hardware/software compatibility** The software should run under the most used server systems (Windows server, Apple server, Linux and Unix) and have low hardware requirements
- **Customized look** Themes customisation that is maintained throughout the different pages and learning objects
- **User presence logging** Availability
- **Chat** Availability
- **Forums** Availability
- **Online support/help** Availability of a system for help/bug tracking for administrators and teachers on the developers' site

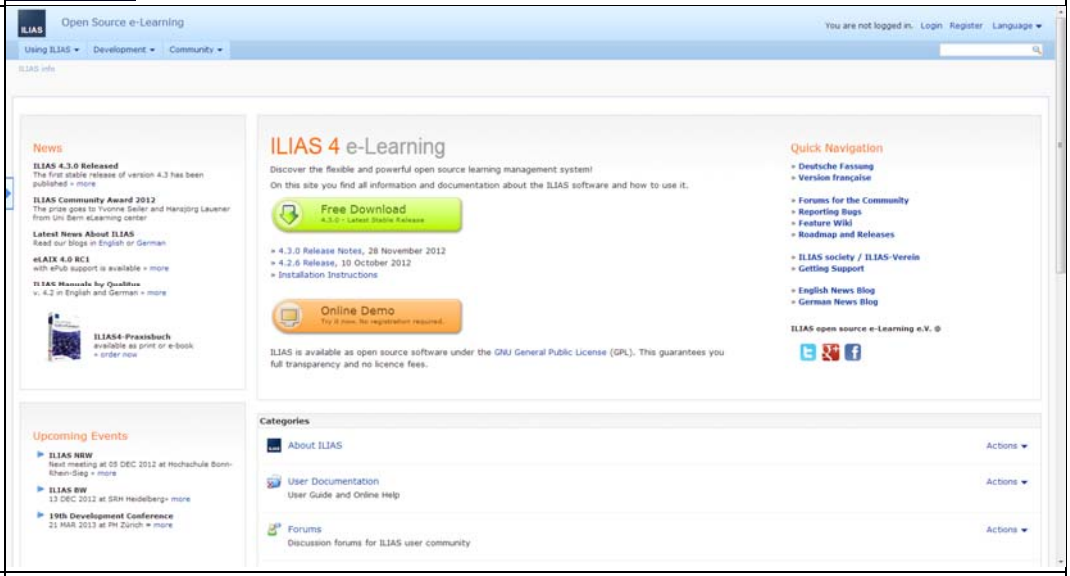
Based on a review of 35 E-learning platforms five were selected for more detailed assessment. These five platforms were frequently present in comparison to charts of benchmarks analysed from 2003 to 2011 and include: LRN (dotLRN), ILIAS, Dokeos, ATutor and Moodle.

The first part of the analysis is more in-depth and retained the specific description of the LMS. This information was retrieved from the LMS's documentation and has been integrated with relevant data documented in case studies, product comparisons and discussion threads.
The following tables summarise the characteristics of the five main E-learning platforms selected: dotLRN, ILIAS, Dokeos, ATutor, Moodle

Table 1	
Name	.LRN/dotLRN (pronounced "dot learn")
Logo	
Platform home page	
Last version	.LRN Stable release 2.5.0 (as of June 2012)
Link	http://www.dotlrn.org/index.html
Dissemination	35 installations. No exact data are available on how many real running installations there are, but from the download page some versions have been downloaded as many as 76.748 times. However, the availability of a stable version suitable for different Linux operating systems, it is likely that installations of dotLRN are higher than anticipated.
About	.LRN is a global community of educators, designers and software developers. .LRN is backed by the .LRN Consortium, a non-profit organization committed to advancing innovation in educational technology through open source principles. Consortium member institutions work together to support each other's deployments and to accelerate and expand the adoption and development of .LRN. The Consortium ensures software quality by certifying components as .LRN-compliant, coordinates software development plans and maintains ties with OpenACS (the open source toolkit which forms the basis for .LRN). The .LRN Board of Directors, representing Consortium members, sets strategy and has ultimate oversight responsibilities for the project. The .LRN Leadership Team manages operations, works with the open source community of users and developers and executes the goals of the Consortium as defined by the Board

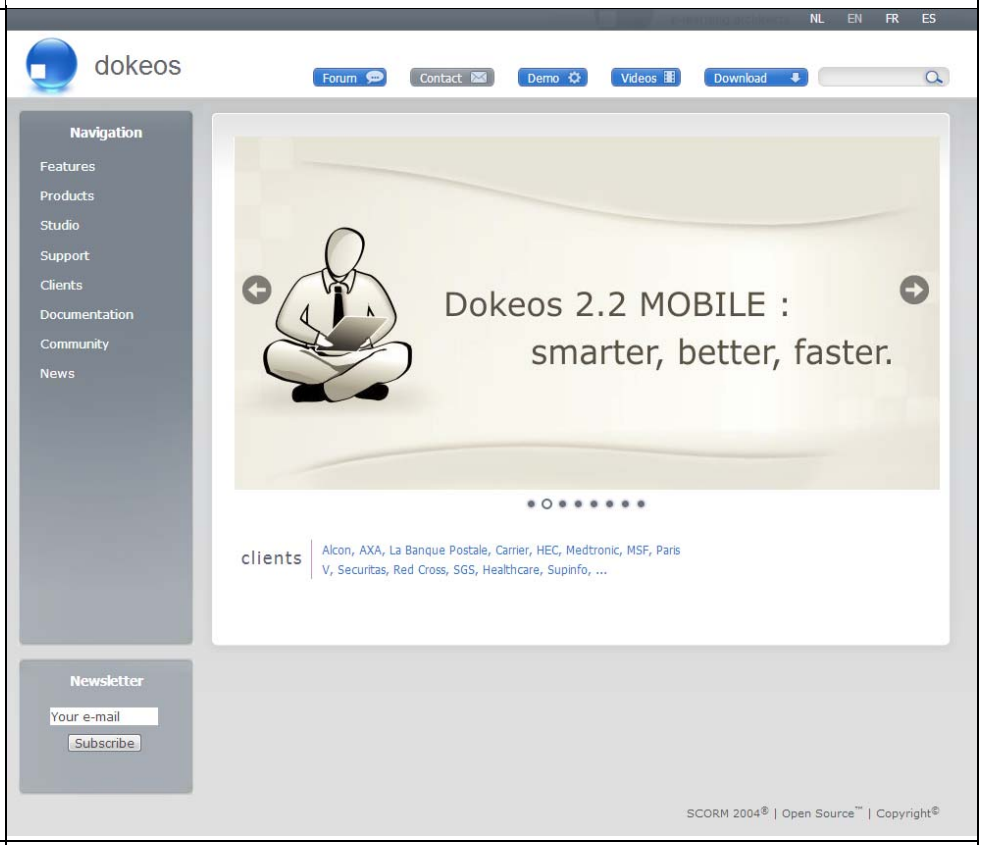
General consideration	.LRN is a group supported environment to which E-learning features have been added. Its logical unit is the user, who has a personal workspace. This space also provides access to shared spaces (classes). The .LRN system was originally developed by MIT as part of the Intellectual Commons project. It is an open source project created according to the motto "Learn, search, network" to support innovation in learning and research co-operative community. The typical characteristics of .LRN reside in the quality of support and development community
Technical	**Technology** .LRN is built using OpenACS (Open Architecture Community System), an advanced enterprise framework for building scalable, community-oriented web applications. The OpenACS "core" has been in development for nearly a decade, with an investment of ten million dollars **Operating system** Linux and Unix. On other platforms a Unix-like virtual machine or OS has to be installed prior the .LRN installation process. Version 2.5.0 is in the standard Debian Stable repository **License** General Public License (GPL) **Reference model/Content Packaging specifications** HTML 4.01 Strict, WCAG double-A compliant, LRN compatible code is also available which uses RSS, Web Services, Learning Object Repository System and various components based on IMS and SCORM standards **Translation** Translated into 41 languages, including only 19 languages of the 27 European Union countries
Integrated features	- Forums, file storage, calendar, news, survey, FAQ, homework dropbox and group email. - Modules for weblogs, assessment, RSS news aggregator, HTML editor, web presentation, complex survey, photo-album and learning object repository are also available but not yet certified for release - At the infrastructure level the current release contains provisions for both basic and external authentication, permissioning, general notifications, internationalization, content management and WebDAV - Teachers can administer classes or online communities by customizing the layout, choosing the language and adjusting the time zone for their classes - Each user can customize the layout, language and time zone (this option is particularly useful in case of appointments) - Classes and communities can be created by an administrator who selects the access modalities
Strengths	– .LRN provides many tools for managing online communities. It is possible to define different types of communities with a variety of tools and resources for share working, discussions and research. – .LRN is extensible – .LRN benefits from the high scientific and technological values of institutions that sponsor the project including: MIT, the University of Heidelberg, Wirtschaftsuniversität Vienna, the University of Bergen in Norway, the Freie Universität of Berlin, Green Peace and the World Bank

Weaknesses	- The platform for .LRN is a combination of modules created by different designers at different stages of development and many features and tools are not always easy to interpret. The interface is not homogeneous and at times suffers from poor quality making it difficult to use, especially for teachers. In addition, the page reloads and the use of bookmarks don't always work as expected - .LRN seems more a collaborative space that an LMS due to the fact that it has only basic functions for file management - There are no real-time chat rooms - Installation is not easy

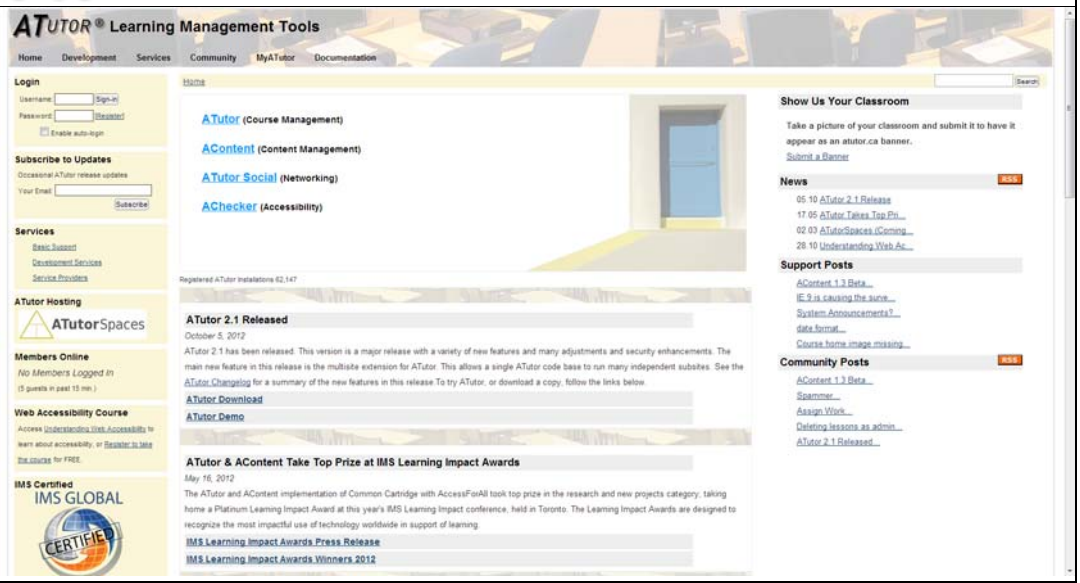
Table 2	
Name	ILIAS
Logo	
Platform home page	
Last version	ILIAS 4.2.5 (as of July 2012)
Link	http://www.ilias.de**/**
Dissemination	5.000 productive installations
About	ILIAS is a powerful system for web-based teaching and learning. It is a multi-purpose tool that can be used as a flexible course player, as an authoring tool and also as a communication and collaboration platform. It was the first Open Source LMS that has been certified as SCORM 1.2 and SCORM 2004 compliant. ILIAS is an open source software published under the General Public License and is free of charge for every institution and organization no matter the number of users. It is a secure LMS that has been certified by NATO and can be used on their system. The system development follows strictly defined guidelines and is coordinated by the ILIAS open source E-Learning society's coordination team
General consideration	ILIAS is a web-based LMS developed, since 1997, within the VIRTUS project by the University of Cologne (Faculty of Economics and Social Sciences) and became in 2000 an open source product licensed under the GNU/GPL. ILIAS was the first open-source LMS with SCORM certification. ILIAS has tools for learning, content creation, accessing information and cooperative work. Authors can create entire courses and publish them on line. Students can set up working groups and go through learning materials as well as communicate with each other and with their teachers

Technical	**Technology** PHP, Apache, MySQL **Operating system** Various platform specific bundles of Apache, MySQL, PHP (AMP trilogy): Windows, MAC OS, Linux, Unix, etc. **License** General Public License (GPL) **Reference model/Content Packaging specifications** SCORM 1.2 and SCORM 2004 modules - Conformance ADL LMS-RTE3, AICC **Translation** Translated into 23 languages, including only 17 languages of the 27 European Union countries
Integrated features	– Personal desktop for each user with all the information on visited courses, new messages or new posts on the forum – Learning environment with personal annotations, test, glossary and print, search and download functions – Course management system – Functions for communication such as mail, forums and chatting – Functionality based on access role – Tools for testing and evaluation – Integrated authoring tools that allow authors to add/edit contents, metadata and subcomponents at each level without advanced technical knowledge – Authoring tools for students to track materials (texts, images or graphics), retrieve all the records/annotation and also share this information with other students – Installation and system administration documentation is available both on- and off-line – Possible to structure courses at different levels, in hierarchical or sequential order including modules, chapters, pages and elements – Metadata defined in one level are available to all LOs (learning objects) – Contextual help and a custom interface is available for teachers/authors and students
Strengths	– Integrated environment for authors and for courses creation – Metadata support for all available learning objects – Multiple clients supported on the same installation – Many tools for users and administrators – Functionality based on access role – Possible to import SCORM/AICC/HTML modules – Testing and evaluation tools available – Good in business as it allows management of a complex centralised archive with a large amount of data

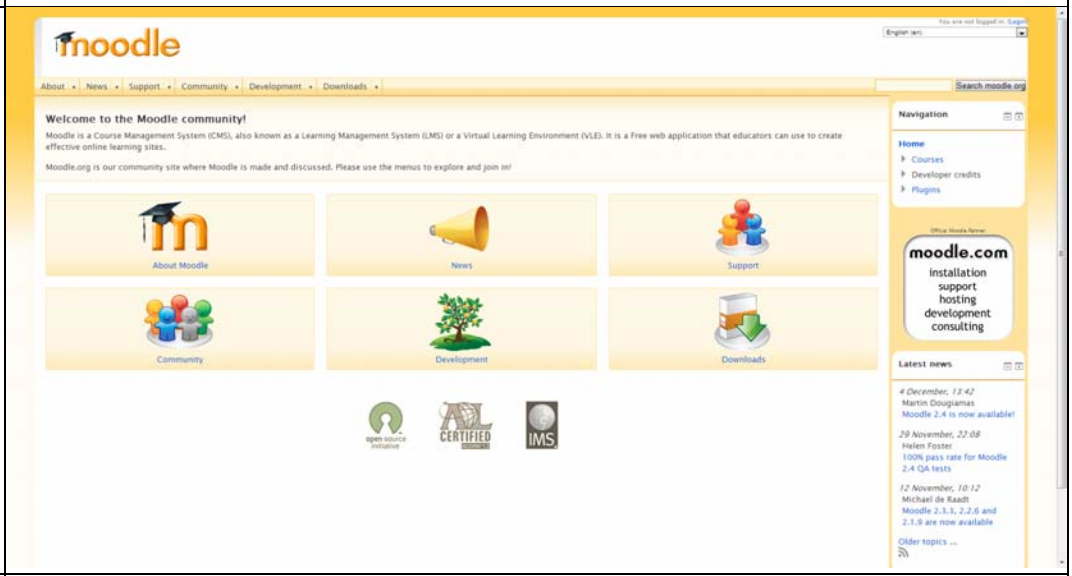
Weaknesses	– Installation in Windows is not suitable for a production deployment as it uses XAMP as server-backend – Usability is limited as some features are difficult to manage and too many steps are required to accomplish otherwise simple tasks. The access to the various functions is not immediate and some tools, like the bookmark function, cannot be used – The role-based high differentiation can be difficult to cope with even for experienced users – The heterogeneous group of developers might increase system complexity – Installation is difficult - ILIAS is one of the most complete and powerful LMS currently available in the Open Source world. ILIAS has a different approach compared to other available products and is more complex. However, with the appropriate knowledge it allows users to develop the most appropriate environment according to needs through the use of the rich variety of tools and features offered

Table 3	
Name	Dokeos
Logo	
Platform home page	
Last version	Dokeos 2.0 (free - as of June 2012)
Link	http://www.dokeos.com/en
Dissemination	11.525 installations
About	Dokeos is an open source online learning suite. It provides all the features needed for E-learning and blended learning management: from authoring to reporting. Dokeos is a company dedicated to open source Learning Management Systems. Its main product is a SCORM-compliant open source learning suite used by multinational companies, government agencies and universities. Dokeos operates on a professional open-source business model based on open code, community development, professional consulting, quality-assurance services and subscription-based customer support

General consideration	The project is a recent development of Claroline, an academic technological platform. Compared to Claroline, the interface has been slightly modified and new features added, including SCORM support and a run-time engine. Quickly Dokeos became an independent product, with four main goals: to help teachers to realize pedagogical contents, structure activities on the basis of learning pathway, interact with students and follow progress with a tracking system. Specifically, Dokeos allows the creation of "educational pathways" for students. Each educational pathway can be built by creating one or more modules that contain all (or part) of the resources of the course. Once the modules are created internal hierarchies can be defined. Students and teachers from various universities, mainly in Europe, support the project
Technical	**Technology** PHP, Apache, MySQL **Operating system** Server Operating system supporting web-service, MySQL and PHP, e.g., Windows Server, MAC OS Server, Linux, etc. **License** General Public License (GPL) **Reference model/Content Packaging specifications** Partially SCORM compliant. IEEE LOM only for documents and groups (The IEEE 1484.12.1 – 2002 Standard for Learning Object Metadata is an internationally-recognized open standard published by the Institute of Electrical and Electronics Engineers Standards Association, New York for the description of “learning objects”) **Translation** Translated into 44 languages, including all languages of the 27 European Union countries, except Estonian
Integrated features	– High usability and reliability – Support of learning paths – Chat, forums, video/audio conferences – Partial support of SCORM – High modularity with plugin use
Strengths	– Learning paths approach – Organization of tools – Flexible, allowing the possibility to build and add new plugins (since version 1.6.0)
Weaknesses	– Installation in Windows is not suitable for a production deployment as it uses XAMP as server-backend – Author’s tools need to be improved – In-site search not available – Documentation is incomplete – The customization of style sheets can be done only at the platform level such that users cannot customize platform default settings – On the official site guides and tutorials are only in PDF (some tutorials are also in Flash) – Lack of XML support

Table 4	
Name	ATutor
Logo	ATUTOR®
Platform home page	
Last version	ATutor 2.0.3 (as of June 2012)
Link	http://atutor.ca/
Dissemination	58.593 official installations
About	ATutor is an Open Source Web-based Learning and Content Management System (LCMS) designed with accessibility and adaptability in mind. Administrators can install or update ATutor in minutes, develop custom templates to give ATutor a new look and easily extend its functionality with featured modules. Educators can quickly assemble, package and redistribute Web-based instructional content, easily retrieve and import prepackaged content and conduct their courses online. Students learn in an adaptive learning environment
General consideration	The ATutor project started in 2002 and was developed by the Adaptive Technology Resource Centre (ATRC) at the University of Toronto; an internationally recognized leader in the development and distribution of E-learning to disadvantage people. ATutor is released under the General Public License (GPL) releasing license and is currently considered among the best distance learning platforms. This LCMS allows developers to build reusable content that can be shared through different E-learning systems; in the same way, contents realized with IMS or SCORM compliant systems can be easily imported
Technical	**Technology** HTTP web server (Apache, IIS, etc.), MySQL, PHP **Operating system** Server Operating system supporting web-service, MySQL and PHP; e.g., Windows Server, MacOS Server, Linux, etc. **License** General Public License (GPL) **Reference model/Content Packaging specifications** SCORM 1.2, SCORM 1.2 Runtime Environment (LMS RTE3), IMS Packaging, W3C XHTML 1.0, W3C WCAG 1.0 accessibility specifications at the AA+ level **Translation** Translated into 69 languages, including all languages of the 27 European Union countries

Integrated features	– Separate interface for administrators of the courses – Courses can be built from sets of pages – Creation of reusable and interoperable learning objects through the adoption of IMS Content Packaging specification/SCORM – Ability to define tags to expand the search mechanism across the courses – Easy creation of courses, although skills in HTML are desirable – Contextual help and further support is available on the ATutor web site – ATutor is under constant development, implementing leading edge standards of E-learning and trying to integrate WYSIWYG editor to allow teachers to create course contents without having to know HTML – ATutor website includes several forum: a support forum, a bug tracking forum and a "wish list" forum
Strengths	– One of the main focuses is on accessibility and for this reason ATutor is the only distance learning product in accordance with the W3C WCAG 1.0 Level AA + standards – The system is adaptable, resource sparing and functional. ATutor is very simple and intuitive even for the most inexperienced users, both administrators and teachers. Teachers can develop online learning environments that are highly adaptable and customised. In addition, ATutor has simultaneous and asynchronous collaboration and communication systems (forums, chat, messaging). Users can customized the presentation of content based on their learning needs and styles
Weakpoints	– No bookmarks to different elements of the courses is available – Difficulty in extending the functionality of ATutor – Authentication is made only against the internal database of ATutor – Requires a fairly long training period – Not enough installation and maintenance documents – Many shortcomings make ATutor unsuitable for non-academic areas

Table 5	
Name	Moodle
Logo	
Platform home page	
Last version	Moodle 2.3 (as of June 2012)
Link	http://moodle.org/
Dissemination	66.000 currently active sites
About	Moodle is a Learning Management System (LMS) or Virtual Learning Environment (VLE). It is a software package for producing Internet-based courses and web sites. It is a global development project designed to support a social constructionist framework of education. Trainers are available around the world making it an effective tool for creating and conducting online courses. The main objective of the Moodle project is to provide educators/teachers the best tools to manage and promote learning. It can be used in small (e.g., small school or independent training) or very large (e.g., hundreds of thousands of students) learning environments. Many institutions use Moodle as an environment for entirely online courses while others use it to support courses in blended learning. The Moodle's activity modules (such as forums, Wiki and databases) are often used to build learning communities (in the tradition of social constructivism). Alternatively, some users prefer it as a tool for content distribution (such as SCORM packets) and to evaluate learning through quizzes and homework

General consideration	Moodle starts from a social constructionist pedagogical model. It is an open source project promoted by the University of Technology in Australia. Moodle provides tools for course management and integration of its content (documents and exercises) by both teachers and students. Moodle is a web based open source (under GNU Public License) project that is actively being developed. It has many features, most of which are aimed towards collaborative work such as forums, instant messaging, an integrated system of e-mail, management of working groups, shared agenda, blogs, wiki and quizzes. The Moodle community is organized around moodle.org. In 2007 the UK government-funded OSS Watch reported that Moodle had become the LMS of choice for 56% of UK FE institutions. According to the Moodle Trust, there are almost 4 million Moodle courses in the world, used by 38 million participants
Technical	**Technology** PHP, Apache, MySQL **Operating system** Moodle can be installed on any computer that can run a HTTP web server, PHP and can support a SQL type database (for example MySQL). It can be run on Linux and Windows operating systems, Linux being the best option. Version 1.9.9 is in the Debian Stable repository thus available in all Debian-derivated Linux distributions **License** General Public License (GPL) **Reference model/Content Packaging specifications** SCORM 1.2 e IMS QTI 2.0 **Translation** Translated into 110 languages, including all languages of the 27 European Union countries
Integrated features	- PHP5 support - Timed multipage test module that supports 7 categories of questions - Teleskill videoconferencing system - Possibility to send SMS through a gateway (not included) - Management of customizable fields of cataloguing and users tree organization - Multimedia delivery support - Moodle is an extremely flexible teaching tool that requires no conceptual map or other complex designing tool. Owing to simple tools, once the format of the course has been defined (some presets are available), authors/teachers can start shaping content and structuring teaching. Once finished, the homepage will present links to various courses or learning modules. The navigation is extremely simple and intuitive (the course has the appearance of any dynamic website) - Moodle.com offers a community-based help system and a commercial assistance service (support, consulting and tailor-made development)

Strengths	– Intuitive and simple to use – Translated into over 110 languages and each administrator can create, complete and amend in their own language – Good scalability – Supported by a large community of users and developers – An ease-to-use focus makes it ideal for low budget organizations, such as schools, non-profit organisations, small businesses and local government agencies; but it is also ideal for large organizations – Many features exist, it is easy to use and can easily be extended to add more functionality – Installation and maintenance documents can be reached from Moodle.org and different mirroring sites – Courses can be structured in a variety of forms depending on specific needs
Weaknesses	- Although the interface is good (for example: one click is enough to switch the localisation from one language to another) there are some navigation issues - Moodle functionalities are sophisticated and sometimes involve tricky configuration options. On the other hand, these configuration options allow a very in-depth customization of the interface - Some parts of Moodle are very easy to use and some are not. The level of usability has not reached excellence because the main resources and functions available are not always immediately identifiable - The creation of hypertext links is complex and not very intuitive, thus making the implementation of hyper textual courses difficult - An improvement of the documentation of the project (based on Wiki) is needed - Accessibility should be enhanced

In order to evaluate each of the LMS we summarized how close its features met the main and secondary criteria using a scale ranging from 0 (non-existent/poor) to 5 (excellent), with 3 being the average value. For each criteria, the evaluations were based on data presented in previous tables and from average values of ratings found in case studies, product comparisons, benchmarks and discussion threads.

Main criteria (0 = non-existent or poor, 3 = average, 5 = excellent)	**dotLRN**	**ILIAS**	**Dokeos**	**ATutor**	**Moodle**
Usability	2	3	4	4	5
Adoption	3	3	4	4	5
Number of languages	3	2	3	4	5
Scalability	4	4	4	5	5
Global score	**12**	**12**	**15**	**17**	**20**

Secondary criteria (0 = non-existent or poor, 3 = average, 5 = excellent)	**dotLRN**	**ILIAS**	**Dokeos**	**ATutor**	**Moodle**
Hardware/Software compatibility	5	5	5	5	5
Customized look	2	3	3	4	5
User presence logging	2	3	4	4	4
Chat	0	5	5	5	5
Forums	5	5	5	5	5
Online support	2	3	3	4	4
Standards (SCORM)	4	4	3	5	5
Total score	**20**	**28**	**28**	**32**	**33**

All criteria	**dotLRN**	**ILIAS**	**Dokeos**	**ATutor**	**Moodle**
Total score	**32**	**40**	**43**	**49**	**53**

2.2 Conclusions

Each component of the five Learning Management Systems (LMS) can be considered as a valuable educational tool. However, only two platforms (Moodle and ATutor) have met the minimum Tell Me Project requirements related to usability, adoption, number of languages and scalability. The exclusion of the other systems, such as dotLRN, ILIAS and Dokeos, was essentially explained by their inability to fulfill the language requirements as they do not support all official languages of the 27 European Union countries.

The Moodle and ATutor platforms fulfill the main requirements of the project. The next step was to compare the two platforms to identify the most suitable one to adopt in the Tell Me Project.
Both LMS platforms are widely used but Moodle is characterized by the highest number of installations (66.000 vs. 58.593 for ATutor) and the largest development community. Both ATutor and Moodle are suitable for small and large installations. The ATutor platform is able to manage 20.000 to 50.000 registered users whereas Moodle is able to manage over 135.000 registered users (these figures are also supported by the utilisation of the FadInMed platform, an Italian distance learning program for medics and nurses).
The usability of both platforms is appropriate but Moodle appears to have a better interface, it is more intuitive and user-friendly, it has been translated into over 110 languages (vs. 69 supported translations for ATutor) and each user can create, complete and amend tasks in his/her own language.
Further, Moodle is supported by a large community of users and developers, installation and maintenance documents can be easily accessed online (from Moodle.org and several other websites), and it can be easily expanded and modified to increase functionality. ATutor is very simple and intuitive even for inexperienced users, but the availability of installation and maintenance documents and the potential to expand the functionality are limited.
Moodle appears to be a more suitable system according to our main selection criteria (usability, adoption, number of languages and scalability).

A re-evaluation of the two platforms based on our additional, secondary criteria minimizes their differences. However, Moodle still appears to be superior as: (1) the interface, modules, plugin and functions levels (it also supports a more multimedia format than ATutor) are more flexible; and, (2) a larger and more active community supports its adoption. The Moodle Trust reports almost 4 million Moodle courses worldwide which are used by 38 million participants. ATutor has not provided specific data on the number of participants which could be related to a decision of the company to put less emphasis on estimating the number of end-users.

Moodle seems to be the LMS platform that best meets the Tell Me Project requirements for the following reasons:
- User-friendly
- Manuals are available in all official languages of the 27 European Union countries
- Availability of material to support the use of the system (tutorials, guideline documents and forum discussions)
- Large and active community of users and developers assisting with problem resolution (e.g., bugs), platform applications and helping to identify strengths and weaknesses of the system

- Availability of numerous functions, plugins and modules to customize the system. These expand the functionality and enhance the adaptive capability of the platform to any technical and/or cultural requirements of the 27 European Union countries involved in Tell Me project.
- Adopted in large-scale training programs as it can support a high number of end-users. This feature is directly related to the aims of the Tell Me Project as it enables a rapid and widespread dissemination of the information across the 27 European Union countries

3. Scientific

3.1 Introduction and background

E-learning

Internet based e-learning is becoming an increasingly popular approach to medical education for practical and theoretical reasons. Compared with traditional face-to-face programs, E-learning platforms offer greater flexibility in training times, improved accessibility and dissemination, reduced costs and time, greater adaptability to individual learning styles and easier access to educational material and updates. Therefore, E-learning represents an ideal tool to achieve the primary aims of Tell Me project to develop an E-learning system for health workers capable of efficiently disseminate information across all 27 European Union countries in case of an infectious disease emergency.

Effectiveness of E-learning

Several studies and a recent narrative review have found that E-learning for health workers can enhance knowledge and modify behaviours equal to or greater than residential learning. In a randomized controlled trial Fordis *et al* found that when appropriately designed, evidence-based E-learning can produce objectively measurable changes in behaviour as well as sustained gains in knowledge that are comparable or superior to those achieved using effective live activities. Cook and collaborators conducted a meta-analysis of 138 studies to compare the effects of E-learning/no intervention and E-learning/live events. The analysis found that Internet-based learning was associated with large positive effects compared with no intervention and had a similar effectiveness compared to traditional methods. A recent narrative review focused on the comparison of the effectiveness between E-learning and residential programs. The review suggested that the effects of E-learning are comparable to traditional residential courses and E-learning is significantly more effective than no intervention.

E-learning approach

Some of the methods used to deploy an Internet-based course may be more effective than others[70]. The identification of an educational model that is suitable to the course requirements and type of learners is needed. The pedagogic model cannot be applied to adults because it assigns a passive role to the learner whereas the teacher has full responsibility for the content, modalities and evaluation of the learning. In contrast, andragogy consists of learning strategies focused on adults. The framework promotes learning by meeting the learners' needs and interests through the stimulation of active participation and use of prior knowledge. The andragogic model is based on an autonomous and self-directed modality of learning centred on a problem-solving approach, which represents a more efficient resource in adult and professional learning.

The most effective E-learning approach is a problem/case-based (or case-vignettes) model, which is closely linked to an andragogic model. Case studies are used as an active learning tool. The model requires the health workers to actively engage in the learning process by using their past experience, comparing the clinical case with their daily practice activities and then applying the new acquired knowledge to real life situations. The case-based approach has several advantages:

- Emphasizes the creation of knowledge and not simply its replication

- Reproduces the natural complexity of the real world without any simplification
- Contextualises the event instead of creating an abstract situation
- Offers a learning environment based on reality instead of pre-determined rigid learning sequences
- Offers multiple representations of reality
- Promotes reflective practices
- Allows gain in knowledge related to the clinical and professional context
- Promotes an active knowledge uptake

The use of a case-based model as a foundation for learning is an educational strategy widely recognized and applied since the second half of the 19th century. Indeed, recent evidence from the cognitive sciences suggests that knowledge and skills are learnt best in an environment where problem-solving approaches are promoted.

Clinical-case learning exposes the learner to scenarios similar to those experienced in their daily activities, presenting real problems and promoting situated learning. Clinical-cases are key tools that can be adapted to different situations and educational purposes such as:

- A study oriented on decision-making with the presentation of a problem that must be faced and decisions that must be taken
- Focused on problem-finding and analysis
- A report, in narrative form, which exemplifies models and baseline situations

Case-based studies are less theoretical than traditional face-to-face teaching as they present not only theories and general principles but also situations in which the learner can apply the theory and immediately verify its validity in practical scenarios. It is an approach focused on practice and centred on the learner rather than on the teacher.

Case-based learning uses the participant's previous experiences, but it is strictly linked to Evidence Based Medicine. It has the advantage that it directly involves the health operator in engaging activities and minimizing the risk of loss of attention, often present in E-learning programs. The clinical case is a real scenario in which health professionals and patient talks to each other and establish an emphatic relationship based not only on the collection of clinical information but also on the appraisal of the experience of the patient, his/her family background and the inevitable doubts and uncertainties that accompany the daily practice. The setting and the debate between the main characters of the "story" is a useful system to generate contextualized questions and encourage taking specific decisions to organize the new knowledge.
The acquisition of new knowledge using experiential techniques is the key principle of adult education.

Case-based approach effectiveness

One of the largest studies of case-based E-learning has been the ECCE project (Evidence Centered Continuing Education) undertaken by the Italian Drugs Agency (AIFA), the Italian Ministry of Health and Zadig scientific publisher, with over 150.000 registered users (100.000 nurses and 50.000 medical doctors, not published data) and a million cases addressed and resolved. ECCE was an E-learning CME tool that used interactive clinical vignettes based on *Clinical Evidence* and a predefined sequence of patient-oriented questions. The vignettes were created to reflect real-life circumstances seen in daily practice by general practitioners or nurses. ECCE's vignettes were well received. More than 90% of the users considered them

as relevant and appropriate for educational purposes, and 82.9% of free-text feedback messages were positive.

A review of the literature, including studies or reviews on the effectiveness of the problem/case-based learning approach, was also conducted. The review was carried out using PubMed and an Internet based search and studies published from January 2008 to present were included. The following Medical Subject Headings (MeSH) and keywords were used: (case[All Fields] AND based[All Fields] AND ("learning"[MeSH Terms] OR "learning"[All Fields]) AND medical[All Fields]) AND ("2008/01/01"[Date - Publication] : "3000"[Date - Publication]). Studies were included if they investigated the effectiveness of a learning course for health operators and health professions students. Articles were selected based on their title and abstract. We retrieved 646 articles in the primary search and 18 articles were included in the main analysis.

Nine articles studies case-based/problem-based learning approach in physicians, graduates or health professions and the remaining nine included health professions students (Marshall *et al* considered both students and health professions).
Five articles were evaluation studies, three were randomized controlled trials, two were reviews, two were reports and two were research article; Drexel C's study was an original research , Ahmed M's article was a commentary. Winkelman C and Kong J's articles are respectively a focus on and a comparative study.

Case-based/problem-based model in health professions
First we considered studies that described or analyzed case-based/problem-based learning approaches in physicians, graduates or health professions. Details of each study are reported below.

The article by Ahmed *et al* is a commentary on the study by Nordquist *et al*. The authors discuss an innovative case-based patient safety training program for junior doctors during the first two years of clinical practice (termed ''Foundation trainees'' in the UK), a population similar the one studied by Nordquist *et al*. The authors concluded that case-based learning is an exciting educational paradigm that should be integrated into the surgical curricula. They argued that this approach promotes clinical reflection and an understanding of patient safety within a contextualized setting, contributing ultimately to enhanced safety in patient care.

Keeve *et al* undertook an evaluation study to assess graduates from a patient-oriented, case-based learning dental curriculum with a specific assessment of the key competencies required for their professional activity. Dental graduates participated to the survey and the results showed that the case-based learning curriculum was associated with a strong positive effect on almost all key competencies required for dentists.

The article by Drexel *et al* is an original research that shows results from a case-based, multi-format, interactive continuing medical education program aimed at improving clinicians' knowledge and competency in evidence-based chronic obstructive pulmonary disease care. The study found that compared to non-participants, physicians who participated to the continuing medical education program on diagnosis, staging and treatment were significantly more likely to deliver evidence-based chronic obstructive pulmonary disease care. Therefore a multi-format, interactive, focused educational intervention improves physicians' diagnostic and therapeutic choices in the primary care setting and alignment to current clinical guidelines for the management of chronic obstructive pulmonary diseases.

Dussart *et al* found in their review that the application of case-based reasoning to large clinical databases and in various medical settings can be a fundamental technique to assist physicians with therapeutic decisions. Therefore, the case-based reasoning is an effective strategy to optimize clinical practice.

The study by Marshall *et al* is particularly relevant to the Tell Me Project as it is an evaluation study designed to test the effectiveness of problem-based learning as a method for the preparation of multidisciplinary learner groups at community health centres for pandemics (e.g., a hypothetical outbreak of severe acute respiratory syndrome, SARS). The study used quantitative and qualitative methods to evaluate the organization of a problem-based learning case with a multidisciplinary group of health professionals and students. The study found that: (1) there was an increased knowledge in bio-event preparedness; and, (2) participants seem to think that the effectiveness was improved by the problem-based learning process and by the multidisciplinary approach to training. The students also believed that the problem-based learning method was more suitable to the teaching of bio-event preparedness compared to traditional teaching methods. The results show that a problem-based learning approach is an effective strategy to teach issues related to global preparedness to community-based health professionals from different disciplines.
Hugenholtz *et al* designed an evidence-based medicine course in combination with case method learning sessions to enhance professional performance, self-efficacy and job satisfaction of occupational physicians. The efficacy of the course was tested in a randomized controlled trial. The study found that an evidence-based medicine course combined with case method learning sessions was perceived as valuable and enhanced the professional performance of occupational physicians. However, the intervention did not appear to influence self-efficacy and job satisfaction.

Kühne-Eversmann *et al* tested the efficacy of a continuing medical education course including a series of seminars on internal medicine. The course was characterized by interactive team- and case-based material related to medical practice. The study found that the course was highly accepted by physicians and an interactive, case-based design of a continuing medical education course with team-based learning led to significant gains in knowledge.

Cook *et al* showed that web-based modules on clinical topics, that contained case-based multiple choice questions, had higher immediate post-test scores.

Case-based/problem-based model in students
We have observed interesting approaches (case-based/problem-based learning) applied to student teaching, which are essentially similar to the learning approaches adopted with health professionals.

The article by Winkelman *et al* explored the conception of case histories, described support for case methods and suggested how case histories could be used to teach the associations between complex health conditions and increased risk for sudden and life-threatening events. The authors found that case histories are useful for the teaching and evaluation of students working in acute care settings. Case histories support student-centred learning and they can be applied to both online and classroom-based teaching sessions. Case histories are interactive and they can provide theoretical, empirical and practical information beyond general principles of individual patient assessment and management.

Mounsey and Reid used a randomized controlled trial to evaluate the effect of case-based questions in two self-paced computerized learning PowerPoint modules that covered key aspects of Medicare. The modules

were identical except that one included case examples with multiple-choice questions, followed by the answers with explanations. The results showed that cases followed by multiple choice questions, embedded in computer-based modules, increase short-term, but not long-term learning. They could be possibly related to the lack of learning reinforcement. However the study demonstrated that case-based learning is an effective teaching method for students and confirms that methods that actively engage learners and require the application of the acquired knowledge have a more positive impact on learning.
Kim *et al* undertook an evaluation study of an online problem-based learning model designed to promote individual reasoning in addition to traditional problem-based learning in medical students. The results show the potential of problem-based E-learning to enhance traditional learning by promoting the development of individual reasoning in a flexible online-learning environment and offering cases in an interactive multimedia format.

Kolb *et al* presented the results of the first stage of the European NetWoRM project, funded by the European Union (EU). The aim was the dissemination and implementation of case-based E-learning in order to improve teaching in occupational medicine on an international platform. They stated that case-based learning on an international platform is a unique tool that supports the quality improvement of education and training and it is a good strategy to improve teaching as it might come closer to the practical aspects than traditional teaching methods.

The comparative study by Kong *et al* assessed the impact of digital problem-based learning cases on student learning in ophthalmology courses. The authors concluded that introducing problem-based learning could improve educational quality and effectiveness. Further, they found that digital problem-based learning cases stimulate interest and motivate students to further improve diagnostic and problem-handling skills.

An evaluation study by Blewett and Kisamore assessed the introduction of tutorials including a case-based interactive session in the Oklahoma State University-Center for Health Sciences. The case-based tutorial appeared to improve student performance on case-based exam questions.

The study of Marshall CS and collaborators, similar to the results for health professionals (see above), found that a problem-based learning approach is useful to train students on issues related to pandemic preparedness.

The evaluation study of Van Dijken *et al* focused on a two years evaluation of a new teaching approach used in a pathophysiology course for medical students in the Faculty of Biology and Medicine of Lausanne: an interactive discussion based on clinical cases. This discussion took place in the last two hours of the course and students were invited to prepare by studying the cases on the web. The number of students who attended the pathophysiology course was 120 and 122 during the first and second year, respectively. The percentage of students who joined the online interactive discussion increased from first to second year (from 67,9% to 84,2%). The authors found that the interactive session was highly appreciated by the students. The results of the evaluation form that was administered to the students at the end of the interactive session were overall positive. This experience shows that case-based teaching has proved to be an effective way to bridge the gap between theory and practice, allowing medical students to take better advantage of their grounding in basic sciences to solve complex patient-oriented problems.
A randomized controlled trial by Kopp *et al* aimed to evaluate the effectiveness of two different approaches of a computer course on case-based worked examples. A total of 153 medical students (104 women, 49

men) from two Munich medical faculties took part in the study. Even though the study was not focused directly on the evaluation of the effectiveness of a case-based model, the authors found that the case-based worked example approach was effective and efficient.

Critics about problem/case-based model

We also found studies, considerations or statements which express some criticism towards the problem/case-based approach. The first two studies presented consider a case-based/problem-based model applied to health professional, while the third article considers the model applied to students.

The review by Thistlethwaite *et al* synthesized evidence relating to the effectiveness of case-based learning as a mean of achieving defined learning outcomes in health professional pre-qualification training programs. The authors report inconclusive results as to whether there are more positive effects on learning compared with other types of activities. The authors highlight the need for further exploration into the effectiveness and impact of case-based learning. They also highlight the need for agreement on the definition and methodologies to allow a better qualitative understanding of how students learn from cases. However, the authors considered that case-based learning provides an opportunity to introduce inter-professional learning; it appears to foster effective learning (even if in small groups), possibly through the effect of having more engaged learners, but perhaps also through having more structured learning activities closely linked to authentic clinical practice scenarios and, finally, it can enhance attention to the online learning environment.

The end point of the evaluation study by Nordquist *et al* was to identify the level of success in the implementation of case-based learning during a surgical semester at the Undergraduate Medical program at Karolinska Institutet and to identify practical and theoretical implications. Implementation of case-based learning was not satisfactory for various deficiencies: failure to engage faculty, insufficient training/preparation and a lack of alignment with clinical rotations and assessment. In contrast, a study by Ahmed *et al* in a similar population found positive results by fixing deficiencies in the work by Nordquist *et al*. This suggests that the failure of the implementation of case-based learning was related to organizational and methodological deficiencies rather that due to the effectiveness of the learning approach itself. Further studies are however needed to replication these findings.

While the study by Mounsey and Reid found support for the effectiveness of case-based learning, as mentioned above, the observed learning benefit was short-term. As highlighted by the authors, this could be due to the fact that the learning reinforcement after the course was limited. However, an E-learning course for health operators that would use immediately the information acquired in their daily practice and produce practice learning reinforcement, could improve the learning curve of the students.

We have also considered other three articles because they are relevant to the discussion about the effectiveness of case-based learning approaches. Kirschner PA's article is an open critic to case-based models whereas Hmelo-Silver CE and Schmidt HG and Loyens SMM studies represent a response.
Kirschner PA and collaborators suggested first that problem-based learning and inquiry learning are unguided or minimally guided instructional approaches. Moreover, although these approaches are very popular and intuitively appealing, they ignore both the structures that constitute human cognitive architecture. Evidence from empirical studies over the past half-century has consistently indicated that minimally guided instructions are less effective and less efficient than instructional approaches that place a strong emphasis on guidance of the student learning process.

Hmelo-Silver CE's and collaborator suggested that Kirschner's considerations are contrary to the empirical evidence that support the effectiveness of problem-based and inquiry learning as educational approaches. In their article they discuss how problem-based and inquiry learning provide guidance and evidence that supports the effectiveness of these pedagogical approaches. These approaches can foster deep and meaningful learning as well as significant gains in students' achievement on standardized tests.
Similarly, Schmidt HG and Loyens SMM disprove Kirschner PA's considerations about problem-based and inquiry learning.

3.2 Conclusions

E-learning is an attractive solution to practical and theoretical teaching. Compared with traditional face to face programs, online learning may offer greater flexibility in training times and progress, improved accessibility, reduced time and costs, and greater adaptability to individual learner styles and teacher's needs. Educational resources can be rapidly disseminated and updated. These features fully satisfy Tell Me project needs; in case of infectious disease outbreak, a common e-learning platform for all 27 European countries is the best tool to deliver homogenous information necessary to coordinate a timely response to the event; another important aspect of e-learning is that every Country, if needed, can implement specific modules in order to adapt the information received to own local and cultural needs (targets, type of health service, etcetera).

Traditional learning methods are instead more expensive, time consuming and less efficient.

The Web interactive and multimedia capabilities provide opportunities for realistic problem solving, performing tasks in the context of clinical problems, engaging in case studies with exposure to authentic clinical learning settings, linking to other resources, and participating in social dialogues. These approaches are at the basis of the andragogic approach and case history is the tool which best reproduces the daily activities of health operators.

The effectiveness of problem/case-based learning is supported by the current evidence.

The findings of our report show that case-based learning is an effective instructional method for students, health professionals and it can be adapted to numerous and different teaching scenarios.

Learning is improved when the new information is presented in a meaningful way such as when it is illustrated by cases with case-based multiple choice questions. Similarly, Cook found that residents who completed web-based modules on clinical topics including case-based multiple choice questions had higher immediate post-test scores.

Our report confirms that a case-based approach that actively requires learners to critically apply their knowledge improves learning.

Mounsey A and Reid study suggests that learning benefits are not maintained in the long term. This result was observed in students that, unlike adult health operators, could not immediately apply their practical knowledge, which interfered with practice learning reinforcement.

Additional criticisms have identified low quality studies evaluating the effectiveness of case-based/problem-based learning approaches. However, Cook et al. and other high-quality studies support the effectiveness and reliability of this learning approach.

An important limitation is that most of the studies report results from case-based learning approaches applied on students learning and therefore these results cannot be transposed to adult professionals. However, adults could immediately apply the knowledge acquired in their daily practice to consolidate their learning curve and improve the effectiveness of the e-learning approach.

Two articles have practically demonstrated that e-learning and case-based approach are compatible and reported to be effective in a setting similar to the one adopted in the Tell Me project:

- Kolb and collaborators support the use of case-based e-learning as an unique tool which can be applied successfully on an international platform (Europe);
- Marshall and collaborators support the usefulness of case-based e-learning in educating community-based health professionals from different disciplines on issues related to pandemic preparedness.

These considerations support the adoption of a case-based e-learning approach in the Tell Me project as it allows 1) to rapidly and effectively disseminate and update critical information necessary to efficiently react to infectious disease emergencies in Europe, and 2) to promote active learning and skill acquisition by using

clinical cases to recreate authentic and realistic clinical learning scenarios, which ultimately enable an effective transfer of the theoretical knowledge into practical problem solving.

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