D.1.3

Comparative analysis of the distance learning platforms and smart labs models at Programme and Partner countries HEIs

DISCLAIMER

PROJECT INFORMATION

Project acronym	**SMARTEL**
Project full title	IMPROVING THE PROCESS OF EDUCATION THROUGH THE DEVELOPMENT OF E-LEARNING MULTIMEDIA PLATFORM AND SMART CLASSROOMS
Project No	618534-EPP-1-2020-1-XK-EPPKA2-CBHE-JP
Funding Scheme	Erasmus+ KA2 Cooperation for innovation and the exchange of good practices – Capacity Building in Higher Education
Start date of the project	15/11/2020
Duration	36 months
Coordinator institution	University of Mitrovica
Coordinator	Prof. Dr Siniša Ilić, University of Mitrovica, Faculty of Technical Sciences
Beneficiaries	International Business College Mitrovica University of Montenegro University Adriatik University of East Sarajevo University of Mostar Universidad Politécnica de Madrid Universita ta Malta Univerza v Ljubljani CESIE

DOCUMENT INFORMATION

Title	D.1.3. Comparative analysis of the distance learning platforms and smart labs models at Programme and Partner countries HEIs
Work package	WP1 – Preparation – Analyzes and study visits
Main author	CESIE
Co-authors	n/a
Other contributors	All partners
Reviewers	All partners

History version	*Date*	*Modified by*
V1.0	10/03/2021	CESIE
V1.1	02/11/2021	CESIE

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List of Abbreviations

Abbreviation	Meaning
D	Deliverable
EU	European Union
HE	Higher Education
HEI	Higher Education Institution
ICT	Information and Communications Technology
IO	Intellectual Output
LMS	Learning Management System
KA	Key Action
UN	United Nations
UPKM	UNIVERSITY OF MITROVICA / University of Pristina in Kosovska Mitrovica
IBCM	INTERNATIONAL BUSINESS COLLEGE MITROVICA
UoM-MN	JAVNA USTANOVA UNIVERZITET CRNE GORE PODGORICA / University of Montenegro
AUB	UNIVERZITET ADRIATIK BAR
UES	UNIVERZITET U ISTOCNOM SARAJEVU / University of East Sarajevo
SUM	University of Mostar
UL	UNIVERZA V LJUBLJANI – University of Ljubljana
UM	UNIVERSITA TA MALTA – University of Malta
UPM	UNIVERSIDAD POLITECNICA DE MADRID – University of Madrid

INTRODUCTION

The world leaders of the UN member states in September 2015, unanimously adopted the 2030 Agenda for Sustainable Development (UN 2030 Agenda) in the UN General Assembly. The agenda includes 17 goals, 169 targets and 244 indicators for progress measurement. They are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental. Particularly important for project SMARTEL is Goal 4: to provide inclusive and quality education for all and to promote lifelong learning.

The relevant ministries in EU candidate and in EU neighbourhood countries have adopted educational development strategies in recent years, which provide guidance on how to improve teaching by applying ICT in accordance with the Goal 4 of the UN 2030 Agenda.

The overall objective of project SMARTEL is to improve the teaching process at the HEIs in the Region 1 (Kosovo UN Resolution 1244, Montenegro, Bosnia and Herzegovina) with a special emphasis on enabling the access to a quality teaching process for students who, for objective reasons, cannot attend regular teaching activities at HEIs.

The project goal is using of modern ICT technology and pedagogical approaches to promote equity to the students with: a) disability, b) economic obstacles: people with a low standard of living, low income, dependence on social welfare system and c) geographical obstacles: people from remote or rural areas; people living in small islands or in peripheral regions;

Expected results of project SMARTEL are:

- implementation of modern distance learning platforms,
- creation of e-content for multimedia platforms,
- equipping the remote and central office classrooms with modern ICT technology for teaching (smartclassroom),
- developing new pedagogical approaches that define the use of ICT in education,
- training of teaching and technical staff.

Project SMARTEL will impact on the improvement of equity in the teaching process at HEIs in Region 1.

1 WORK PACKAGE 1 – ANALYSIS

Work Package 1 (WP1) of project SMARTEL seek to identify and analyse the models of existing distance learning platforms and smart labs at higher education institutions (HEIs) in the Programme and Partner countries. Special attention is paid to the applications that help vulnerable groups (people with disability and with economic and geographical obstacles) to attend lectures in an appropriate way for them.

The analysis is done for each institution in particular, and then the results will be integrated into: one joint report for models in the Programme countries (D1.1) and one joint report for models in the Partner countries (D1.2). The reports will also include information of laboratory structure and classroom settings for teaching, distance learning, application of hardware and software in a modern presentation of teaching materials, ICT application for students with special needs.

The differences in applied models will be studied and recommendations for improvements in setting up the appropriate models will be generated for each Partner country HEI. The similarities and differences between the teaching models will be presented in a comparative report (D1.3). It will be analysed which key elements from distance learning platforms and smart labs model for teaching in the Programme countries HEIs should be applied in models for teaching in Partner countries HEIs in order to meet needs of students that belong to vulnerable groups. Comparison of these teaching models will be presented in the joint report.

1.1. Methodology

This research was conducted through a questionnaire which was circulated among partners at the beginning of SMARTEL project. Data collection took place in February and March 2021. All data are self-reported.

Questionary investigated the existing modern distance learning platforms and smart labs models by inquiring eight (8) units: E-learning organization; Learning Management Systems; Videoconferencing; Collaborative platforms; Exams and Knowledge assessment platforms, proctoring systems; Multimedia learning material storage (repository); E-learning, online learning accredited study programs and E-learning enhancements for the students with disabilities. Educational, technical and executive aspects and follow-up mechanisms adopted were taken into consideration.

Data were analysed and are available in two (2) reports:

- D.1.1 Analysis of existing modern distance learning platforms and smart labs models at the Programme countries HEIs; and
- D.1.2. Analysis of existing distance learning platforms and smart labs models at the Partner countries HEIs.

This report aims to provide recommendations for the further use and development of e-Learning systems in HEIs that aim to enhance special needs students' academic performance.

2 HIGHER EDUCATION AND DISTANCE LEARNING

Worldwide demand for higher education is expected to grow exponentially from 100 million students currently to 250+ million by 2025[1]. This raises the question of how Higher Education Institutions (HEIs) will be able to sustain and improve the quality of the learning experience in the face of continuing growth and diversity in the student population. New student groups want education that is relative, timely, available on-demand, and fits their specific need, especially in regards with personal disadvantages, disabilities, impairment. For these reasons and more, we begin to see a shift also in HEIs from traditional education providers to more interactive, technology inspired and internationally oriented institutions.

Over recent years and especially after the COVID-19 pandemic, university education faced new challenges arising from the need to remodel both their methodology and teaching-learning processes to be able to use Information and Communication Technologies (ICTs) to enable students to be delivered (part or all of their) learning and training through digital resources and devices (aka e-Learning). This is meant not only in the view of modernisation of Higher Education, but also of providing students with digital skills and facilitating education through technology (a top priority according to the EU Digital Agenda), and it is especially significant in the perspective of inclusion and accessibility through a learner-centered approach. Different experimentations were launched in HEIs: the *'TRENDS in European Higher Education'* report of the European University Association (EUA) had already attested in 2015 that more than two thirds of European universities had e-learning and ICT strategies in place and a large majority of the others were in the process of developing them. The Covid-19 pandemic marked the triumph of technology, with digital infrastructure playing a key role in maintaining the essential functions of the Higher Education Institutions. When universities reopen, physical classrooms will look a lot different: reconfigured and repurposed for social distancing, set up with video and audio technology to allow communication between remote students and faculty.

However, this change has in no way eliminated, but rather emphasised, the major pre-existing issue of the risk that technology will generate new inequalities (exploitation by only some of the possibilities offered by the new ICT: winners and losers). Inclusion is still a priority. One of the effects of the pandemic was to exacerbate economic and social inequalities: despite offering distance learning HEIs have lost contact with those who have no internet connection, no personal computer, or no smartphone, or teachers themselves were unable to have signal. Students with special needs deprived of face-to-face teaching have not even been able to benefit from distance learning. The dimension of the phenomenon is very relevant.

2.1. Results from D.1.1 and D.1.2

Findings from D.1.1 and D.1.2 found that HEI in Partner and Programme lack support systems for special needs learners to actively participate in e-Learning programs set in place. Partially because it was not required by their strategy to make their LMS accessible to special needs students, mostly because the modernisation process of the HEI towards e-Learning got suddenly boosted by the pandemic, institutions faced an increased workload and they invested and did tremendous effort to

[1] European Commission (2014): Report to the European Commission on New modes of learning and teaching in higher education. ISBN 978-92-79-39789-9/doi: 10.2766/81897

maintain their function of research, education, and service to the larger academy and greater society while still not having resources to take all special needs into consideration.

The current state of e-Learning in terms of actual utilization of e-Learning in Partner and Programme Countries HEIs involved in the SMARTEL project has been examined. Such an examination shed light on HEIs' needs and resources already available which can support more effective e-Learning systems. Main results are summarised in the table below and are extensively treated in D.1.1 and D.1.2 available in the project website.

Table 1: Summary of comparative analysis

	Programme Countries	Partner Countries
E-learning organization	HEIs have specific internal entities responsible for technical infrastructure management and assistance to faculties/units/members.	• Missing a comprehensive strategy document for the institutions. • Missing comprehensive guidelines and recommendations setting quality standards and ensure the best educational performances.
Learning Management Systems (LMS)	Moodle as preferred system. Tendency to have a single LMs per institution. Combination of a manual and automatic work.	Moodle as preferred system in 5 HEIs out of 6. Tendency to decentralisation: multiple LMS.
Videoconferencing (remote or online lectures, laboratory work, auditoria work)	• Situation is similar in all HEIs: institutions used a varity of tools and eventually integrated them to their LMSs. • Videoconferencing is meant to still be in use in the future, connected with the development of courses in hybrid (blended) learning.	
	Recording of lecturers is done with different purposes.	Recording of lecturers is not done mainly because of storage system deficit.
Collaborative platforms	• Situation is similar in all HEIs: institutions used a varity of free tools. • Technological optimization is required in this sense.	
Exams and Knowledge assessment platforms, proctoring systems	• Regulation and guidelines are available to staff and students. • Written tests through the LMS. • Wide use of anti-plagiarism ans security systems.	• Written tests through the LMS. • Oral examination held face-to-face. • Limited use of anti-plagiarism ans security systems.

Multimedia learning material storage (repository)	Use of internal and external repository systems.	All HEIs reported a problem with lack of repository systems.
E-learning, online learning accredited study programs	Limited number of courses in hybrid (blended) learning or full e-learning.	No accredited e-learning study programs.
E-learning enhancements for the students with disabilities	Not available or left to mentoring staff. Testing of specific plug-ins for LMS is in progress.	Not available or left to teaching staff.

3 COMPARATIVE ANALYSIS AND RECOMMENDATIONS

3.1. E-learning organisation

3.1.1. A need for institutional e-learning strategies

HEIs must be able to move fluidly between remote and in-person teaching to stay productive. With moving to deployment of e-learning, HEIs became conscious of its potential and of the workload and demands put on administrative, technical and teaching staff and institutional resources and infrastructure. Development of e-learning strategies is one component of the effort to integrate e-learning more widely in the institution. A strategy acknowledges the successes already achieved in using ICT for teaching and learning, using them to provide a strong foundation for further development work and it can also help institutions to offset the negative effects of change, such as duplicated action, competition between different parts of the same institution, and investment in incompatible technologies.

The application of ICT to Education should be anchored in the pedagogical-didactic sphere, from which it finds a general sense (educational models and theories) and the possibility of continuous repurposing (didactic aspects). Modifications must be placed within a "dynamic didactic becoming", implicit in every educational situation, which is never static and defined, but open to the rich, motivating but also failing unpredictability in which every subject is in continuous transformation.

In this regard, a strategy for technological innovation of HEI make it possible to place the success of this process in a space made up of different dimensions that are closely and mutually interrelate. Trentin[2] proposes an integrated approach to the sustainability of e-learning by trying to identify the specific characteristics of each dimension.

- Economic dimension refers to aspects linked to the optimisation of the resources involved, from those of development, to those of operation, to those of subsequent investments;
- Organisational-managerial dimension of the system refers to the creation of organisational conditions for a real integration of e-learning methodologies in the working practices of the organisation in order to institutionalise them;
- Professional dimension concerns the identification of the key figures necessary for the management, design, development and delivery of e-learning interventions, as well as the methods for their training
- Socio-cultural dimension refers to the social and cultural changes necessary for a wide dissemination of e-learning methods;
- Content dimension concerns both the quality of the contents conveyed and their implementation, and the aspects linked to transportability, reusability and adaptability to contexts;
- Technological dimension relates to the aspects linked to the functionality and stability of an adequate technological infrastructure;

[2] Trentin G., Un approccio multidimensionale alla sostenibilità dell'e-learning, in TD "Tecnologie Didattiche" N°40, 1, 2007, Ortona, pp.14-20. (2) Trentin G., Towards a real sustainability of e-learning. Proceedings of E-learning & sustainability, Fondazione ENI Enrico Mattei, Giune 2004

- Informal dimension concerns those processes in which the individual deals autonomously and in real time with his or her own cognitive needs, through the use of e-content, but above all through "networked" interaction within professional online communities of practice aimed at extending the processes of knowledge sharing.

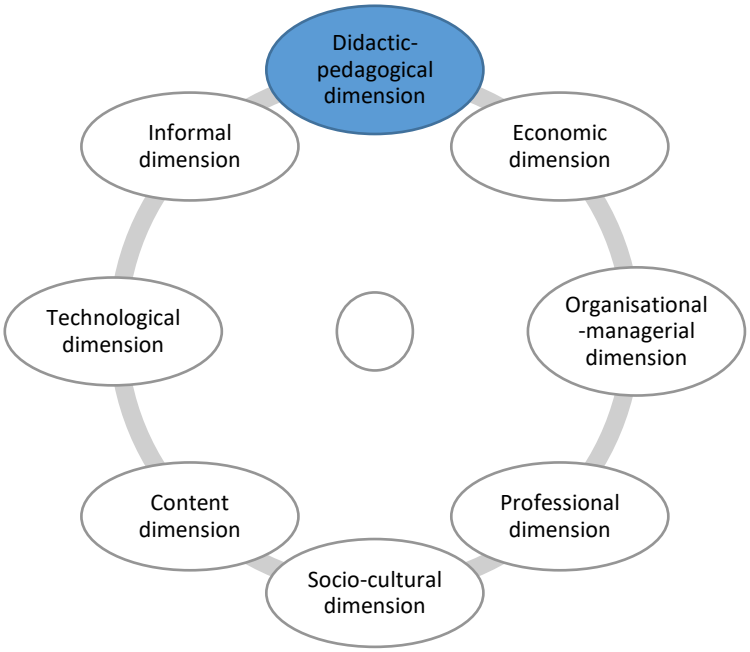

Figure 1: The different dimensions of sustainability of e-learning

Of the HEIs involved in the project, all three (3) Programme Countries HEIs and one (1) HEI from Partner Countries cited the existence of some form of central strategy for e-learning; one HEIs is in the process of developing one, while other HEIs reported no distinct central strategy, but rather the existence of documents formalising the discussions around the role e-learning will take at the institution. However, it is not unusual that HEIs engage in developing a e-learning strategy (typically demanding considerable effort to produce in any detail) some time after a practical commitment was made to advancing e-learning across the institution.

E-learning is no longer an experiment. HEIs need to create a vision of the desired end state to begin any strategic planning. Strategy documents are important as they reveal as much about how an institution wishes to present itself and its deliberations (descriptions of current practice with statements of ambition and vision), as about the 'real' strategic processes, developments and activities concerned (how this would or might be achieved, in a task-oriented style).

According to Garrison and Anderson (2003)[3], the winning strategy is to find relatively low-risk niche areas in which the technology can be understood and incubated and where, if there are failures, they will come early and will be less expensive. An e-learning strategy needs to involve consideration of the

[3] Garrison, D. R., & Anderson, T. (2003). E-Learning in the 21st century: A framework for research and practice. London: Routledge/Falmer. doi:10.4324/9780203166093

following aspects of the institutional functions in terms of e-learning potential, as depicted in the figure below:

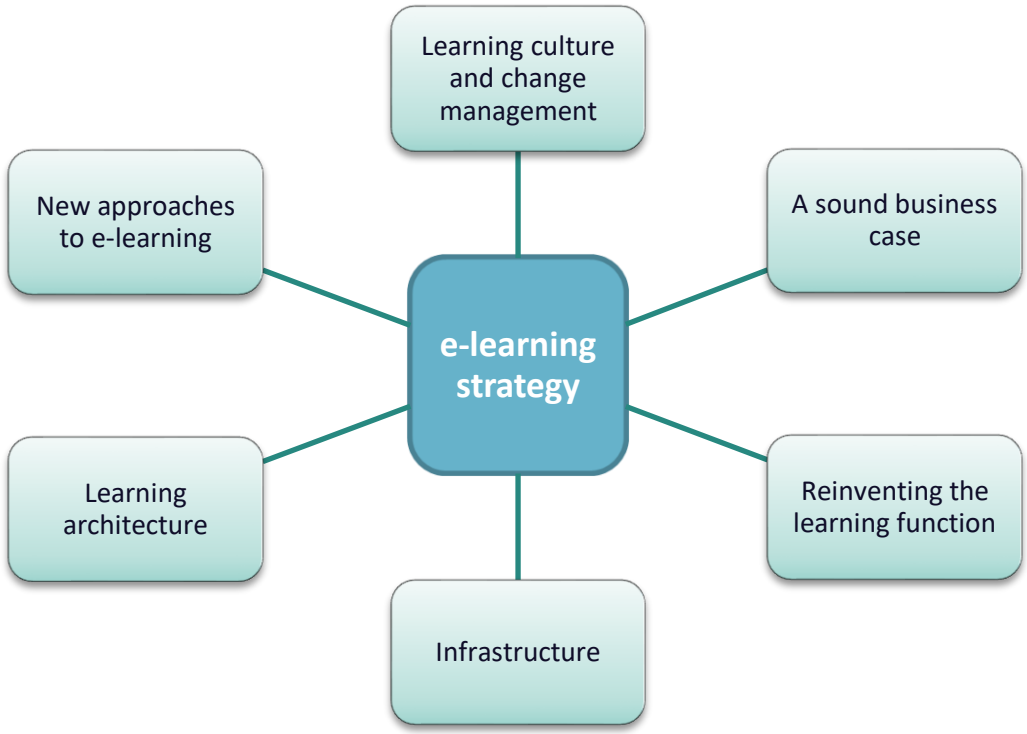

Figure 2: Aspects in an e-learning strategy

A policy document needs to be systemic and needs to cover:

1. A vision with an understanding of the background, defining the core values and describing strategic goals that are attainable and have institutional support.
2. A needs and risk assessment that identifies issues, challenges and best practices.
3. Educational principles and outcomes described.
4. Implementation initiatives and strategy that links to institutional priorities, gives leadership with authority and creates a steering committee and identifies communities of practice.
5. Infrastructure including the design of multimedia spaces and administrative processes.
6. Infostructure including the design of institutional connectivity, that creates a knowledge management system, provides digital content and that creates standards.
7. Support services to provide professional development and learner support.
8. Budget and resourcing arrangements need to be outlined.
9. A research and development framework in order to remain current and innovative.
10. Benchmarking that establish success criteria, assess progress and communicate direction and accomplishments in order that e-learning remains a priority and that support is sustained.

According to best practices, the following guiding questions are to be considered:

- *Is the e-strategy aligning technology initiatives with the University's mission?*

- *Is the e-learning strategy addressing all key components: e-learning, e-research, e-community, e-business and connectivity?*
- *Is the e-learning strategy addressing:*
    - *pedagogy/pedagogic impact?*
    - *delivery/access?*
    - *faculty and student IT literacy?*
    - *service/application integration?*
    - *infrastructure enhancement/availability?*
    - *consistency of application/service?*
    - *quality assurance/evaluation?*
- *Who owns the learning objects or material collected and used for e-learning? Is the institution addressing this intellectual property issue?*
- *Is the e-learning strategy defining the current and future technical needs of the institution?*
- *Is the IT infrastructure described? Is the use of LMS and other applications to support or complement e-learning defined?*
- *How are academic and administrative systems integrated?*
- *Are data protection and privacy procedures in place?*
- *Are the components of the strategy, the over-arching conception and progress to date available to the public? Are they mentioned in the HEI's website?*
- *Where users can find out about the latest developments (including visiting speakers, student projects and research breakthroughs).*
- *Which user-feedback mechanism is in place?*

It seems important to stimulate and support strategies development and implementation, with the establishment of dedicated technical unit responsible for e-learning centres and the appointment of specialised staff.

3.1.2. Dedicated unit responsibility

According to Garrison & Anderson[4] e-learning presents enormous opportunities and risks: a more systematic and centralised approach towards successful e-learning require a solid infrastructure and a dedicated technical unit responsible for promoting the use of technology-based teaching, providing the necessary infrastructural and training support to students and staff engaged in e-learning initiatives. Indeed, majority of HEIs from both Programme and Partner Countries cited a specialist ICT unit or units as central to its development.

These dedicated entities may have a critical, central role in the systemic take-up of e-learning across an HEI and must therefore be developed as part of a strategic plan, aligned to the institutional goals and vision. This technical dedicated unit:

- Need clear operating standards and management processes;
- Should monitor the technical requirements of the system on a regular basis;
- Collaborate with academic, media development and administrative staff in the development of strategies and plans that take into account the potential of emerging technologies:

[4] Garrison, D. R., & Anderson, T. (2003). E-Learning in the 21st century: A framework for research and practice. London: Routledge/Falmer. doi:10.4324/9780203166093

    - Set the institutional plan for the provision of training in the technical aspects of e-learning;
    - Organise access to self-help training materials;
    - Provides helpdesk services to staff and students;
    - Produce new knowledge about e-learning;
- Should integrate e-learning requirements with the longer-term IT infrastructure plans of the organisation;

The presence of a dedicated unit ensures that:

- appropriate training is provided for staff and that this training is enhanced in the light of technological and educational developments;
- adequate support and resources (e.g. technical helpdesk and administrative support) are available to academic staff, including any affiliated tutors/mentors. This support should extend to software used for authoring and production, including audio/visual media, and for teaching support, including learning analytics.

3.2. Learning Management Systems (LMS)

All HEIs reported use of an LMS. Institution-wide LMS do not always coincide with local LMS in use at faculties/members: despite all HEIs using Moodle as preferred system (no surprise, the past years of LMS development and adoption in tertiary education have seen considerable system convergence), in Partner Countries the tendency has been towards decentralisation, with multiple LMS in use in the same HEI. Sharing the same LMS set the foundation for joint work within the same international interoperability standards, and integration of academic and administrative IT systems.

When asked to indicate the proportion of current courses/programmes in their LMS, no institutions had precise figures, although some offered considerable detail. However, all HEIs reported their presence has become more significant with the pandemic (which reduced face-to-face classroom time) and in some cases 100% of study courses are already wholly or very largely conducted online.

However, an indication of the relative immaturity of online learning in many institutions concerns:

- the complexity level of the LMS, which for some institutions is still basic (putting electronic learning material for the students) and for few of them is fully advanced (performing team work, collaborative work, seminars, regular monitoring of students' progress); and
- the integration of the LMS with internal information systems and the automation. As the range and scope of academic and administrative software has proliferated (typically involving both in-house and third-party solutions), inefficiencies arise where different systems are unable to communicate, so recent trend has been for institutions to attempt to integrate their systems. Almost all HEIs mentioned integration between their LMS and information system. For those mainly relying on a manual system, no mention to integration plans was made.

System integration has a number of benefits, including greater efficiency in terms of information management (from the perspective of students, faculty and staff), improved data integrity, reduced paper costs, a finer-grade view of accounts and self-service access to core systems.

3.3. Videoconferencing (remote or online lectures, laboratory work, auditoria work)

Videoconferencing systema are crucial to e-learning, as they increase the degree of understanding and information. Luckily, technology has reached a level of stability, usability and affordability which permits its use in real teaching scenario, which was of great help to HEIs in maintain their functions, especially in the first wave of the COVID-19 pandemic.

In our research, HEIs were asked to comment on any other tools or platforms that are widely used at their institution in support of e-learning. As for the technical equipment, it varies greatly between HEIs. Videoconferencing has been used in virtual meeting mode to facilitate distance learning in the sudden blocking of all face-to-face training activities and the mode is still in use since then. Integration with LMS has been used by HEIs but not by all. It certainly is seen as an induction tool towards the establishment of hybrid (blended) learning in the future, as it has opened up possibilities for a different interaction between teachers and learners, or between learners themselves, or even between teachers.

Nevertheless, it is important to consider advantages and disadvantages of this medium:

Table 2: Video-based learning

	Pros	Cons	Use and application
Video-based learning	• Adds life to the e-learning course by making it effective and engaging. • May be delivered as synchronous and asynchronous. • Reduces cognitive overload and maximizes retention (a learner is likely to remember 95% of audio-visual content). • Easily delivered through a videoconferencing tool or an LMS. • Video addresses different learning styles of visual, auditory and kinaesthetic learners. • If recorded, can be revisited.	• Teaching staff usually finds harder to actively involve students, to encourage participation. • Less personal interaction - physical events allow people to engage in more social conversation. • Needs strong presentation skills. • Technical problems are possible – thus determining a block in learning process.	• Set clear goals to produce and provide effectively-designed videos, with a focus on meeting your learners' goals. Consider whether videoconferencing situations are suitable for a given teaching strategy or target group. • ICT of both students and HEIs have a dramatic effect on the quality of the communication achievable

3.4. Collaborative platforms

One key aspect in the change towards 21st century skills is the ability to work in groups. UNESCO points at this fact in their report series Education Research and Foresight from 2015: "The *collaborative learning environment challenges learners to express and defend their positions, and generate their own ideas based on reflection*"[5], and clearly connects the emergences of new digital innovations: "*With the development of new ICTs innovative forms of collaboration are also emerging (Leadbeater, 2008, p. 10)*"[6]. Accordingly, recent studies show that using response technology facilitates more classroom interaction and communication[7], providing even more relevance for technologies supporting collaborative learning environments.

Programme and Partner countries HEIs have showed a common attitude towards collaborative platforms, which they use not really to support teaching strategies of collaborative learning and cooperative learning but rather to facilitate collaboration and communication between teachers and learners, or between learners themselves, or even between teachers and other HEI staff in order to achieve common goals.

3.5. Exams and Knowledge assessment platforms, proctoring systems

While online examinations are not a requirement for e-learning, their feasibility and trustworthiness are important factors in the flexibility and global outreach of learning provision. Plus, because of the pandemic HEIs found themselves forced into re-organising their assessment methods to limit face-to-face activities to the minimum. Contrary to the widespread expectation that all students would take online examinations, the practice at Partner Countries HEIs differs from that of Programme Countries ones: in Partner Countries oral examinations happen mostly in a face-to-face setting.

As for written exams, LMS are capable of delivering assessments in a range of styles and providing feedback in response to student error (when designed and instructed to do so). For assessments that are essentially conventional in format, e.g. essays, but are submitted online, security in transit between student and teachers, quality of the marking tools and detection of plagiarism are technical aspects that are to be implemented and monitored.

Due to e-learning generally becoming more pervasive in Higher Education, HEIs were already in the process of analysing ways to assess online students' academic achievements. This is also connected to the need of ensuring the quality of study curricula is maintained irrespective of the environment in which courses and assessment activities are being undertaken. The pandemic put a boost also in this dimension, but there is no common trend in this. Main concerns remain for validity and appropriateness of assessment, including both formative assessments – focusing on feedback-based learning, and summative assessments – dealing with evaluative judgements of student learning, which

[5] Anderson T., Dron J. (2011): "Three generations of distance education pedagogy". The international review of research in open and distributed learning, Vol 12, No 3. http://dx.doi.org/10.19173/irrodl.v12i3.890

[6] Scott, Cynthia Luna (2015): The futures of learning 3: What kind of pedagogies for the 21st Century?" UNESCO series Education Research and Foresight. Working papers. http://unesdoc.unesco.org/images/0024/002431/243126e.pdf

[7] Einum, Even (2019): Discursive lecturing: an agile and student-centred teaching approach with response technology. Journal of Educational Change, 20(2), 249–281. doi: https://doi.org/10.1007/s10833-019-09341-7

in HEIs is used to test whether a particular student fulfilled the specified learning outcomes and may achieve some kind of accreditation, like progressing to the next level of studies.

In the SMARTEL perspective, a decision is to be taken by HEIs in their enhancement of e-learning. Although a course may be delivered and moderated via e-learning, it is not compulsory to perform all assessment online: online students may be requested to act like their campus-based counterparts and attend supervised examinations at the end of the courses. However, when engaging in e-learning, an e-assessment process should be considered. Also, in devising assessment strategies for e-learning HEIs will need to pay attention to the regulations and requirements of national validating bodies.

To aid this process, table 1 lists the more commonly used methods of e-learning assessment methods, with their individual advantages and disadvantages:

Table 3: E-learning assessment methods

Instrument	Pros	Cons	Use and application
Collaborative assignments	• Enables deeper learning experiences to emerge from group work and discussions. • It is a good approximation of how students will use knowledge within their working lives. • Can utilise case-study material from different national/cultural settings. • Develops collaborative skills much prized in the workplace. • Peer group pressures lead to enhanced participation. • Sophisticated grading systems possible – students can apportion marks to group members. • Fewer assignments to mark.	• More effort needed by staff to set up. • More effort needed to assess group processes and interactions. • Group tensions over varying inputs and free rider problem. • Distance students are often highly motivated and used to autonomous working and may resent group assignments. • Collaboration may be difficult where students work in different nations, time zones, and languages	• Set authentic tasks that teams have to investigate and solve. • Learners must use online resources to work collaboratively, share resources and findings. • Appreciation of trans-national/cross cultural insights. • Develop learner communication and team-building skills that are so valued by employers. • Contributes to the internationalization of the curriculum.
Online exams	• Standard and well-known assessment procedure, producing results and grades readily assimilated	• Autonomous and motivated on-line learners well acquainted with richer modes of online	Moderate and control online exams with start and stop times, or with

	within university structures. • If students live locally, staff can require them to take live exams on campus at previously agreed times and thereby control the time taken, and authenticate those taking the exam.	assessment may resent such passive and unimaginative assessment procedures. • Technical problems are possible – the university computer may go down; the modems or IT connections of distance students may fail. • Possible problems with student authentication and plagiarism. • With large batches of students taking exams at different times, one cohort may advantage another by passing on information about the test, so it may be necessary to use pre-seen papers. • Long examinations may lead to eye strain from prolonged exposure to computer screens.	login passwords and timeouts
Online quizzes	• Can be used as a diagnostic tool to assess the level of student knowledge prior to the course. • Instant online feedback is given to learners through questionnaires and multiple-choice questions.	• Where quizzes require familiarity with a particular program, there is a danger that IT competence rather than subject knowledge is being measured. • Students unfamiliar with software for quizzes may find the experience both unrewarding and stressful.	• Use regular quizzes online for a small component of final assessment. • Quizzes can be used as formative assessment during the course, ensuring sufficient skills and knowledge have been attained before attempting a final assessment. • Fun quizzes can be used as an introduction to the

			online assessment environment.
Computer-marked assignments	• Exams available online can be accessed anywhere at any time. • The question set can be randomized to reduce the possibility of sharing answers. • Exams can be scored automatically with savings in staff time. • Students and staff can get immediate feedback with computer marked assessments. • Grading is consistent, transparent and objective. • When computer marked assignments can be used repeatedly, as progress monitoring tools, they encourage self-evaluation by the student.	• Unless they are very sophisticated, computer-marked assignments will be able to test knowledge of facts but not student understanding or learning or self-expression. • Guessing of correct answers is possible. • Technical problems are possible – the university computer may go down; the modems or IT connections of distance students may fail. • There may be problems of student authentication and students may report technical problems of they find the examination to be difficult.	• Set multiple-choice tests as a quick and easy indictor to learner and facilitator alike of the learner's progress. • Multiple-choice exams, although able to assess mainly knowledge, can cover a broad range of topics. • They are easy to administer to large groups of learners and can be made accessible at a time and place convenient to the learner. • Further developments are examining the use of automated marking for essays and reports.
Simulations	Require learners to construct knowledge and use metacognitive strategies; allow performance-based assessment	Can involve complex programming and specific hardware and software	Run a simulation where there is a crucial aspect of the study course involved. However, they are expensive tools to design and develop.

Choices over assessment modes will be constrained by the extent to which the HEI uses ICT in teaching, and the sophistication and capacity of its ICT infrastructure.

3.6. Multimedia learning material storage (repository)

The extensive and growing use of online resources and materials in learning and teaching made necessary for HEI to set storage systems in order to ensure safety of the online resources for teaching, learning and research as well as their sharing and re-use. As well as teaching materials, repositories can be useful for a wide range of institutional resources and collections: undergraduate dissertations, student work, past examination papers, digitised images used locally and collections of video/sound recordings from lectures or other activities.

It follows from this that HEIs' policies and processes may need updating to take into account the corresponding changes in management approach and systems provision, especially since the advent of cloud computing resulted in HEIs using services that are hosted in third-parties' clouds rather than on servers controlled by the institution's staff. Within an institutional repository a HEI must decide its own way of working and set its own rules for usage and management.

Results from research suggest that HEIs in Programme and Partner countries are already aware of the benefits of sharing materials in terms of saving time and trouble and improving quality. Lecturers often use external Web 2.0 sharing systems (such as YouTube, Dropbox, etc.). In many HEIs staff use the institutional LMS (Moodle, G-Suite applications) as a storage and sharing system as this is where they upload a substantial amount of their teaching materials. Programme Countries HEIs cited the existence of an in-house learning object repository and pointed to developments in that direction to increase actual capacity. Partner Countries mostly use third-parties' systems.

In order to decide the best strategy or taking development of repository systems forward, main issues to be taken into account are[8]:

- The **strategic vision**: publishing and implementing the agreed institutional policy and approach to sharing and reusing online resources, both locally and externally;
- The **legal framework**: defining ownership, copyright and IPR in a way which protects the organisation's assets yet allows open sharing within the educational community.
- The **online systems**: identifying the different kinds of systems for sharing and re-use both locally and externally; providing and developing the use of institutional systems and repositories which meet tutors' immediate practical needs, yet also exploit the benefits of managing, sharing and reusing resources.

For repositories in e-learning, we suggest that HEIs adopt the approach which fits more closely to the way they work, better represents their attitudes to sharing and carefully think their design and how they will be used.

3.7. E-learning, online learning accredited study programs

The results of research indicate a very modest level of mainstreaming in e-learning: full e-learning and blended learning (the most widespread form of provision) occurs throughout only in Programme Countries and in very limited number and for a specific target group. This fact sets a huge potential for further development in both Partner and Programme Countries and indeed most HEIs are interested in widening their offer of study programs in blended learning, thus allowing at least 50% of teaching to be face-to-face.

Collaborative provision with Programme Countries HEIs is strategically important for Partner Countries in exchanging good practice in teaching and the use of technology, improving quality and recognition and developing internationalisation. Hands-on experience could contribute to a realistic estimate of the additional workload and resource costs entailed in the process.

In SMARTEL project, provision of study programs in e-learning is meant to widen access to education and foster inclusion of non-traditional or external students, namely those individuals which for their

[8] Rothery, Andrew (2008) Managing and sharing e-learning resources: how repositories can help. Other. JISC.

economic and social status are considered as vulnerable and/or their coming from distant and isolated geographical areas make their participation in classroom teaching extremely difficult or expensive.

3.8. E-learning enhancements for the students with disabilities

Although the e-learning provision has been expanded, adaptation to educational needs of students with special needs is still poor in both Programme and Partner Countries. E-learning systems should be developed or selected to meet the requirements of both learners and teachers for easy access and high-quality interaction with the learning materials.

In the educational field, the learner represents the first categorical element of the educational learning process, which exists prior to the teacher, even though the latter give meaning to their relation. The teacher exists within the relational context with the learner and this leads to say that every didactic action is sustained on otherness. On the other hand, learning can happen even in the absence of a teacher, by means of technologies, tools, formal and informal resources, including the knowledge of others adequately made available. These considerations are useful to put the focus on those who learn: attention to the learner is in every didactic actions and new technologies simply provide new teaching tools and settings.

The European disability policy is expressed in the Madrid Declaration written by the European Disability Forum for the European Year of People with Disabilities. It is focused on disability as a human rights issue. People with disabilities are entitled to the same human rights as all other European citizens. In general, in most European countries, people with special educational needs usually include the following subgroups: (1) people with specific learning disabilities, (2) persons with visual impairments, (3) persons with hearing impairments, (4) people with slower cognitive functioning, (5) autistic people, (6) people with neurological and other diseases, (7) people with complex cognitive, emotional and social difficulties, (8) people with multiple difficulties, and (9) people with speech and language disorders. In SMARTEL project, partnership addresses

- Blindness/low vision: serious problems or diseases like blindness and ocular trauma
- Deaf/hard hearing: Hearing disability includes people that are completely or partially deaf.

Inclusive teaching means recognizing, accommodating and meeting the learning needs of all students to help them to achieve their scholar, professional and social inclusion. It means acknowledging that students with disabilities have a range of individual learning needs and that they are members of diverse communities. Such an approach challenges the teacher to move away from an instructional role of selecting and transmitting information towards a role of facilitator of the way students find, analyse, evaluate, and apply information relevant to a particular subject domain, with a focus on developing and supporting student autonomy.

ICT is important supportive technology for education of students with disabilities. Realization of goals of students with disabilities education is based on the differentiation and individualization of teaching. Setting up a suitable e-environment for students with specific learning disabilities includes two (2) interconnected tasks:

- Providing assistive technology: any mean, hardware or software, which can increase, improve or maintain capabilities of persons with disabilities and enable them to execute tasks that are sometimes difficult or impossible to do without technical aid.

- Designing e-learning and e-teaching to promote participation, allowing all students to take part in all subjects and activities, enhancing cooperative learning. Learning is a social activity and understanding is socially constructed.

The framework for designing accessible e-learning has 3 main development steps[9] [10]:

1. In **pre-design** we refer to learning theories and paradigms to give a theoretical structure to the pedagogical model and to design the learning environment. We pay attention to the following issues: constraints (human/economic resources, implementation times, No. of users); aims and objectives; curricula and domain knowledge to develop. Then we proceed to outline the users, the disability typologies and their special educational needs. Pre-design phase is accomplished by the need analysis and the definition of learners' prerequisites.
2. **Pedagogical design** foresees 3 levels of transformation of learning content: content transformation, pedagogy transformation and presentation transformation.

Figure 3: Levels of transformation of learning content

   a. Content transformation: identifying the learning style to be considered for learners with a certain disability or impairment (which defines the learner accessibility preferences) and define a pedagogical model: didactic methods and strategies according to accessibility criteria;
   b. Pedagogy transformation: providing variation in the organization and implementation of didactic contents and resources according to learners' requirements, as well as communication and interaction tools Teaching patterns do no work equally for all type of learners, so it is necessary to vary the way of teaching;
   c. Presentation transformation: representing the content in a format that learners are comfortable with and can understand what is taught to them.

3. **Technological design** is the phase in which the virtual learning environment is designed and planned, by describing the communication architecture and the interface; technical standards for accessibility must be respected.

PRE-DESIGN		
Theoretical frame	Organisational Context • Project Constraints	Users • Typologies of users

[9] Guglielman E. (2010): "E-learning and disability: accessibility as a contribute to inclusion", in Doctoral Consortium at EC-TEL 2010 - Proceedings of the 5th Doctoral Consortium at the European Conference on Technology Enhanced Learning, Barcelona, Spain, pp. 31-36.

[10] Jemni, Mohamed & Laabidi, Mohsen & Ben Ayed, Leila. (2014). Accessible E-learning for Students with Disabilities: From the Design to the Implementation. 10.1007/978-3-642-38291-8_4.

	• Course objectives • Curriculum	• Needs analysis • Users' requirements

DESIGN	
Pedagogical model • Didactic Methods and strategies • Assessment tools	Activities and content • Planning of learning courses • Contents organisation • Choice of tools and instruments standard • Pedagogical support

TECHNOLOGICAL DESIGN	
Conceptual design • Interface design • Accessibility and usability standards	Virtual learning environment • Choice of tools and instruments • Hardware and Software supports

Figure 4: Framework for designing accessible e-learning (Guglielman, 2010)

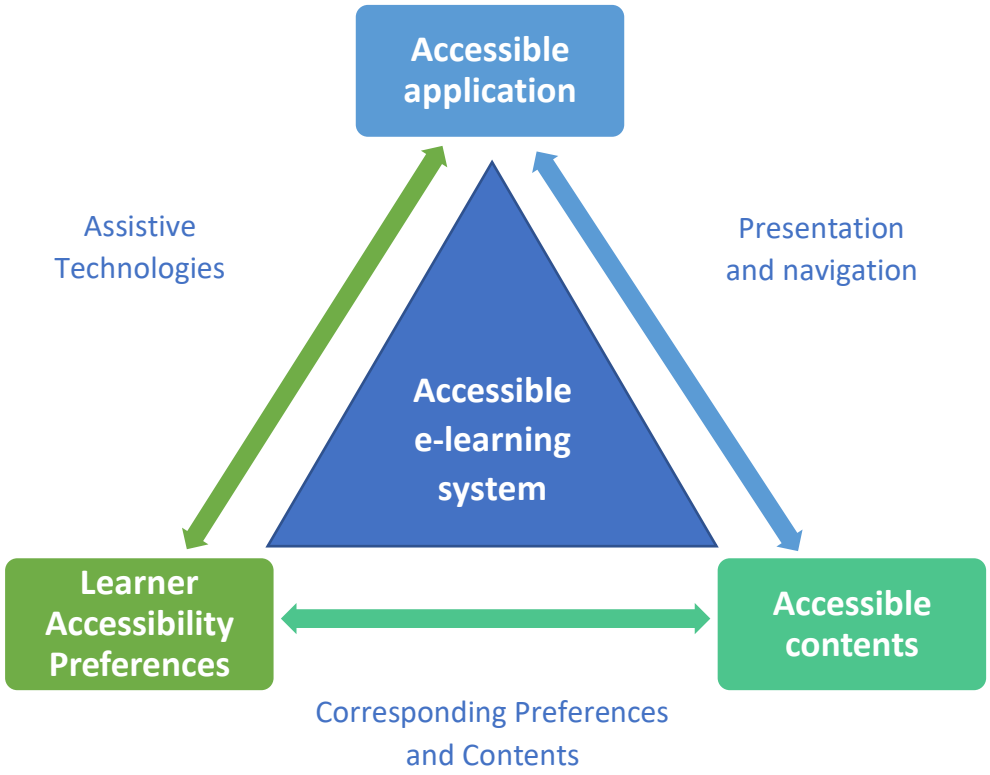

Figure 5: Architecture of an accessible e-learning system (Jemni, Laabidi & Ben Ayed, 2014)

These steps are to be considered in the next stages of SMARTEL projects. Given the constraint of the project in terms of time and resources, it is recommended to HEIs to focus on.

GLOSSARY

Accessibility: refers to a characteristic of technology that enables people with varying impairments or disabilities to use it. Accessible design also benefits people with older or slower software and hardware. eLearning content developers and instructional designers should aim to make courses clear, easy to understand, and simple to complete. Learners who suffer from sensory, intellectual or technological difficulties will need assistive technology to successfully access and complete their training courses.

Assessment: Assessments often take the form of a test included at the end of a course to evaluate learner performance. They should be aligned with the learning objectives of a course to accurately measure learner progress.

Asynchronous learning: allows learners to access to training material that they can complete at their own convenience. It doesn't require real-time interaction, enabling learners to complete courses at a time, place and pace that suits them. It includes use of online materials that can be obtained or submitted by the internet via classroom portals, messages, emails, etc. Does not require a continuous connection.

Augmented reality (AR): an interactive and enhanced version of the real-world physical environment. Whereas virtual reality (VR) creates its own cyber environment, AR adds to the existing world as it is. It does it by using computer-generated visual elements, sound and other sensory stimuli.

Blended or Hybrid Learning: combination of traditional, face-to-face learning methods with technology-based online learning methods. It's also be described as a blending of live training and self-paced training. It offers a great way to augment the learner's experience. Between 25-50% of instructions, assignments, and discussion takes place online.

Classroom-Based Training: also known as face-to-face or live training, classroom-based training is a more traditional training method. An instructor guides learner through a course in a real-world environment such as a classroom or meeting room.

Cloud computing: 'software as a service'; the cloud provides the infrastructure and platforms on which the applications run and end-users access cloud-based applications through a web browser or a light-weight desktop or mobile app.

Cloud LMS: a web-based platform that helps organisations and institutions to deliver, track, and report on eLearning. The main difference between a cloud LMS and other solutions is that learning content, tracking and reporting data is stored in the cloud. One benefit of a cloud LMS is that it's quicker and more cost-effective to install than self-hosted learning solutions. Cloud learning management systems also tend to require less in-house technical expertise to maintain and run.

CBT (Computer-Based Training): traditional name for what is now known as eLearning Computer-Based Training specifically describes the on-demand elements of eLearning, excluding instructor-led training.

Collaborative platform: a virtual workspace where resources (information, files, data) and tools are centralized with the aim of facilitating communication and interaction. Some example of services are shared calendars, collaborative documents and message notes.

CMS (Content Management System): a system that supports the creation, management, organization and consumption of digital content. An LMS is likely to contain a CMS function, to allow the internal curation of educational content.

Course Builder: Functionality in a learning management system that is used to upload and create courses. Course builders allow you to combine elements such as text, image, video etc., to make your courses more engaging.

Distance Learning: also known as Distance Education. Distance learning occurs when student and teacher / instructor are in different locations. Distance learning has been around since long before the Internet and the presence of a computer in nearly every home and office. Distance learning was a form of asynchronous learning, long before the internet. With the Internet and mobile telephony, distance learning can now be both synchronous and asynchronous – or a combination of both.

eLearning / e-learning / eLearning (Electronic Learning): the delivery of learning and training through digital resources and devices. Although eLearning is based on formalized learning, it's provided through electronic devices such as computers, tablets and even cellular phones that are connected to the internet. This makes it easy for users to learn anytime, anywhere, with few, if any, restrictions.

F2F (Face to Face Training): refers to the in-person elements of instructor-led training. Both teacher and learner are physically present in the same environment and able to converse naturally with no need for digital intervention.

Face-to-Face Web Enabled: Students "meet" virtually with their instructors (and other class members) via video chat or teleconferencing

Feedback: Feedback can be provided while a learner completes a course, an exam, or assignment in an LMS. Types of feedback include showing the learner if the answer they submitted is correct or incorrect or displaying correct answers after submission.

Fully online: Active instruction, testing, assignments, and discussion takes place online.

Hybrid or Blended Learning: combination of traditional, face-to-face learning methods with technology-based online learning methods. It's also be described as a blending of live training and self-paced training. It offers a great way to augment the learner's experience. Between 25-50% of instructions, assignments, and discussion takes place online.

ILT (Instructor-Led Training): training delivered by an instructor either in an in-person or webinar conference setting.

Immersive Learning: it leverages technologies like VR and AR to create stimulated or artificial learning environments. The interactive environments help in replicating possible scenarios and in teaching specific skills and techniques.

Learning Analytics: the measurement, collection, analysis and reporting of data accumulated during an online learning activity. Learning analytics allow for deep insight into the behaviours, competencies and experiences of learners in addition to accurately identifying areas for improvement in both the learner and the learning environment.

LMS (Learning Management System): a software application that is used to manage the administration of training (creation, management, delivering and tracking). Typically includes functionality for course catalogues, launching courses, registering students, tracking student progress

and assessments. A good LMS will allow you to deliver course content in a range of eLearning standards, sell online courses, assess and evaluate learner performance, deliver blended learning, brand or white label the LMS, integrate with third-party systems, and much more.

Learning Platform: a rather general term that refers to the underlying technologies people use to build and deploy eLearning. It usually refers the authoring software, the Learning Management System (LMS) or both.

mLearning (Mobile Learning): learning that's conducted on a mobile handheld device, like a smartphone or tablet. mLearning can occur anywhere at any time. The movement from desktop to portable devices has had a big impact on the development of online learning content. Instructional designers increasingly need to develop responsive mobile learning content that can adapt to the many devices learners now use.

MOOC (Massive Open Online Courses): a pre-recorded online course aimed at unlimited participation and open access via the web with open-ended, self-paced learning, available 24/7.

Online Learning: Often used interchangeably with eLearning and web-based training. Any form of education and training where materials are distributed, and communication takes place on a computer and usually over the internet.

Simultaneous Teaching: Faculty will teach online and in-person at the same time, i.e. a live stream of a lecture that students can attend in person or virtually. Students study course material outside class and utilize classroom time to reinforce learning, ask questions, and interact with their instructor

Synchronous learning: instructor-led learning in a (virtual) classroom setting. During this kind of event, learners attend on at the same time and an instructor guides the class. It includes real time teaching, feedback and contact with instructor and other students, requiring a live (and fast) internet connection.

Virtual Classroom: where a live education or training environment is created online and accessed via digital devices, this is known as a virtual classroom. Learners and instructors need to use the same virtual classroom software to communicate, and this might be downloaded as a desktop application or mobile app, or accessed online with cloud-based software.

Virtual Learning Environment (VLE): a web-based platform to organize resources, courses and users, often within an educational institution.

Virtual Reality (VR): the computer-generated construction of a 3D environment that can be interacted with by a user, often with a headset and/or gloves fitted with sensors to allow for the realistic interaction and manipulation of objects. Virtual reality has application in online compliance training as it can safely simulate dangerous scenarios.

Web Based Training (WBT): delivery of learning content via a web-based application or internalized intranet. Content may be hosted within a web-based application (such as an LMS), or retrieved from external sources to allow a diverse and up-to-the-minute consumption of learning content.