

Contributions to the debate on

LEARNING OBJECTS

for skills development

50 years



International Labour Office
CINTERFOR

Contributions to the debate on **LEARNING OBJECTS** for skills development



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The Inter-American Centre for Knowledge Development in Vocational Training (ILO/Cinterfor) is an ILO technical service, set up in 1963 with the aim of encouraging and coordinating the action of the Latin American and Caribbean institutes, organizations and agencies involved in vocational training in the region.

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Preface

LOs and skills development

The development of vocational training (VT) in Latin America and the Caribbean is characterized by collaborative work between the vocational training institutions (VTIs) in the network coordinated by the ILO/Cinterfor. This paper is the result of collective knowledge management by several organizations that have contributed their experience, knowledge and innovations.

Between August and October 2012, ILO/Cinterfor conducted a survey on learning objects (LOs), to which 25 organizations from 12 countries¹ replied. Their answers made it possible to achieve a general overview of different concepts; production, use in competency-based training, in face-to-face, distance and blended modalities, their interest in strengthening knowledge and sharing, as well as management systems for these learning resources.

At the behest of SENAC and ILO/Cinterfor, several agencies² were convened in order to advance jointly in the analysis of LOs. Two meetings took place during this collective knowledge-building process – one sponsored by SENAC (Rio de Janeiro, 4 and 5 December 2012) and the other by DuocUC (Santiago, 24 and 25 April 2013). The working group met online over the course of six months, using ILO/Cinterfor's platform (<http://evc.oitcinterfor.org/course/view.php?id=44>) in order to share their experiences and identify conceptual and methodological coincidences. Other institutions made their LOs available and they have been included in this study. At the same time, a software tool has been designed that will allow the network's VTIs to share the LOs they host in their repositories.

In the evolution of vocational training in the region, the joint action of VTIs led to Cinterfor Basic Collections (CBCs) and the modular structure of training programmes. Since then, learning activities have fed participants quantified information in terms of extent and difficulty; examples; exercises, and mid-term learning evaluations. These features are preserved in the LOs, in printed or digital format – their essence is their learning purpose, which distinguishes them from other resources used for learning.

Contributions to the Debate on LOs for Skills Development will continue to be enhanced by input from the network's VTIs; they have always incorporated methodological and technological developments in the production of training material, in order to response the demands of human resource development. We wish to express our warmest appreciation for all the support given to this research, which once again shows the commitment of a dynamic, innovative and generous network.

Martha Pacheco
Director ILO/Cinterfor

¹ See Appendix 1

² Ministry of Labour, Employment and Social Security, Argentina; SENAI and SEBRAE, Brazil; DuocUC, Chile; SENA, Colombia; INA, Costa Rica; CTIC, Spain; INTECAP, Guatemala.

Introduction

One of the purposes of the ILO/Cinterfor-coordinated network is the knowledge management of subjects that vocational training institutions (VTIs) identify as priorities.

The need to provide easy access to training and employment for more people, within a regional context of great social and productive variety, has led VTIs to explore innovation, seek creative solutions and increasingly use technology to cater to a variety of changing needs. In this context, it has been noted that there is a growing interest in the challenges and opportunities for collaboration posed by Learning Objects (LOs)³ among those responsible for skills development and learning.

The creation of new collaborative knowledge-building areas – a distinctive feature of vocational training (VT) in the region – offers the opportunity to generate a methodological framework for the design, use and quality assurance of learning objects (LOs) in order to:

- contribute to skills acquisition, development and updating
- facilitate learning processes
- foster the key role of people in their own lifelong learning process

This paper is the outcome of collective knowledge building involving different VTIs, and leads to reflection regarding LOs. It is, therefore:

- **open** to experiences, innovative solutions and lessons learnt in the region and beyond;
- **dynamic**, bearing in mind the speed at which change occurs in different settings, including learning methodologies and the use of Information and Communication Technologies (ICTs);
- **inclusive**, in view of the fact that it adopts an evolutionary perspective of VT and is based on VTI contributions and developments;
- and a **collaborative** exercise between VTI senior staff, facilitators and technical experts.

³ Also known as learning capsules, educational objects, virtual learning objects.

We suggest that while reading this paper and contributing to its enhancement, you should bear in mind:

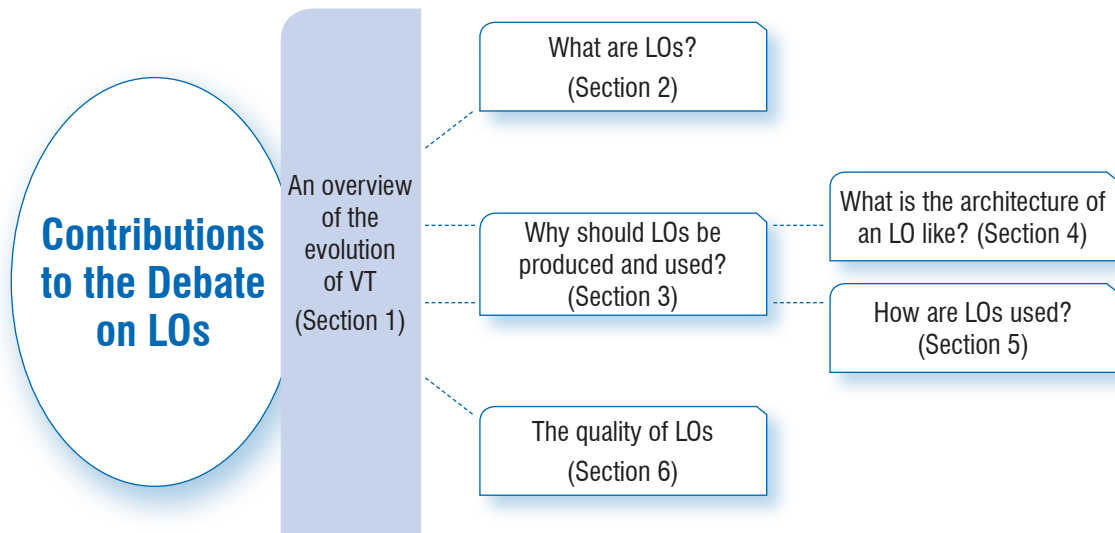
- different LO alternatives, and not only those involving a high technological component;
- the necessary flexibility to contextualize solutions and introduce changes based on reality;
- the potential capacity of ICT programmes and the media to produce interactive learning;
- the synchronization of LO design and use with other learning resources and the competency-based approach.

The sections included in this paper are:

- 1. An overview of VT evolution:** the innovative solutions and methodological contributions that VTIs have historically resorted to in order to meet the economic and social demands of the region constitute an essential aspect in addressing LOs. Some of these contributions include active and dynamic analytical methods, flexible and open curricula, modular programmes and Cinterfor Basic Collections (CBC) (ILO/CINTERFOR, 1971-1979), clearly the forerunners of LOs (ILO/CINTERFOR, 1990). Also included are the results of a survey conducted among members of the CINTERFOR network, which explore the following aspects: LO development, production, and use and perspectives.
- 2. What is an LO?** This chapter underscores the learning purpose of LOs, which is reflected – with a different emphasis – in a variety of definitions. Some of their characteristics are analysed and they are classified according to their educational use and taxonomic combinations.
- 3. Why should LOs be produced and used?** This section explores some of the reasons for producing and using LOs in learning environments.
- 4. What is the architecture of an LO like?** This section attempts an approach to designing LOs, on the basis of an educational analysis of competencies and their components, as well as a synthesis of the phases and stages of their production process.
- 5. How are LOs used?** The educational potential of repositories is considered here (Looms and Christensen, 2002), and some application modalities and guidelines for LO use and synchronization are addressed. In addition, and with the purpose of providing support for users (participants and facilitators) in their application of LOs, aspects and criteria to be borne in mind when selecting them are listed.
- 6. The quality of LOs:** this section examines some standards for producing, packaging and identifying LOs, as well as some evaluation models.

Finally, all sections include subjects to encourage debate and collective building, with links and appendices in order to broaden and strengthen information and provide examples.

Content map



An overview of VT evolution

VT and teaching resources

VT in Latin America and the Caribbean has traditionally responded to the demands of the labour market with a practical perspective, to which end the occupation structure of enterprises and productive sectors has usually been taken into consideration.

In this regard, the design and evolution of methodologies, training solutions and learning tools by the VTIs in the region represents a remarkable fund of knowledge, which has been increasing since the mid-70s.

In recent decades, the information available has grown at unprecedented rates; the responsibility of selecting, using and transforming is an increasingly individual matter. People organize their own individual learning without being restricted to receiving information passively; they become, rather, active participants in the process.

The challenge that teachers face is rising above the role of merely transmitting information and becoming facilitators to help people to overcome the obstacles to learning. Learning capacity is essential (learning to learn) and because of this, educational resources are basic.

In seeking to support and facilitate the learning process, resources are designed, developed and implemented by combining a diversity of variables in different political, economic and social contexts. In relation to training for work, these variables are primarily associated with:

<i>How productive processes and work are analysed</i>	<i>What is the understanding of how people learn</i>	<i>What teaching and learning (TL) methodologies and strategies are applied</i>	<i>What resources and materials benefit TL processes</i>
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The broad range of existing learning resources is the result of the different ways of understanding work and learning, and of the methodologies and technologies available from each moment in history. The links between these variables and technological developments have contributed to creating and applying learning resources that are increasingly in line with people's very different lifelong training needs. In this respect, it is possible to state that LOs have a solid background in skills development in Latin America and the Caribbean.

From CBCs and modular training to LOs

The ILO's Recommendation 195 (2004) on human resources development included definitions related to contemporary VT:

“... ”

a) the term “lifelong learning” encompasses all learning activities undertaken throughout life for the development of competencies and qualifications;

b) the term “competencies” covers the knowledge, skills and know-how applied and mastered in a specific context;

c) the term “qualifications” means a formal expression of the vocational or professional abilities of a worker which is recognized at international, national or sectoral levels;

d) the term “employability” relates to portable competencies and qualifications that enhance an individual's capacity to make use of the education and training opportunities available in order to secure and retain decent work, to progress within the enterprise and between jobs, and to cope with changing technology and labour market conditions....”

The joint action of VTIs to develop CBC constituted a milestone in Latin America and the Caribbean in the 70s. These CBCs established methodological grounds and standards to govern their design, together with regular assessment and revision procedures. CBCs include instruction sheets (IS) which explain the tasks and operations of the productive process through charts and diagrams.

The CBCs, which were the result of collaborative work among institutions, have been and still are a valuable source of information in the development of further training proposals and teaching materials. Since they came into use, VT learning activities offer participants quantified information in terms of amount and difficulty; examples to facilitate understanding; pictures to clarify concepts; exercises to reinforce learning; summaries of main points; and mid-way evaluations to test learning.

In subsequent years, from the methodological point of view, the knowledge accumulated by VTIs has evolved from a “learning by doing” approach using demonstration and repetition⁴ (ILO/Cinterfor, et al, 1971-1979), towards a knowledge building and occupational skills development paradigm.

This methodological transformation was grounded on the dynamics of the world of labour, which made it necessary to renovate the technical and educational organization of training and make processes, methods and content more flexible. The modular structure for training programmes began to be applied in VT as a timely response to the demand of the productive sectors, changes in occupational profiles and the need for lifelong learning (Appendix 2).

⁴ The “four-step” method; 1) Teacher say and do. 2) Teacher say and learner do. 3) Learner say and do. 4) Learner do and instructors supervise.

The modular approach led to the design of pathways that provide alternative training routes based on a basic module, with intermediate outlets to the labour market and with successive returns to training whenever technological changes call for it.

A training module includes certain basic and technological knowledge and professional practices that make it possible to acquire competencies and offer quantified information, examples, pictures and assessment.

The modules can be combined according to the specific requirements of companies and workers, encouraging their participation in the identification of their own objectives.

In the late 90s, a new educational approach involved competency-based curricular design structured in independent modules, which makes VT extremely flexible.

The convergence of modules and flexibility in training design and execution is increasing and is applied in different learning modalities.

A significant contribution to this convergence is the recent development and incorporation of resources such as LOs, in view of their potential in directed or self-directed learning processes. ICTs have also shown that they can be used in a wide variety of ways, despite the fact that a digital divide persists, which must be reduced in order to achieve their full potential.

LOs (Wiley, 2000) are digital or non-digital entities that describe independent instruction components, which can be used and reused in different contexts. LOs answer to the knowledge-building paradigm in which – among other aspects – learners make decisions regarding what, how and when to learn, interacting with the information available (Fernández, Server García and Carballo Ramos, 2006). LOs enable the active learning of individuals, who are the architects and designers of their own training.

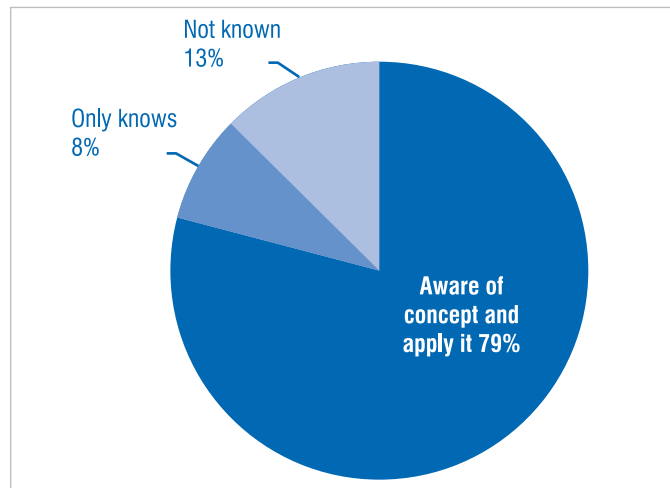
LOs in the region in 2012

A survey (Appendix 3)⁵ on LO production, use and perspectives for vocational training in the region reveals significant data that indicate that this type of resource is widely used in different training fields.

Proof of this is that 79% of the institutions have been aware of and have been applying the LO concept for more than three years.

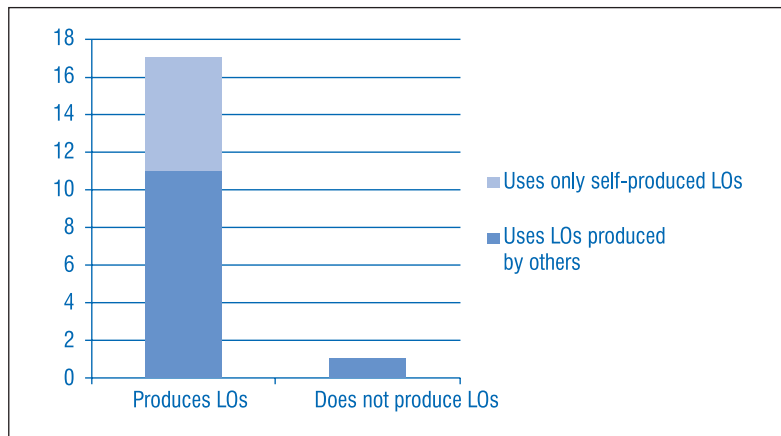
⁵ A survey conducted by ILO/Cinterfor between August and October 2012; there were 25 respondents.

The LO concept in institutions



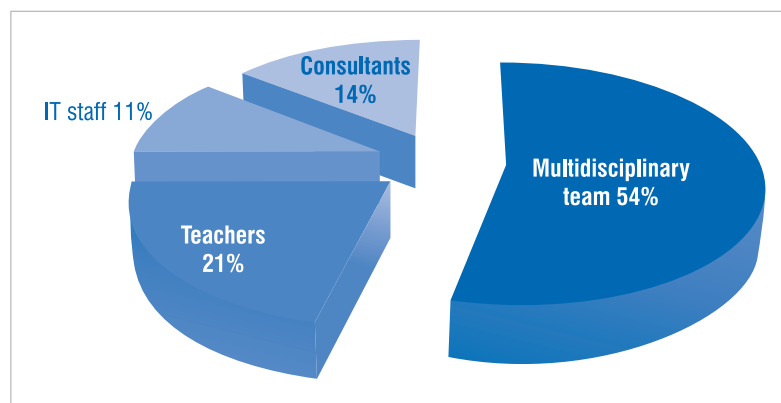
Figures showing that awareness exists, but is not applied, or that awareness is lacking, do not imply that institutions have not expressed interest in the field of LOs.

With regard to production, the answers show that while most of the VTIs use LOs produced by other institutions, few restrict themselves to using only LOs they produce themselves and even fewer do not produce LOs at all.



To the question regarding who was responsible for producing LOs, more than half of the institutions responded that the job was done by multidisciplinary teams.

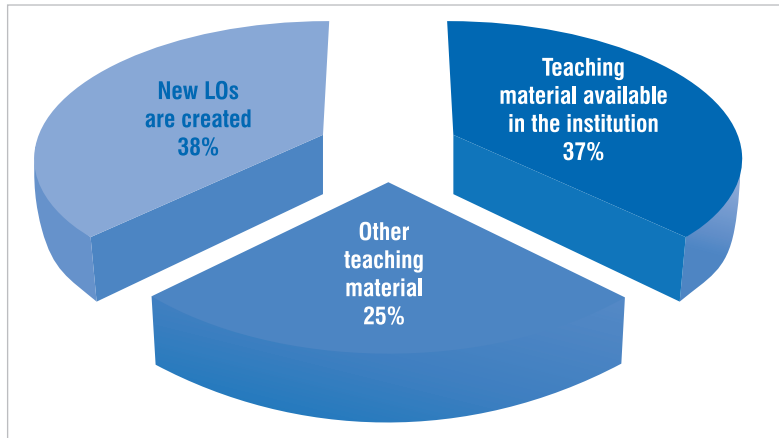
Who produces the LOs ?



Multidisciplinary team production may be due to the need to generate fairly standardized and good quality LOs that comply with institutional guidelines, particularly in the case of VTIs that engage in large-scale production in order to meet the demand for learning resources.

It is interesting to note that institutions use a similar proportion of existing and new educational material in their LO production.

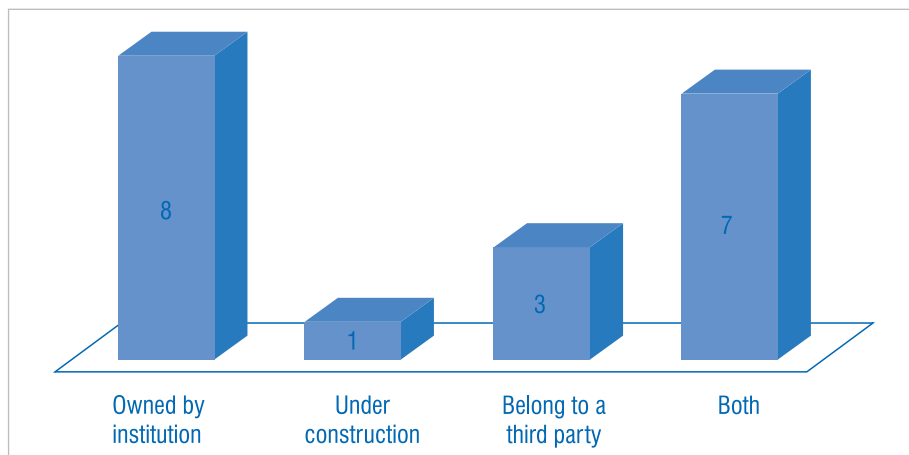
Material used in LO production



Examples of LO production are provided in Appendix 4.

Storing LOs in repositories is a concern for all of the institutions and although solutions differ, most of them have chosen to use their own repository and/or combining it with others.

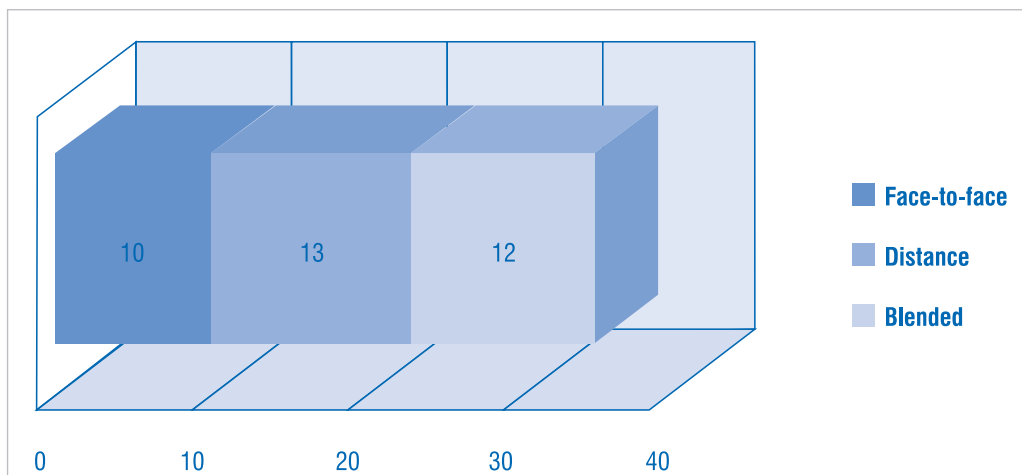
Repositories are



Whichever type of repository is used, in most cases, access is limited to institutional users (requiring user name and password).

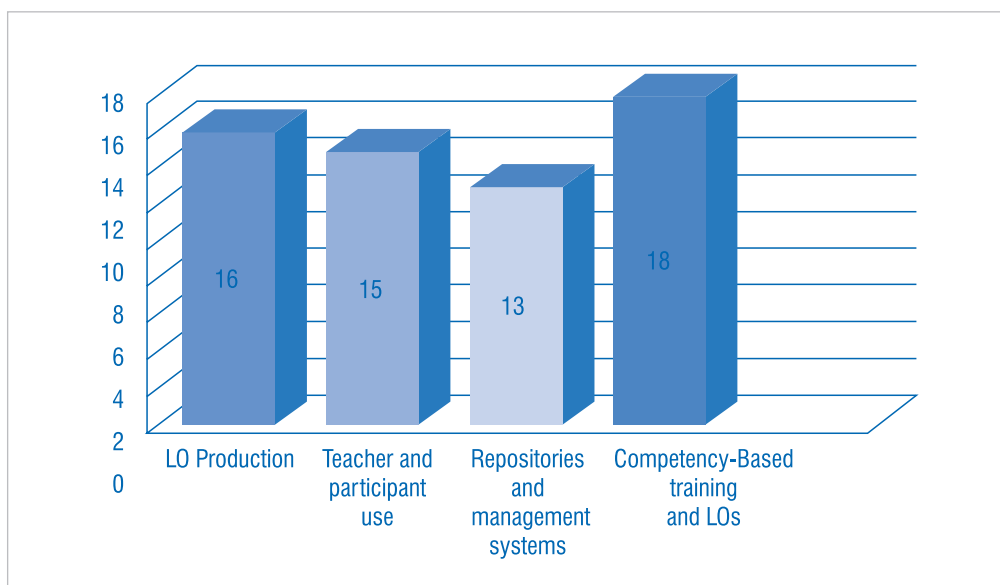
Data show that LO application is not limited to any specific training modality, but is used almost equally in face-to-face, distance or blended training.

Modality LOs are used in



Finally, an indicator which is increasingly significant with regard to LOs is the interest that VTIs have expressed in extending their knowledge and sharing educational issues related to the production of LOs, covering use by facilitators and participants, repositories, and competency-based training and LOs.

Interest in extending knowledge and sharing



Among other issues that they are interested in knowing more about, VTIs underscored the following:

- Competencies in LO design for technical staff.
- Training and capacity-building in LO design and use for facilitators. Training for online tutors.
- LO production methodologies.
- Student-produced LOs aimed at peer learning.
- LO production standards.

- Microtraining.
- Designing interactive content, learning games and other content.
- Content for virtual learning environments in social networks.
- Development of personal thematic learning environments on the use of ICTs in the productive sector.
- Mobile device accessibility strategies (amount of information, type of information).
- Learning analysis⁶ applied to LOs.
- Experience in producing LOs for use in the communications media, as well as in courses containing LOs (enrolment, evaluation and other aspects).
- Marketing strategies to draw VT participants into the system.
- Continuity policies related to repositories.

Moving on...

In their ongoing search for TL innovation, institutions currently allocate human and financial resources to LO production, or to gain access to LOs produced by other institutions.

Obstacles and challenges emerge in their path, but by abiding by their traditional networking operations, the region's VTIs will surely devise solutions that will enable them to overcome these hurdles and enhance LO production, application and evaluation.

The survey was an initial study to explore several aspects such as:

- ◆ Factors that influence decisions regarding which LOs to develop and for which areas.
- ◆ Establishing criteria for investing in LO production.
- ◆ Adapting to international standards in cataloguing, organizing and reusing the LOs held in repositories.
- ◆ Opportunities to coordinate and optimize LO production in the network, by means of regional strategies.
- ◆ The need to train facilitators so that they become LO users or producers.
- ◆ Promoting the assessment of:
 - ✓ LO management and production;
 - ✓ the contribution of LOs to the TL process in different training modalities;
 - ✓ participants' opinions of LOs.

⁶ Refers to measuring, data-gathering, analysis and reports on participants and their learning contexts. Available from: <http://www.educause.edu/library/learning-analytics>.

What is an LO?

Different perspectives and constant change coalesce into a diversity of designations for LOs.

Educational purpose and different concepts

In order to be meaningful and promote learning, LOs must have an educational purpose. Otherwise, they would not be LOs, but merely digital or non-digital information resources⁷ used in face-to-face or distance learning processes (Flamand and Gervais, 2004).

An LO is a digital or non-digital resource, which is independent and reusable, preferably interactive, produced for learning and to contribute to the development of competencies.

Some definitions are quoted below that underscore – with more or less emphasis – LOs' educational purpose and concepts used in different contexts (López, 2005)⁸.

“An LO is an autonomous structure (distribution, organization) that contains a general objective, specific objectives, a learning activity, metadata (external information structure) and, therefore, means of evaluation and weighting, which can be developed by means of multimedia elements in order to make them reusable, interoperable, accessible and durable...” (Cano Zárata, 2007).

LOs are “learning units; generally of limited length, which aim to develop one or several components in a competency and can exhibit a diversity of formats and include a great variety of resources (texts, pictures, videos, news items, hands-on exercises, simulations, serious games, cases, poems, music, utilitarian objects, SMSs, forum, etc.)” (Miller, 2004).

⁷ An information object is a digital resource devoid of any philosophy, or learning or teaching theory. Available from: <http://www.colombiaaprende.edu.co/html/directivos/1598/article-172371.html>.

⁸ “In formal terms, there is no single definition of the LO concept and definitions are very broad. The Learning Technology Standards Committee (IEEE, quoted in López, 2005), states that learning objects are ‘any digital resource that can be reused to support learning’; Mason, Weller and Pegler (quoted in López, 2005) define a learning object as ‘a digital piece of learning material that addresses a clearly identifiable topic or learning outcome and has the potential to be reused in different contexts’. In practice, the breadth of these definitions may make them inoperable, as there is nothing that clearly distinguishes LOs from other resources.” Available from: http://gredos.usal.es/jspui/bitstream/10366/56649/1/DIA_Repositoriosobjetos.pdf.pdf.

“An LO is an informative digital entity that corresponds to (represents) a real object, created for the generation of knowledge, skills, attitudes and values and that becomes meaningful according to the needs of the individual using it” (Rabajoli, 2012).

“An LO is digital (encapsulated) information in which general data, learning objectives (who the target is) and the content as such are reflected. An LO is an element that may have links to external or internal virtual learning environment (VLE) sites, links to multimedia elements such as pictures, videos, audio files, etc. An LO contributes to learning for users of a distance education platform in e-learning” (Dibut, n.d.).

“An LO consists of a series of self-contained, reusable digital resources with an educational purpose and containing at least three internal components: content, learning activities and contextualization elements. An LO should have an external information structure (metadata) in order to enable storage, identification and recovery” (Ministry of Education, Colombia, n.d.).

“An LO is any digital learning material with a beginning, a middle and an end, which has a purpose in itself” (SENAC, 2011).

“LOs are defined as any digital or non-digital entity that can be used, reused or referenced in technology enabled learning” (LTSC, n.d.).

From a diversity of concepts to the characteristics of LOs

Having an educational purpose is essential for LOs, be they digital or non-digital. Some of their characteristics are:

- **Reusability:** the possibility of reusing an LO in different learning situations and contexts.
- **Generativity:** LOs' capacity to adapt according to the competencies or group of competencies to be developed, facilitating the generation of ideas and concepts by users (Zapata, 2009). Also understood as the capacity to build content, new objects and be updated and modified, thus increasing their potential through collaboration (Agudelo and García, 2010).
- **Flexibility:** this refers to the great versatility and elasticity of LOs in combining into different designs focusing on developing skills and fields of knowledge.
- **Granularity:** refers to content divided and classified into micro information and/or micro applications, selected or produced with an educational purpose, in order to enable nano-learning situations (Elliott, et al., 2006).
- **Scalability:** the capacity to be incorporated into and synchronized with others of different kinds and extensions. This feature is essential in order to maximize opportunities to combine or assemble LOs.

- **Accessibility:** a characteristic that makes LOs easy to identify, seek and find, thanks to labelling with various descriptors (metadata) that enable cataloguing and storing LOs in suitable repositories (Agudelo and García, et al., 2010). Should LOs not be accessible, searching for them may lead to loss of motivation and effectiveness.
- **Structure:** the internal logic of information organized in a deductive sequence (on the basis of concepts, examples, practical activities and verification) or an inductive sequence (based on examples leading to concepts and activities).
- **Adaptation to standards:** common criteria to facilitate integration with other LOs developed by different producers.
- **Currency:** this refers to an LO's continued usefulness regardless of technology changes (Graboski da Gama, 2007), as well as the validity of information that does not need to resort to new designs (Agudelo and García, et al., 2010).
- **Interoperability:** the capacity to be applied in different content and learning management systems.

From the characteristics of LOs to their classification

Different LO classifications are possible, according to the following criteria:

- **Design and educational use**, teaching strategy and learning context.
- **Taxonomic combinations** between objects and their reusable, scalable and granular features (Castro and Landa, 2008), without entailing fixed rules of combination.
- **Institutional requirements**, bearing in mind cognitive levels and degree of complexity, which may be lower (knowledge, understanding and application), or higher (analysis, synthesis and evaluation) (EDUTEKA, 2002-2010).

In addition, there are classifications according to functionality, such as SENA uses for:

- Project activities.
- Thematic content development.
- Laboratory presentations.
- The exhibition of learning activities.

LO classification according to design and educational use

Bearing the learner's role and the learning environment in mind (Callejas, Hernández and Pinzón, 2011).

- **Teaching objects:** these support learning without requiring learners to play an active role.

Examples are:

pictures, maps, charts, audio files, videos, videoconferences, application demonstrations, passages containing detailed information, case studies, directed exercises.

- **Collaboration objects:** developed to facilitate communication in learning environments, with individuals playing an active role.

Examples are:

- sharing between facilitators and participants, who must display their skills or knowledge in face-to-face sessions;
- synchronous or asynchronous interaction between facilitator and participants.

- **Practice objects:** intended for self-learning, with a high level of participant interaction.

Examples are:

- role play to build and evaluate knowledge and capacity to interact with others;
- interactive exercises that make it possible to establish links between concepts through hands-on exercises;
- organizational environment simulations to control and operate a range of management variables;
- exercises involving complex tasks associated with specific software or hardware development, such as computer assembly.

- **Assessment objects:** their function is to evaluate the status of competencies at a certain stage of the training process.

Examples are:

- pre-assessment and/or initial self-assessment in order to determine competency level;
- progress or formative assessment in order to determine progress and focus on areas in which weaknesses are detected;
- final or summative assessment in order to recognize competencies, identify training needs, provide guidance regarding training alternatives and possibilities.

Combination taxonomy

Its purpose is to provide some classification parameters which may be of use in LO design and when producing metadata labelling descriptors, thus facilitating their selection in a repository (Callejas, Hernández and Pinzón, 2011).

Fundamental: those that cannot be sub-divided; for example, the photograph of a pianist.

Combined-closed: can be combined with a very few directly related objects; for example, a video of a pianist, accompanied by an audio file.

Combined-open: can be linked to any other object without restrictions; for example, a website combining a picture of a pianist, an audio file and a text file.

Presentation generation: these are more complex and in the same example, a graphic application might be used to draw musical notes on a pentagram.

Instructional generation: this is more closely related to practical exercises; for example, teaching music and at the same time suggesting musical practice exercises.

These categories may be related to other variables linked to combination and reusability possibilities, such as: number and type of element combined, form of use, dependency on another LO, the logic contained in the LO and its use in other contexts.

Moving on...

The many different conceptualizations and variety of attributes lead to interpretations, applications and classifications that constitute an invitation to continue developing knowledge management with the purpose of

- ◆ Arriving at an institutional definition of LOs in order to encourage the sharing of these resources.
- ◆ Facilitating application in training and the construction of learning pathways.
- ◆ Guiding LO production, storage and selection.

Why should LOs be produced and applied?

Vocational training is eminently practical and has always made use of teaching resources to implement its programmes. The formative process has confronted social and technological evolution that has promoted the development of a shared and collaborative TL concept, in which LOs provide significant support.

This is based on:

- The evolution of learning, incorporating a variety of easily accessible sources and means of information, where methodologies have been put at the disposal of different TL requirements and styles. Thus, multiple modalities have been used, with a variety of resources.
- The advent of ICT led to a rethinking of the learning process with regard to how information is accessed, processed and assimilated. Access to information is no longer a barrier and it has become necessary to develop the critical capacity to select it according to needs.
- The sustainability of organizations is based on people who learn, innovate, contribute and produce collectively.
- The digital culture and the new learning trends converge to provide answers to the demands of society. New forms of production and communication, as well as greater levels of collaboration between stakeholders, tend to extend learning venues beyond a formal context.
- 21st century skills (UNESCO, 2010) are indispensable in preparing people to perform professionally: learning and innovation competencies, and the skills required to handle information, as well as information means and technology for an individual's personal and professional life.
- LO production and application with an educational purpose in specific scenarios make it possible to achieve a meaningful combination of basic conceptual schema (Miller, et al., 2004).
- It is possible to combine and assemble a variety of digital and non-digital resources, both in building and in implementing learning situations (online and face-to-face).

In this context, the production and application of LOs makes it possible to:

For institutions:

- Respond speedily, flexibly and relevantly to a wide spectrum of needs with regard to learning.
- Promote collaborative knowledge building and, as a result, support the TL process.
- Foster the dissemination and development of educational innovations.
- Make a wider variety of resources generally available.
- Achieve greater interinstitutional cooperation and collaboration.
- Enhance teaching methods and teaching innovation.
- Promote creativity in the design, use and update of resources.

For users:

- Be free to choose according to their needs and interests.
- Assimilate different TL styles, in relation to both participants and teachers.
- Encourage their active participation in the design, use and update of resources.
- Stimulate self-learning, the search for educational resources and training autonomy, beyond formal venues.

Experience in the use of LOs in many different fields of training show their:

- **validity** as a tool to generate learning opportunities;
- **effectiveness** in the learning outcomes, actively involving users and generating communication between the individuals involved in learning;
- **relevance** in terms of their capacity to adapt to the target population and institutional guidelines;
- **flexibility** of assembly with other objects, in the organization of training processes, bearing in mind differences in environments, times and students;
- **efficiency** their capacity to be reused in different learning contexts and synchronized with other LOs leads to a better use of resources.

Moving on...

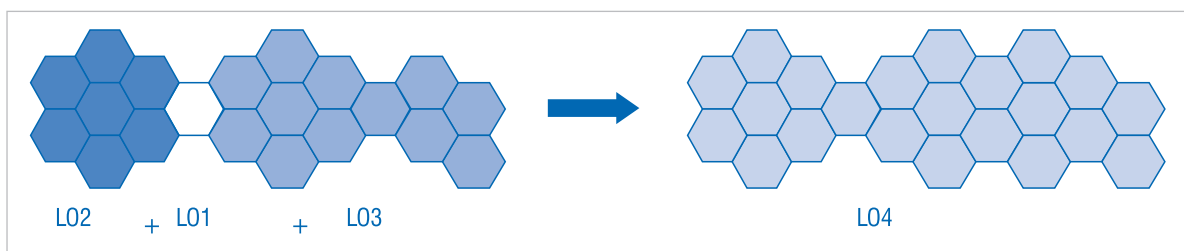
Many other reasons justify the production and application of LOs. There are many LO repositories in existence; however, many studies are still based on pilot experiences. This may indicate that the use of LOs can still expand further. In view of this, we should:

- ◆ identify improvements in order to increase LO application in different contexts;
- ◆ expand training opportunities for facilitators in order to improve LO use;
- ◆ take advantage of features such as reusability, generativity and scalability in order to promote the production of new LOs;
- ◆ evaluate their contribution to a meaningful learning process and the achievement of competencies.

What is the architecture of an LO like?

LOs contain micro information and/or micro applications, selected or produced with an educational purpose, in order to enable nano-learning situations (Elliott, et al., 2006).

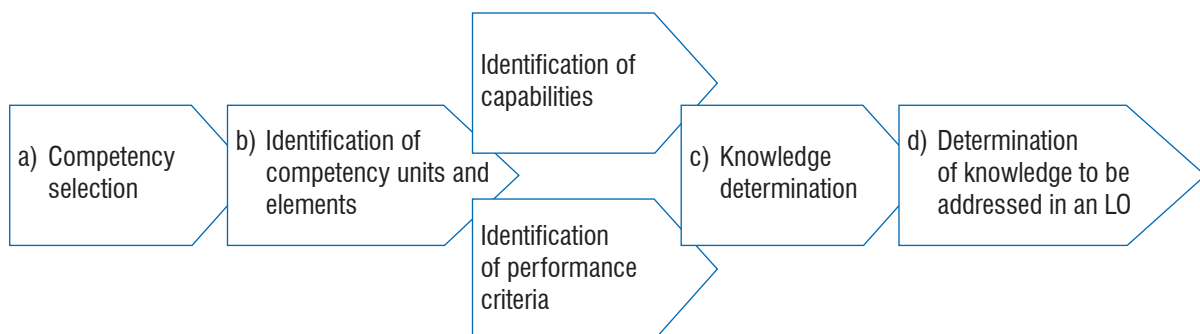
Content is divided and classified into micro information that endows LO development and the TL process itself with the characteristics of granularity (Cuadrillero, Serna and Corrochano, n.d.) and reusability or combination capacity, generating multiple opportunities for synchronized learning, which are depicted below in the shape of a honeycomb.



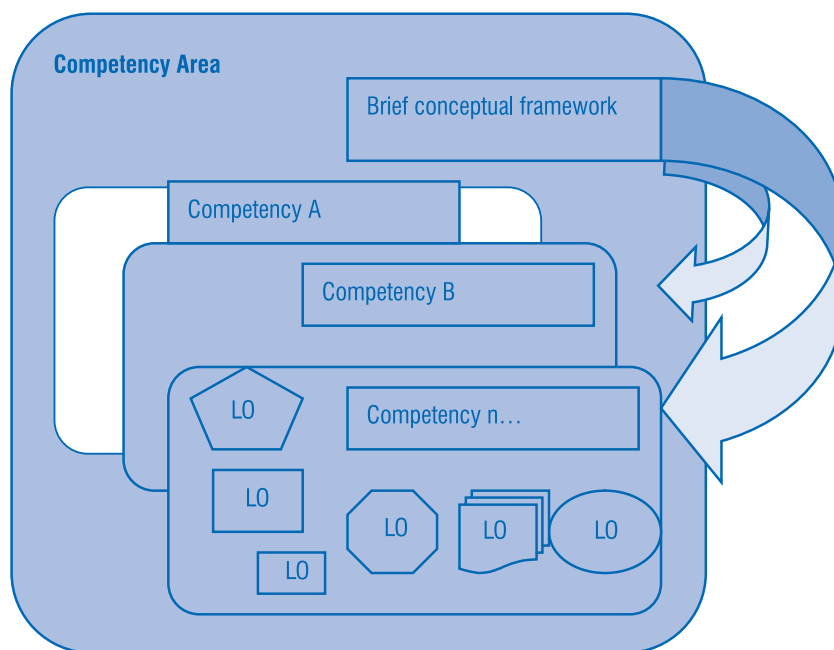
But, how are these micro applications and/or this micro information established in the competency-based training approach?

LOs and competencies

Bearing in mind that the purpose is to trigger the development of knowledge, competency-based LO production includes a number of stages, as indicated in the following chart:



- a) *The selection of competencies* or set of them (areas or blocks of competencies) necessary for a person's job performance. The following chart shows the critical or key competencies that make up each of the areas or blocks selected in order to produce an LO (example in competency ...n).



- b) *Identification of competency units and elements*: includes the capabilities to be developed, as well as performance criteria to be used for baseline evaluation.
- c) *Determination of knowledge involved*: knowing, knowing how, knowing how with others, knowing how to be and behave and wanting to do.
- d) *Establishing the knowledge to be addressed in an LO*: from the point of view of the knowledge to be mobilized, an LO could be developed for each performance criterion, according to its complexity.

Each LO is therefore based on the capabilities expressed in a competency element and on one or more performance criteria⁹ derived from a job skill, which could be (or not be) specific to a productive sector.

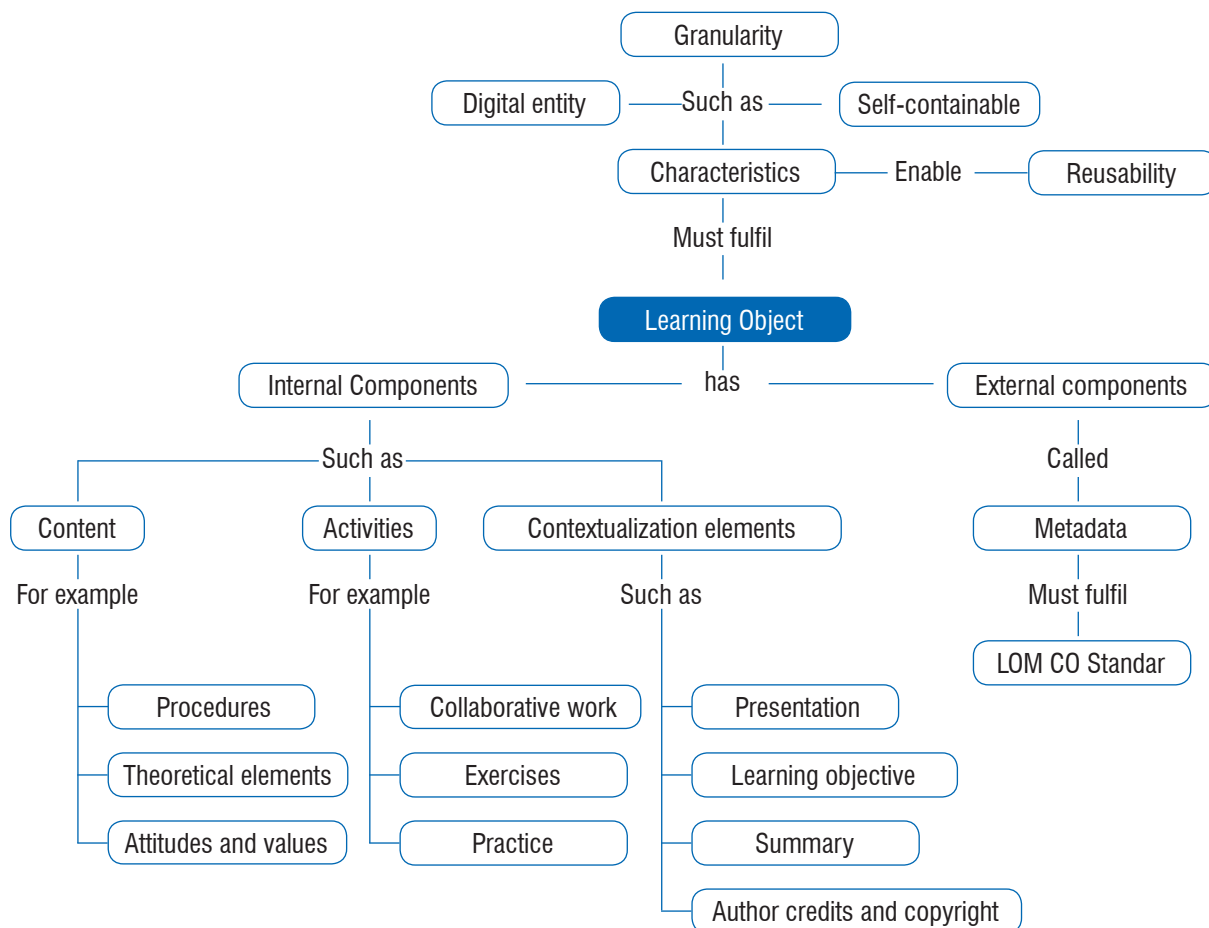
This link shows examples of virtual, competency-based LOs produced by SENA (2011), in which the assessment activity refers to performance criteria: <http://distritocapital.sena.edu.co/virtualizacion/ovas.htm>.

Appendix 5 shows an example based on a unit of competency and its elements.

⁹ Also known as achievement criteria.

The structure of an LO

An LO has external and internal components. External components are generally composed of metadata, or letter of presentation for the LO content, which facilitates locating it or identifying it in a repository. An example of this is shown below in the chart showing the structure of an LO according to Colombia's Ministry of Education¹⁰.



An LO's internal components resemble a curricular micro-design, to which other tools and resources can be linked and incorporated according to:

- The type of learning activity to be supported (see section 2 – LO Classification according to educational use).
- Training objectives expressed in terms of competency.
- The training context (equipment, means with which to apply the LO, teacher and student roles).
- Essential content to focus on.
- Examples to illustrate content.
- Suggested practice.
- Self-assessment, prior or subsequent, which can include proof.

¹⁰ <http://aprendeenlinea.udea.edu.co/lms/men/oac1.html>

Learning Objects (LO)

These components are apparent, with varying levels of emphasis, in the LO examples produced by the VTIs and other organizations connected to vocational training (see Appendix 4).

As the LO structure chart above shows, it is crucial to apply the premises of reusability, generative capacity, adaptation and combination potential to the design of an LO. This can only be done by using production patterns or standards¹¹.

In this regard, several VTIs have developed and applied guidelines for LO production methodology, which include: data sheets for the design of LO production projects; content development templates; checklists to evaluate the template and the LO produced; as well as presentation tips (colours, design, font) and writing standards. Appendix 6 includes some LO production guidelines; Appendix 7 contains the guidelines used by SENA.

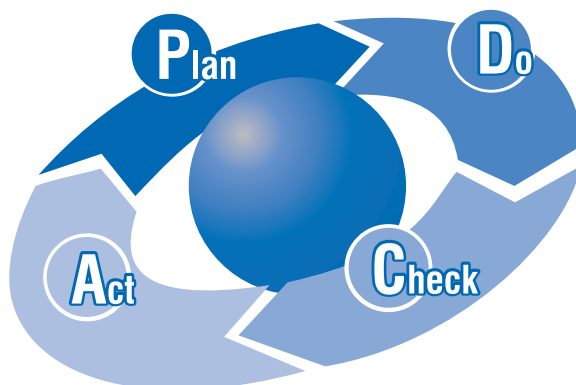
Phases and stages of the production process

The LO production process includes a number of actions which, in most cases, are the outcome of the multidisciplinary work of specialists in learning theory¹², content, training methodology and evaluation and even in information technology, when it comes to generating digital resources.

Although differences are perceived between institutions, LO production shows similar phases and stages, which indicates the presence of common processes and production flows which can sometimes be combined (Nieto Mesa, 2009).

Producing a digital or non-digital LO requires multidisciplinary competencies, particularly when the resources are to be used in virtual environments. Some authors suggest using a participatory approach in order to involve teachers, participants, software designers and evaluators in the whole process, from construction to implementation (Osorio, Muñoz, Álvarez and Arévalo, undated).

By way of a model, the use of the Deming Cycle is suggested, bearing in mind that LO production is a continuous process and, as such, its desired output is susceptible to improvement (Gherssi, n.d.). This process consists of four phases and different stages, as shown below.



¹¹ Described in further detail in section 6.

¹² According to the VTI survey, in 54% of the institutions, LOs are produced by multidisciplinary teams (see section 1).

► *Phase 1: Plan*

This entails establishing objectives and the necessary processes to obtain learning results in keeping with the skills required for the labour market.

Stage 1: Defining the project. Includes a strategy and work plan; requirements and the adoption of technical criteria.

Stage 2: Organizing resources. Includes technical, technological, human and financial resources.

Stage 3: Form multidisciplinary teams.

► *Phase 2: Do*

This is when the plan is executed. The purpose is to identify and produce the way in which learning is to be approached.

Stage 1: Design. Includes instructional design.

How a person is going to learn is determined on the basis of what kind of learning must be done. To this end, a general LO plan is drawn up to determine the connection between objectives, information content, learning activities and evaluation criteria. Possible participants also intervene indirectly, inasmuch as their characteristics are borne in mind. Descriptors are also defined at this stage, in order to enable LO organization and cataloguing.

Stage 2: Development.

In the case of a digital LO, a software specialist and a graphic designer take part in order to provide a suitable interface which will provide motivation to learn. For a non-digital LO, a graphic designer will suggest suitable representations according to the guidelines provided in the previous phase.

Stage 3: Production/Publication.

Included here are classification and distribution, recommendations for application and use, packaging and publication. The LO is incorporated into the appropriate repository. At the end of this phase the LO is stored in a temporary repository.

► *Phase 3: Check*

Follow up and measure LO processes and products in terms of policies, objectives and product requirements, and report on results. In the education area, checking is akin to evaluation, which should be done in different circumstances and at all institutional levels (Padula, 2005).

Stage 1: Select the type of evaluation (self-assessment or third-party assessment) and who is to evaluate, bearing in mind both the production process and the LO product.

Stage 2: Assessment on the basis of previously established criteria.

► *Phase 4: Act*

Take action for continuous improvement.

Stage 1: Decide whether the LO is to be maintained in its current form, whether it can be improved or whether it should not be used.

Stage 2: Application. If it was decided to maintain or improve the LO during the previous stage, it is now incorporated into a learning management system to be used and reused.

Moving on...

LO production poses a number of different challenges. On the one hand, there are those related to decision-making regarding their internal structure (both educational and technological) and their inclusion in a repository. On the other, LO production implies opting for a collaborative process, with a constructivist approach, with a view to generating self-learning among participants.

With all of this in mind, the following points may be raised for consideration:

- ◆ LO production is a fundamental element in the competency-based approach.
- ◆ It is necessary to overcome certain barriers, particularly related to “know-how” as a benchmark in the design of LOs.
- ◆ A flexible perspective should be maintained in order to prevent patterns and standards from restricting LO production.
- ◆ Participants should play a leading role in LO production.

How are LOs used?

LOs in themselves could well be any kind of teaching material, relevant only to those who produce them and their direct recipients. However, the reusability, accessibility and interoperability of these resources become apparent when they are available in repositories that can be freely or widely accessed (Looms, Christensen, 2002).

There is consensus regarding the fact that hosting LOs in repositories – in the case of digital LOs – and/or storing them in educational centres – in the case of non-digital LOs – implies empowering an intellectual capital which tends towards breaking out of the boundaries of a classroom or the limitations of individual use of resources, in order to share educational information and increase learning opportunities, both for facilitators and for participants.

From a social perspective, open LO repositories provide an open door for the general public to gain access to a variety of content.

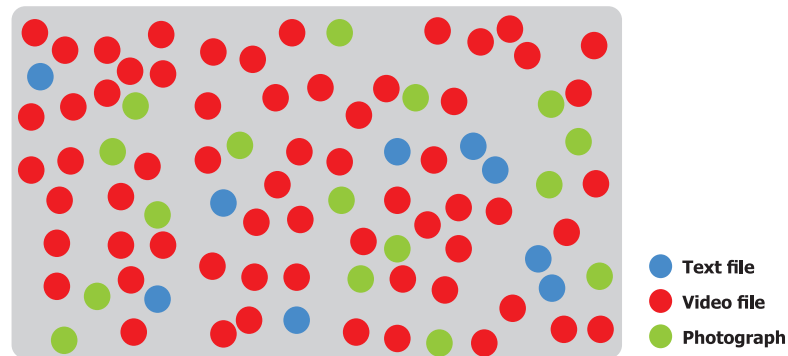
Educational potential of repositories

In the field of training, the use of repositories to store and organize LOs and learning resources benefits training institutions, as it allows them to coordinate efforts and share products and outcomes, which:

- increases the value of the learning resources, inasmuch as the LOs are reusable and can be adapted to the needs of the final user;
- makes it feasible to combine and establish LO sequences flexibly and in different contexts, throughout the various learning pathways available;
- contributes to the facilitator's role by avoiding the rediscovery of solutions that are already available or have been previously implemented by other teachers;
- makes it possible for facilitators, as well as any individual who wishes to learn, to share the benefits of good practices.

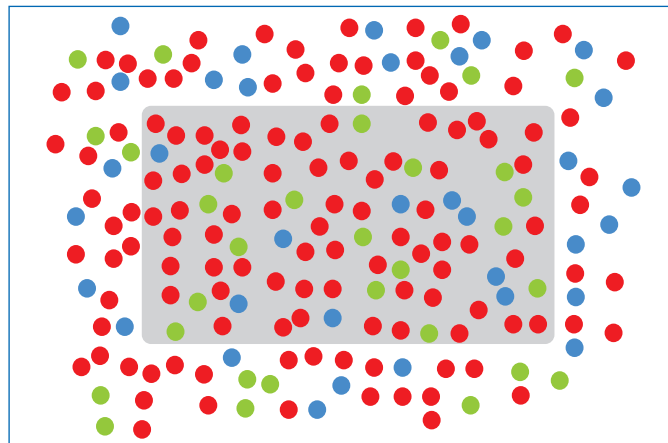
The following illustrations depict the opportunities offered by LO repositories to build directed or self-directed training pathways of different levels of complexity in the modalities of face-to-face, distance or blended training (Freire, 2011).

A repository of independent and catalogued digital learning objects



This shows a repository which is restricted to an institutional setting. However, the current trend is to create repository networks (LACLO, 2011) so that an LO developed within an institution can be nourished by other repositories or by those available on the Internet. It means that it is possible for an institution to have access to its own content, as well as to content produced by third parties (Ministry of Education of Brazil, n.d.).

Open repository synchronized with other repositories or Internet objects



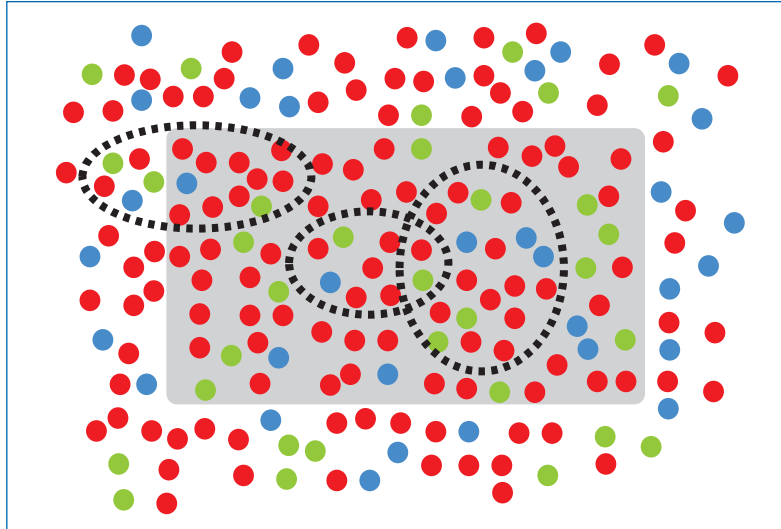
This illustration depicts an open repository synchronized with other sources of educational information.

This integration implies, among other things, that when managing the repository the following aspects should be borne in mind:

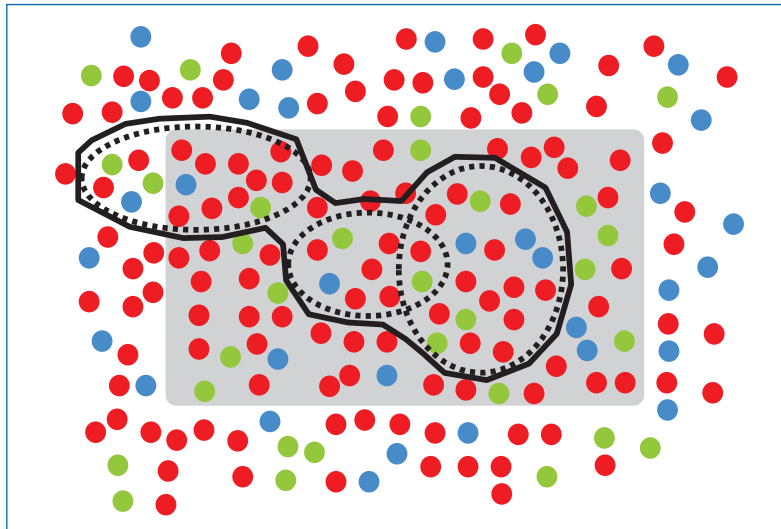
- national and international standards (Alarcón, n.d.);
- interoperable elements in order to connect a critical mass of LOs hosted in repositories in other institutions and other countries;
- the management and business models of other repositories (Alarcón, et al., n.d.);
- content administration through follow-up of an LO's creation and publication flow, version control and storage functions, authorship tools;
- administration of and compliance with digital copyrights;
- Metadata compatibility, object taxonomy, navigation systems, etc.

In each of these cases (centralized and open or distributed repository) self-learning processes can be generated, particularly when users have the necessary skills to use digital objects and are able to choose the LOs that satisfy their needs and interests.

The following illustration shows how users (teachers or students) can choose LO groups according to the new capabilities they wish to develop.



Facilitators provide counselling to individuals or small groups of students, guiding and suggesting self-learning pathways by means of a logical sequence of LO assembly depending on individual and/or collective learning needs.



At the same time, teachers can link up LOs in order to create learning situations that are conducive to the development of specific skills in a training programme.

In sum, a set of LOs can be conceived as a toolkit stored in a repository with the purpose of being used by all those who wish to facilitate individual and collective learning.

User-selected LOs

In training, LOs are more valuable when they are incorporated into a variety of curricular proposals and TL methodologies. This is particularly true when users have a clear idea of *how to select the LOs* to which they have access, and how to use and reuse these resources, adapting and/or combining them in directed or self-directed learning pathways.

In the case of free repositories, users search for and select LOs according to the information provided by the metadata, relating it to their own interests and needs. Thus, users build their own learning processes.

When selecting an LO, teachers analyse and evaluate resources in order to incorporate them into the TL process.

Different authors agree in pointing out certain aspects of the selection of resources for conventional learning, among which they underscore those that apply to LOs specifically; a facilitator's purpose when teaching certain content, to whom it is addressed and the characteristics of the LO (Ministry of Education of Colombia, n.d.):

- The learning objective: *what for* – this refers to competencies or competency components that participants need to develop; that is, what should they be capable of doing after using the LOs successfully?
- The competency-based content to be developed/updated.
- Participant characteristics: considering *for whom*, implies thinking about the needs, interests, learning styles and existing skills of participants in the learning process.
- Functional characteristics and level of interactivity required for learning, in view of the teaching strategies planned.

Other aspects involved in the selection are related to conditions for choosing LOs in a specific context:

- The facilitator's preferences and abilities.
- The training modality in which the LO is to be used (face-to-face, online, blended, and their conditions).
- LO accessibility and whether any cost is involved for teachers or students.

On the basis of all these aspects, it is possible to establish criteria and assign them a certain value (Vidal, Segura and Prieto, 2007). For example:

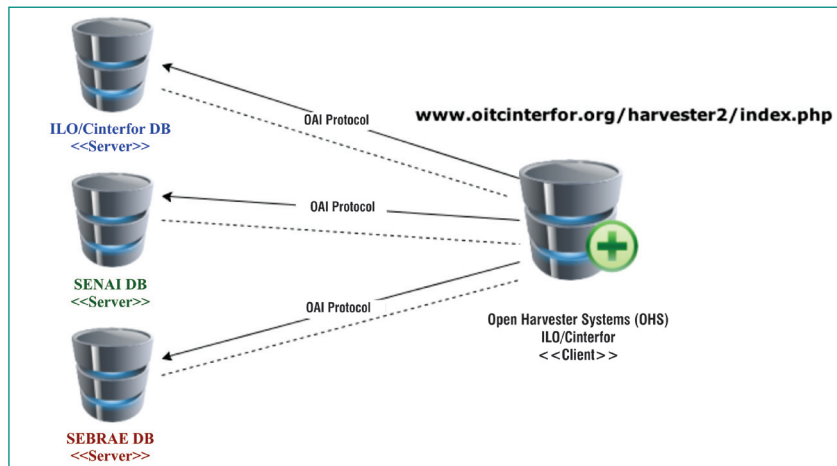
Aspects	Criteria	Value (in %)
Objectives / Competencies	Faithful representation of the competency subject.	
	LO's educational coherence regarding the learning objective: the information specified in the metadata should be coherent with the facilitator's objective.	
	Visual, textual, audio, etc. media and resources should be relevant to the learning objectives.	
Content / Competencies	Content sufficiency and currency: the LO's content should be sufficient to achieve its objectives. The object in itself makes it possible to achieve the learning objective; that is, it contains all the necessary elements to guide the learning process and the content sequence enables the achievement of the competency. Content should be up-to-date.	
	If necessary, the LO should include references or provide access to complementary information to enhance understanding of its content and the achievement of learning objectives.	
Participant characteristics	Information presentation should be motivating for participants.	
	Level of ease with which objects can be handled. For example, in the case of digital LOs, are labels, buttons, menus, texts and general distribution of the interface consistent and visually intuitive?	
	LO language and content should bear gender equality and cultural differences in mind.	
Functional characteristics and interactive level	Experimentation and feedback capacity. For example, in digital or non-digital LOs, is there room for reflection and action? Does the resource provide answers to problems posed?	
	The interactive level should foster collaborative work.	
	The possibility to be combine with other curricular activities.	

Finally, how LOs are used depends on the learning concept that guides educational practice and, therefore, on the greater or lesser weight of the teacher and student roles in training situations. In any case, the intention is to achieve a change in individuals' job performance, which implies applying what they have learnt to real situations.



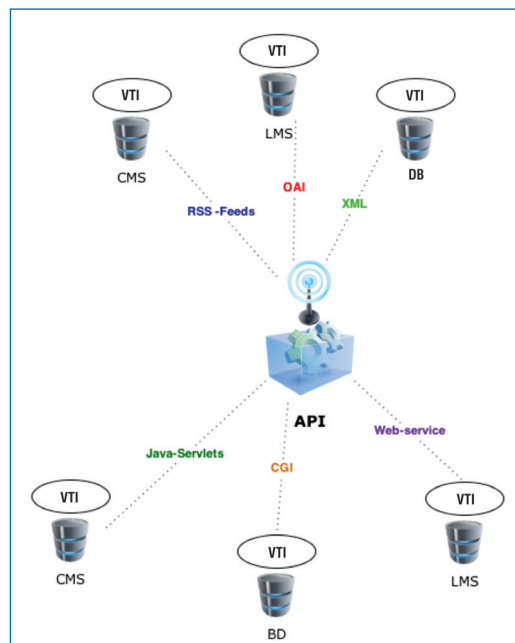
Collaborative work to design an LO search engine

In 2012, and together with several VTIs, ILO/Cinterfor began an LO knowledge management process of which this paper is an output. At the first meeting held in Rio de Janeiro, Brazil (December 2012), it was agreed to design a software tool that would make it possible to disseminate and share LOs between VTI network members.



The implementation of a “central metadata repository” for LOs makes it easier to set up a consultation interface on the portals of ILO/Cinterfor network members and thus take advantage of LOs available in all participating repositories. This service is in line with ILO/Cinterfor’s¹³ target of providing a knowledge management platform, with the purpose of enabling access to and the collective generation of knowledge.

Piloto project



¹³ www.oitcinterfor.org

In the context of the project “Research and development of ICT-based training methodologies for MSMEs”¹⁴, SENAI and ILO/Cinterfor used the OAI-PMH protocol (Open Archives Initiative Protocol for Metadata Harvesting) and the Dublin Core standard (see section 6) to establish communication between its databases.

On the basis of this experience and bearing in mind the technological context of SENAI, SEBRAE and ILO/Cinterfor, it was agreed to adopt a federated exploitation model for educational resources. This model endows the portals of these VTIs with the technical and methodological capacity to display the metadata associated with their resources, while respecting the diversity of technological solutions in each institution¹⁵.

Collaborative work has shown that this technological solution is feasible to share the LOs available on the network. When this tool was analysed at the 2nd Meeting in Santiago, Chile (April 2013), the VTIs attending expressed their interest in joining the initiative.

Moving forward, the technological convergence of the network’s VTIs towards content management systems (CMS) will increase their interoperable possibilities.

Moving on...

Challenges emerge in the use of LOs and repositories:

Facilitators require training in order to use LO repositories effectively and efficiently.

- ◆ The repository catalogue or menu enables facilitators to select an LO suited to their curricular objectives, exploring and taking advantage of its potential for reuse.
- ◆ In order to select and organize their own learning pathways, users require LOs to display full and specific metadata so that they can relate them to their interests and needs.
- ◆ The implementation of complementary methodological strategies (such as face-to-face collaborative activities, or the inclusion of asynchronous discussion fora in distance sharing) promotes interaction between participants and LOs.
- ◆ LO features such as reusability, generativity and scalability are apparent and put into practice in the frequent building of directed or self-directed learning pathways.
- ◆ Synchronized work between stakeholders involved in producing and using LOs facilitates following up on their application, evaluation and quality maintenance.
- ◆ Each VTI establishes its access requirements for its institutional repository. Access to interinstitutional repository networks is determined – according to international standards – by agreement protocols in which articles are usually included regarding licensing rights, authorship, references, etc.

¹⁴ www.oitcinterfor.org/node/2331

¹⁵ www.oitcinterfor.org/harvester2

The quality of LOs

Like many other aspects of the training process, the matter of the quality of learning objects has been widely debated in recent years (Sarasa and Doderó, 2004; Mauri et al. 2005, Vidal et al., 2008, and Cervera et al., 2009, Menéndez-Domínguez et al., 2012).

By LO quality is understood the level to which an LO's several characteristics comply with the agreed standards, and satisfy the needs of its users and its previously established skill development purposes.

LO quality assessment is an important aspect that influences LO design, use and the value they add to instruction processes and learning support (Vidal, Segura and Prieto, et al., 2008).

There are many different factors to consider when evaluating LO quality. Quality evaluation should cover the whole range from the product itself and its creation process to its application and use (Jayanthi et. al, 2008 and Menéndez-Domínguez et al., 2012).

With regard to the product, the characteristics and attributes of a quality LO should be established, in order to determine the standards to be used. Some of the most significant aspects in this regard are content, structure and design.

With regard to the production process, some criteria to be considered are the role of the authors and other participants, organization and coordination, as well as efficiency.

Lastly, and perhaps most importantly, the criteria of application, usability and management should be considered. Thus, with regard to application, LO quality is a twofold factor of influence:

- in selecting it to be incorporated in the TL process and, as a result to exploit its characteristic reusability potential; and,
- in the learning results that participants can obtain by using an LO and their opinion regarding its use in learning.

In this context, trainers can react in different ways to LOs: in some cases they may resist looking for and applying them, as they may be unaware of the potential of these TL resources. Their negative stance may also be due to not having been involved in the LO production and evaluation process; not having assimilated the means of using these tools, and lacking confidence in their quality and impact on learning outcomes. In this regard, it is no accident that it is stated that *"one of the principal barriers to the adoption of LOs by trainers is their perception of a lack of quality or quality variations, and the time it takes to locate and evaluate LOs for instructional use"* (Christiansen and Anderson, 2004).

In addition, the lack of information about the impact of LO use on participants may be attributed to the absence of agreement on the standard or standards to be applied to measure the effectiveness of these resources in TL processes.

It is a fact that specifying existing standards makes it possible to share LOs which, because of their accessible and interoperable features, can be reused. In fact, standards are appropriate to:

- perform quality control;
- identify strengths, weaknesses and issues that need to be improved;
- promote reuse based on the dissemination of quality assessment results.
- increase application by trainers; and,
- learn about how effective they were for training.

However, standards do not necessarily guarantee content quality, or the potential of LOs to synchronize with other LOs and respond to the different needs of users.

There are different standards and tools to assess the multiple factors that intervene in LO production and application. These standards vary, among other aspects, according to the breadth of the evaluation and to quality management procedures (Kay et al., 2007 and Menéndez-Domínguez et al., 2012).

Dimensions of LO quality

Considering that LOs are defined as “*a digital or non-digital resource, which is independent and reusable, preferably interactive, produced for learning and to contribute to the development of competencies,*” it is very important to assess all of the components of this concept. The dimensions of process, product and usability address these elements.

- **Process:** seeks to establish an LO’s contribution to skill development; that is, its impact on the TL process in order to obtain an optimum level of competency. Two aspects should be noted with regard to an LO’s impact: in the first place, accounts regarding its use, including context, participant handling and effectiveness in learning achievement. Secondly, a more objective evaluation, by means of pre-established criteria leading to a measurement of the effectiveness of the TL process. To this end the opinion of facilitators as well as participants should be gathered, by means of closed evaluation guidelines, such as rating scales.
- **Product:** this refers basically to the LO as a facilitating element of the TL process, whose principal aim is to achieve learning. It seeks to include elements related to its educational purpose and content specific to the work area (field) which it is targeting. An attempt should therefore be made to discover to what extent an LO is aligned with its associated competencies, on the part of both the field it is working in and the methodologies used to achieve its purpose.

- **Usability:** this basically includes the attributes that determine, to a large extent, an LO's capacity to be used in one or more contexts. Some of these attributes are: reusability, generativity, flexibility, granularity, scalability, accessibility, structure, currency, interoperability (access, architecture, metadata, interactivity).

LO quality standards

According to Casassus (1997), standards are understood to be:

“Reference constructions (theoretical constructs) that are useful to us in order to perform activities in a specific setting. (...) they consist of systematized and available information that provides us with a feeling of security in our daily lives, inasmuch as we are confident that what we expect will happen, will, in fact, occur.”

In addition, ISO¹⁶ defines an international standard as *“a tool that enables the development of a harmonious, stable and globally recognized framework of reference for technologies, better practices and agreements in support of the general growth of the Information Society and more equitable development”* (Bryden, 2003).

Therefore, the purpose in this context of establishing LO quality standards is related to the possibility of achieving a common framework of reference. It can be stated that the existence of standards makes it possible to establish general criteria regarding what an LO is expected to be in order to facilitate its use in different learning environments. This makes it easier for the community working with LOs to have clear parameters regarding quality, as well as a clear idea of what work can be done with LOs.

Internationally, several projects have produced quality criteria or standards with which to assess LOs, their potential as a TL tool and their ease of use. Among these, some of the most widely-referenced models, which respond to the dimensions described in the previous point, are:

LORI¹⁷: this is a tool which can be used to evaluate an LO individually and can be complemented by a collaborative evaluation. It is based on nine criteria, each with its own specifications to which the evaluator assigns a value, by means of a rating scale, where five is the highest number of points. The purpose of the instrument is to obtain an assessment by specialists in the field.

¹⁶ International Organization for Standardization.

¹⁷ LORI: Learning Object Rating Instrument.

Learning Objects (LO)

The criteria are:

	Criteria	Specifications
1	Quality of content	Veracity, accuracy, balanced presentation of ideas, and appropriate level of detail.
2	Learning goal alignment	Alignment between targeted competencies and learning goals, activities, assessments, and learner characteristics.
3	Feedback and adaptation	User response according to each student's performance and learning style and context-appropriate content.
4	Motivation	Capacity to stimulate interest in a group of students.
5	Design and presentation	The audiovisual scheme enhances information processing.
6	Interaction usability	Ease of navigation, intuitive user interface and the quality of help features.
7	Accessibility	Controls and information presentation are suitable for learners with disabilities on any device.
8	Reusability	Potential for use in different courses, learning contexts or scenarios.
9	Standards compliance	Adherence to national and international standards and specifications.

This instrument makes it possible to address the three dimensions, as indicated in the following table:

LO quality dimensions	Criteria
Product	Quality of content
	Learning goal alignment
	Motivation
	Design and presentation
Process	Feedback and adaptation
Usability	Interaction usability
	Accessibility
	Reusability
	Standards compliance

The following is an adaptation of a self-assessment instrument applied in a case study at university level (Morales et al., 2008):

EVALUATION CATEGORIES AND CRITERIA		RATING
Psycho-pedagogical aspects		
Motivation	I remained interested during the course of the lesson.	
Difficulty	The level was suited to my prior knowledge.	
Participation	My intervention in the lesson was clearly explained.	
Curricular and teaching aspects		
Description	The explanation of the subject was satisfactory (summary, introduction, etc.).	
Objectives	I achieved the objectives suggested for the lesson.	
Content	Subjects addressed were coherent (appropriate to objectives, references, etc.).	
Activities	Were clear and meaningful.	
Time	Length was adequate to achieve the objective.	
Feedback	I was given feedback through fora, activities, interaction and other means.	
Technical and operational aspects		
Interaction	Adequate to achieve objectives.	
Navigation	Appropriate, intuitive, easily accessed and with links providing guidance.	
Design	Clear and intuitive with the use of various colours, font sizes, diagrams and drawings.	

MERLOT¹⁸: a free and open digital resource repository developed by higher education institutions, professional associations and enterprises, led by California State University. One of its goals is “to develop and apply evaluation standards for its peer reviews of the learning resources in its catalogue” (MERLOT, n.d.). The quality of the LOs published and stored in this repository is assessed on the basis of criteria agreed by members of the community. While they refer to digital resources, the standards they use can be applied to all LOs, digital or not.

LOs are submitted to peer reviews, with the purpose of selecting new material to upload to MERLOT, review existing material and determine the requirements for the development of new material.

¹⁸ MERLOT: Multimedia Educational Resources for Learning and Online Teaching.

Learning Objects (LO)

Evaluation is based on three criteria:

	Criteria	Specifications
1	Quality of Content	Content should be meaningful in terms of the core curriculum (or study/qualification/training programme), its difficulty regarding the TL process and its relationship to other content.
2	Ease of Use	The basic question is how easy is it for teachers and students to use the LO, particularly for the first time.
3	Potential Effectiveness ¹⁹ as a Teaching-Learning Tool	This refers to the assessment of the educational capacity of the materials, including their interactivity and clarity regarding learning objectives, as well as what it is hoped to achieve after using these materials. The importance of context is particularly noted, including the learning process stage at which it should be used, as well as student profiles.

Each of these criteria is rated according to a range (between 1 and 5 stars) where 5 indicates the highest quality. Evaluation should produce an average of 3 stars for the content to be published and made accessible to users.

This tool covers the following dimensions:

LO quality dimensions	Criteria
Product	Quality of Content
Process	Ease of Use
	Potential Effectiveness as a Teaching-Learning Tool

CLOE²⁰: this is a system for the cooperative exchange of LOs among universities and schools in Ontario, Canada. LO repositories form the basis for the development, exchange and reuse of multimedia learning resources produced and shared by institutions (Educause, n.d.).

SCORM²¹: this is a widely used model, because it makes it easy to share content across platforms or teaching environments.

¹⁹ Establishing a tool's true effectiveness in the TL process is not a simple matter, as it is necessary to obtain information at the very moment that the resource is being used by participants. However, a tool's effectiveness can be potentially assessed by specialists, who can determine whether the resource will help to improve the TL process.

²⁰ CLOE: Co-operative Learning Object Exchange.

²¹ SCORM: Sharable Content Object Reference Model. Technical inter-operational specifications. Available from: <http://www.scormsoft.com/scorm;LOM> (Learning Object Metadata).

SCORM's²² objective is to establish a baseline standard for the creation of structured training content objects, which feature accessibility, interoperability, reusability, adaptability and durability:

	Components	Description
1	Content Aggregation Model	Ensures coherence in format and series of procedures with regard to storage, identification, conditions for content exchange and recovery.
2	Run-Time Environment	Describes implementation requirements for learning management systems.
3	Sequencing and Navigation	Enables the dynamic presentation of content.

Complementary to SCORM, some organizations developed technical specifications (JCA Solutions, n.d.) and other, design-related specifications (IMS Global Learning Consortium, n.d.) with the purpose of compiling guides to the principal elements to consider in LO production.

It may be inferred that SCORM responds particularly well to the LO's usability dimension, as it enables the assessment of accessibility, reusability, metadata, architecture, flexibility and interoperability.

LOM²³: a multi-part standard developed by IEEE²⁴ (2002), which aims to enable learners, instructors, or automated software to search, evaluate, acquire, and utilize LOs. It specifies a conceptual data scheme and defines the structure of a metadata instance.

DublinCore (DCMI)²⁵: its goal is to provide descriptions and the identification of resources by means of metadata, their maintenance and management; to which end it establishes classification categories that strengthen resource interoperability and help to search for information.

These metadata are widely used in repositories and web platforms. As a quality standard, the DCMI enables easy access to LO repositories, and addresses the usability attribute, making it possible to recover LOs (Dublin Core Metadata Initiative, n.d. 1 and n.d.2).

While all of these standards cover three LO quality dimensions, it is always possible to develop further standards in order to address the job skill-based training rationale, according to which the product should incorporate quality patterns that respond to the educational purpose, in keeping with the needs of participants and facilitators.

²² The standard originated in the work conducted at the Open University of the Netherlands (OUNL), in which a balance was sought between the languages used by different educational approaches.

²³ LOM: Learning Objects Metadata.

²⁴ IEEE: Institute of Electrical and Electronics Engineers.

²⁵ Dublin Core Metadata Initiative (DCMI)



Characteristics of LO repositories

Products and services are increasingly subject to standards and LO repositories are no exception to this trend.

An LO repository is a large collection structured in the form of a database or bank with associated metadata and which can usually be searched through web-based environments (García, 2005).

Most of the research indicates that it is a technological tool to interact with, share and reuse LOs hosted in databases.

A repository should have a form of classification, or metadata, to facilitate indexation of objects available on the Internet. Its architecture is described as “...*the art and science of structuring and organizing information environments to help people effectively fulfil their information needs... ..organization involves the structure, grouping and labelling of site content.*” (Toub, 2000).

Good quality repositories should display at least the following features:

- **Usability** implies that something is easy to use and may originate in the term *user friendly*, which it replaces in view of its vague and subjective connotations.

ISO defines usability as “*The effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments.*”

In the case of LOs, it is suggested that usability be understood as “*a quality attribute that assesses how easy user interfaces are to use*” (Nielsen, 1993).

- **Accessibility** is reflected in how easily potential users can access content, including disabled persons, or persons with technologically-based limitations (Hassan and Martin, 2003).
- **Integration** is the capacity to combine with other content, making it possible to share LOs by means of a protocol that facilitates collaborative work.

LO repository quality standards

The increase in the exchange of data and information is possible thanks to a variety of initiatives, one of which is Open Access²⁶. In this environment, for usability, accessibility and integration to occur, it is necessary for repositories to comply with standards that facilitate exchange, migration and the assembly of LOs located on different platforms²⁷.

²⁶ “Open Access” initiative promoted by the Open Archives Initiative (OAI), which fosters projects based on open access (open and free) through the Internet to studies published by the scientific community, as well as their use and distribution, while respecting intellectual property laws and rights.

²⁷ Further information on metadata standards Available from: <http://ltsc.ieee.org/wg12/>.

Assessment criteria have been developed in order to describe contents and evaluate the use and impact of repositories. *Ranking web*, for example, is a sorting system that links several criteria and uses webometrics²⁸ to classify academic and thematic repositories²⁹.

Repositories have reached a critical mass; however, statistics are needed to show who uses them, in what environment and what outcomes are achieved by LOs in skills development.

Moving on...

The quality of LO repositories is a challenge for competency-based training and several points should be borne in mind:

- ◆ Statistics on the use, sorting criteria and impact evaluation of LOs available in repositories.
- ◆ Sharing repository organization experiences leading to exchange, improvement and adaptation.
- ◆ Establishing protocols to facilitate interoperability.

²⁸ An emerging field in which a quantitative analysis of the Internet and network content is carried out, particularly when related to the process of generating and academically communicating scientific knowledge.

²⁹ http://www.webometrics.info/en/About_Us A "Ranking Web of Repositories" is available through an initiative of the Cybermetrics Lab of Spain's Higher Council for Scientific Research (CSIC for its acronym in Spanish): <http://repositories.webometrics.info/>.

Appendix 1

Participants in the LO knowledge management process

The people and institutions below contributed their knowledge and efforts to this collaborative task, through their various agencies:

VTIs that answered the survey

- 1) Instituto Nacional de Educación Tecnológica – *INET*/Argentina
- 2) Fundación UOCRA para la educación de los trabajadores constructores/Argentina
- 3) Ministerio de Trabajo, Empleo y Seguridad Social – MTEySS – Secretaría de Empleo /Argentina
- 4) Unión de Trabajadores del Turismo, Hoteleros y Gastronómicos de la República Argentina – UTHGRA/Argentina
- 5) Instituto Nacional de Formación y Capacitación Laboral – Fundación INFOCAL/Bolivia
- 6) Centro Paula Souza - ETEC, FATEC – CEETPS/Brazil
- 7) Serviço Brasileiro de Apoio às Micro e Pequenas Empresas – SEBRAE/Brazil
- 8) Serviço Nacional de Aprendizagem Comercial – SENAC/Brazil
- 9) Serviço Nacional de Aprendizagem Industrial – SENAI/Brazil
- 10) Serviço Nacional de Aprendizagem Rural – SENAR/Brazil
- 11) Centro de Formación Técnica de la Universidad Católica de Chile - DuocUC/Chile
- 12) Comisión Sistema Nacional de Certificación de Competencias Laborales – Chilevalora/Chile
- 13) Sociedad Nacional de Agricultura – SNA Educa/Chile
- 14) Servicio Nacional de Aprendizaje – SENA/Colombia
- 15) Instituto Nacional de Aprendizaje – INA/Costa Rica
- 16) Ministerio de Trabajo y Previsión Social –STPS/El Salvador
- 17) Instituto Técnico de Capacitación y Productividad – INTECAP/Guatemala
- 18) Instituto Nacional de Formación Profesional – INFOP/Honduras

Learning Objects (LO)

- 19) Secretaría del Trabajo y Previsión Social – STPS/Mexico
- 20) Consejo Nacional de Normalización y Certificación de Competencias Laborales - CONOCER/Mexico
- 21) Corporativo de empresas - ICAM Group/Mexico
- 22) Servicio Nacional de Adiestramiento en Trabajo Industrial – SENATI/Peru
- 23) Cidec - Innovación y Desarrollo Social/Spain
- 24) Fundación CTIC - Sociedad de la Información/Spain
- 25) Servicio Público de Empleo Estatal –SEPE/Spain

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Institutions that attended the face-to-face meetings Rio de Janeiro, Brazil (December 2012) and Santiago, Chile (April 2013)

- 1) Ministerio de Trabajo, Empleo y Seguridad Social – MTEySS – Secretaría de Empleo/Argentina
- 2) Serviço Brasileiro de Apoio às Micro e Pequenas Empresas – SEBRAE/Brazil
- 3) Serviço Nacional de Aprendizagem Comercial – SENAC/Brazil
- 4) Serviço Nacional de Aprendizagem Industrial – SENAI/Brazil
- 5) Serviço Nacional de Aprendizagem Rural – SENAR/Brazil
- 6) Centro de Formación Técnica de la Universidad Católica de Chile – DuocUC/Chile
- 7) Servicio Nacional de Aprendizaje – SENA/Colombia
- 8) Instituto Nacional de Aprendizaje – INA/Costa Rica
- 9) Instituto Técnico de Capacitación y Productividad – INTECAP /Guatemala
- 10) Fundación CTIC - Sociedad de la Información/Spain

Appendix 2

Differences between LOs and other educational resources

Instruction Sheets and LOs – common and different features

- Common:
 - ✓ content is divided and classified
 - ✓ minimum or reduced extension
- Different:
 - ✓ used as a reference for production
 - ✓ TL concept:
 - teaching by showing and repeating
 - learning by building knowledge through reflection, experimentation, interaction, problem-solving, etc.

Instruction Sheets	LOs
<i>Reference point: an operation considered to be the basic teaching unit representing the least part that should be taught separately.</i>	<i>Reference point: competency components for which learning units are generated (Miller, et al. 2004); usually of reduced length.</i>

Modules and LOs – common and different features

- Common:
 - ✓ produced with a specific teaching purpose.
 - ✓ content and access to content are independent.
 - ✓ content can be assembled/combined, leading to different pathways in keeping with users' interests and needs.
 - ✓ content can be reused in different environments.
- Different:
 - ✓ used as a reference for production.
 - ✓ LOs are less complex and content is less extended.
 - ✓ sequence:
 - predetermined, in the case of modules;
 - constructed, in the case of LOs.
 - ✓ learning:
 - guided in modules;
 - open to knowledge development (knowing, knowing how, knowing how with others, knowing how to be and behave and wanting to do something), in the case of LOs.

Modules (1980s – 1990s)	LOs
<p><i>Reference point: occupations or families of occupations “In the modular system, the educational design organizes a set of tasks that must be learnt progressively. These tasks are grouped into occupational modules that incorporate the amount of training needed to move from one skill level to another within a specific occupation, and that may be common to various occupations within a family or specific to a single occupation” (ILO/Cinterfor, et al., 1990).</i></p>	<p><i>Reference point: competencies</i> <i>Content granularity: micro-information and/or micro-applications selected or produced with an educational purpose, in order to enable nano-learning situations (Elliott, et al., 2006).</i></p>

International references

In other parts of the world, when digital technology came into use in the early 70s, D. Merrill began to assemble digital resources for training purposes and eventually developed two theories:

- the Component Display Theory (CDT); and
- the Component Design Theory, which focuses on how to design instruction processes for computer-based courses (Crespo, n.d.).

In the early 90s, the Component Display Theory became the Instructional Transaction Theory (ITT), which already included the idea of knowledge objects as core elements of training.

While it is difficult to pinpoint the exact year when it emerged, the consensus seems to be that it was Wayne Hodgins (1992) who coined the term Reusable Learning Object (RLO), as it is usually known. When watching his son at play with his Lego bricks, he realized that this could serve as a metaphor to explain the learning process, defined by training blocks that could easily be combined to build larger and more complex structures or products. This notion was to be put into practice in the development of ICT-based training materials, given the scalability and growth potential of ICTs. Since then, many IT companies adopted the concept and developed it by creating products such as Oracle or Cisco System, among others (e-history, n.d.).

Appendix 3:

LO survey conducted among VTIs



International Labour Office
CINTERFOR

Learning Object (LO) production, use and perspectives in vocational training

This survey should be answered by a qualified informant (or team) in your institution's vocational training area. The purpose of the survey is to gather and share information regarding the status of LO development and progress in the ILO/Cinterfor's VTI network. It is composed of three sections:

1. LO development in your institution
2. LO production and use
3. Perspectives

INSTITUTION: _____ COUNTRY: _____

ANSWERED BY: _____ E-mail: _____

Put an X in the appropriate box or write your answer in directly, using Word.

LO development

In your institution, the concept of LOs

is known and applied	only known	is unknown (go to section 3)
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Are LOs produced in your institution? YES NO

Are LOs produced by others used in your institution? YES NO

If your answer was "yes", give a brief account of your LO providers:

If your VTI works with LOs, since when has it been doing so?

More than 3 years	Between 1 and 3 years	Less than 1 year
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Learning Objects (LO)

LO production and use

The persons responsible for producing LOs in the institution are:

A multidisciplinary team	Facilitators	IT personnel	External consultants	Others (please specify):
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In the production and use of LOs

Teaching material already available in the institution is used	Other teaching material is used	Entirely new LOs are created
--	---------------------------------	------------------------------

The orderly storage of LOs (repository) is:

Based in the institution itself	Belongs to a third party (please specify)	Both alternatives are used (the institution itself and access to other repositories)
---------------------------------	---	--

LOs are used in the following modalities:

Face-to-face	Distance	Blended	None
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Give brief examples of LOs and, if available, their links on the Internet:

Observations and Comments

Perspectives

In your institution, LOs

Are not used and there are no plans to do so	Are not used, but there is interest in doing so	Are used, but expanding their production/use is not a priority	Are used and there is interest in expanding their production/use
--	---	--	--

The institution would be interested in learning more, and sharing experiences on the network, with regard to:

LO production	LO use by facilitators and participants	Repositories and storage and management systems	Competency-based training and LOs
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Other LO-related subjects of interest to the institution:

Appendix 4

Examples of LOs produced by various institutions

VTI/ Organization	LO	Area / Content	Link
Ministry of Labour, Employment and Social Security, Argentina	Videos	Safety and Hygiene: personal protection in forestry when working with agrochemicals and handling food by using the operational methods of confectioners.	http://www.youtube.com/watch?v=WpWcOHTivxM http://www.youtube.com/watch?v=NA8wPnt3hRc
Centro Paula Souza, Brazil	Videos	IT: interactive IT techniques	http://www.cpscetec.com.br/colecaotecnica/
SENAR/Brazil	Booklets	Farming: quality milk production, milking by hand, dairy products: cheese, yoghurt, milk beverages and <i>dulce de leche</i> (milk caramel).	www.canaldoprodutor.com.br/eadsenar
SENA/ Colombia	Virtual LOs	Car industry: basic sensors for an electronic fuel injection system, car transmission systems. Electricity: parameter measurement. Working material: Sharpening design tools. Footwear industry: loafer manufacturing. Occupational health and safety: chemical storage according to the IMCO system Health: pharmaceutical forms, therapeutic groups, dispensing medicine. Entrepreneurship: customer service, financial planning and control, entrepreneurial mentality, export incentives, financial analysis, statement of sources and uses of cash, financial system structure. Mining: iron, copper and aluminium properties, alloys and acquirement. IT: microsoft application programming, digital animation techniques, basic principles of animation movement, handling layers with Flash, Flash functions and tools, etc.	http://distritocapital.sena.edu.co/virtualizacion/ovas.htm
DuocUC, Chile	Guidebooks	Health: physiotherapy, guide to short-wave and microwave, guide to haemorrhaging and first aid. Mechanics: laboratory guide for on-board electronic diagnosis.	http://evc.oitcenterfor.org/mod/folder/view.php?id=974



Learning Objects (LO)

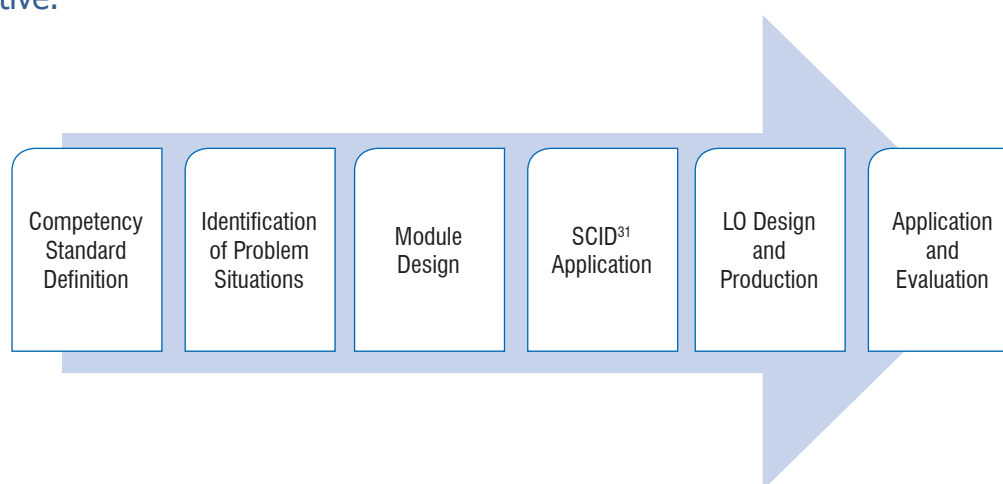
Institution	LO	Area / Content	Link
INA/Costa Rica	Videos, capsules, radio programmes	<p>Organic farming: soil preparation and organic compost; bio-fertilization of fruit for your harvests.</p> <p>Diving activities: diving.</p> <p>Nautical fishing unit: diving suit, burns, fire-fighting, etc.</p> <p>Bricklaying: hollow block masonry for walls, mixing concrete, abutments and reinforcements, etc.</p> <p>Food industry: a radio programme on food handling.</p> <p>Radio play scripts and production: on family and social life; produced by participants.</p> <p>News services: on the INA's gender equality policy, entrepreneurship, tripartism.</p>	<p>http://www.youtube.com/inatvonline</p> <p>http://radioina.com/descargas/podcast</p> <p>http://www.radioina.com/index.php?option=com_content&view=category&id=3&layout=blog&Itemid=45</p>
INTECAP/Guatemala	Website	<p>Applied marketing: marketing basics. Marketing definition, market partition, supply, demand, competition, customers.</p>	<p>http://www.intecap.edu.gt/dt/mercadeoaplicado/Sesion1/</p>
Fundación Tripartita para la Formación en el Empleo/Spain	LOs, videos and capsules	<p>Product store: farming, Graphic Arts, Construction, Leather Industry, Trade, Languages, Industry, Engineering, Bakery, Human Resources, Health and others.</p>	<p>http://www.fundaciontripartita.org/index.asp?MP=57&MS=220&MN=2</p>
Fundación CTIC, Spain	Videos	<p>MSME: the use of technology in enterprises</p>	<p>https://www.youtube.com/playlist?list=PL9395C4CBA892B66D&feature=plcp</p>
ILO/Cinterfor	PPT	<p>MSME: core competencies for MSME entrepreneurs: networking, continuing education, innovation, results-based management.</p>	<p>http://www.oitcinterfor.org/node/4837</p>

Appendix 5

From competency standards to LOs³⁰

Design steps, from competency profile to LOs

The use of specific methodologies are suggestions and in no case to be considered definitive.



A competency standard will be used to illustrate the application of this process: “Driving motor vehicles for tourists”.

³⁰ Example provided by Mauricio Reyes. MRConsultores. 2013.

³¹ SCID: Systematic Curriculum Instructional Design.

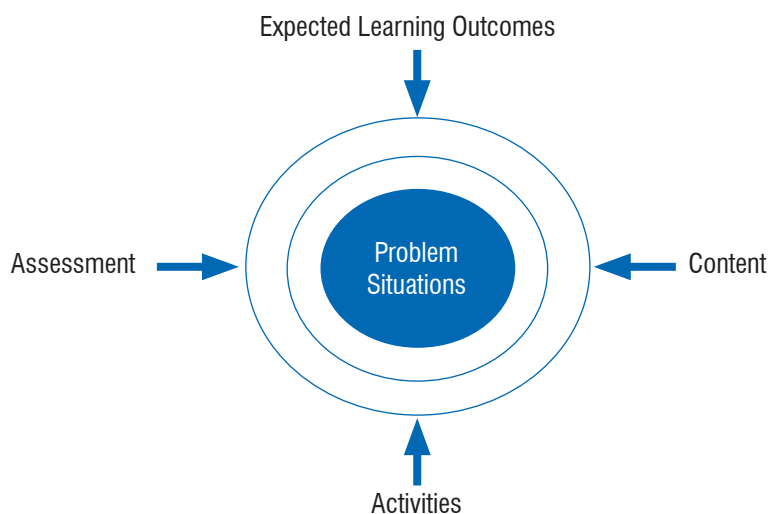
LUC (Labour Unit of Competency) – Driving motor vehicles for tourists – Tourism Sector / Subsector: Tourist Assistance Activities

Occupational Profile: TOURIST TRANSPORT DRIVER

Key Activities:	Performance Criteria:
1. Charging for services	<ol style="list-style-type: none"> 1. The metre is checked at the start of service, following the company procedure. 2. The metre should always be visible to the customer, in keeping with traffic regulations and company procedure. 3. Passengers are informed of rates prior to the journey, in keeping with company procedure. 4. Complementary payment documentation is received and checked according to company procedure. 5. Cash is counted out according to company procedure. 6. Change is displayed and delivered when the transaction is completed to the customer’s satisfaction, according to company procedure.
2. Driving the motor vehicle	<ol style="list-style-type: none"> 1. ... 2. ...
3. Handling accidents, complex situations and special passengers	<ol style="list-style-type: none"> 1. ... 2. ... 3. ...

Module Core

Once the competency standard is determined, it is necessary to identify the problem situations to be faced when the task is performed and which, therefore, mobilize and incorporate competency resources. Identifying these situations leads to a definition of expected learning, content, activities and the evaluation of the training module.



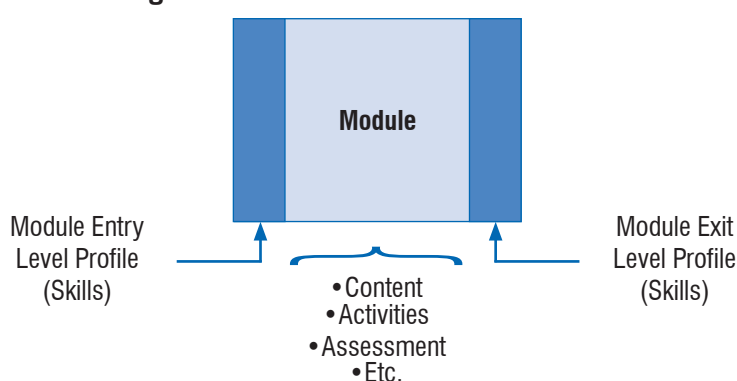
Three problem situations can be identified in the standard’s Key Activity 1, which require appropriate performance, as expressed in the standard’s criteria.

Key Activity: Charging for services:

1. Operating the taximetre.
2. Handling means of payment.
3. Giving information about the service and charging the correct rates.

A competency-based learning module can thus be produced using problem situations, since by responding to these it is possible to ensure the achievement of the learner profile specified by the performance criteria.

Competency-based learning module



As an example of the first key activity in the competency standard, the learning module could be designed as follows.

Learning module

Expected Learning Outcomes	Assessment Criteria
1. Operating a taximeter	<ol style="list-style-type: none"> 1. Describes a taxi metre’s operational components by function. 2. Operates a taxi metre’s operational components according to current procedures and regulations. 3. Solves taxi metre operational problems according to the manufacturer’s handbook.
2. Handling means of payment	<ol style="list-style-type: none"> 1. Recognizes means of payment as used in the market. 2. Performs currency exchange according to current rates.
3. Giving information regarding the service and charging the appropriate rates	<ol style="list-style-type: none"> 1. Carries out the charging for service transaction according to procedures. 2. Indicates rates in accordance with the services provided.

Learning content					
Knowing	<ul style="list-style-type: none"> • Taxi metre: <ul style="list-style-type: none"> - Components. - Name of parts - Functionality - Problems and solutions 	Knowing How	<ul style="list-style-type: none"> • Problems identification • Troubleshooting • Operating components • Basic taxi metre maintenance • Applying regulations • Reading the metre 	Knowing How to Be and Behave	<ul style="list-style-type: none"> • Ethical handling of taxi metre • Service protocol • Careful handling of equipment



Learning Objects (LO)

The next step is applying part of the SCID method (Systematic Curriculum and Instructional Development) as a series of questions posed to discover what skills are required for carrying out the task. These questions are asked of persons with experience in driving tourist transport.

SCID Information Gathering Format

Competency:
Assessment Criteria:
Importance of the competency: expected outcome (efficiency and quality)
Routine to be followed (key parts)
Machinery, equipment, tools to be used
Quality to be achieved
Information to be consulted
Decisions to be made
Contingencies to be resolved
Typical errors to be avoided
Safety and hygiene standards to be fulfilled
Communication to be maintained
Suggested improvements
Attitudes: positive to be displayed and negative to be avoided
Emotions to be handled

The LO can now be produced on the basis of the information compiled. This implies addressing components such as content, methodology and graphic design (if relevant).

LO Design and Production

Three components:

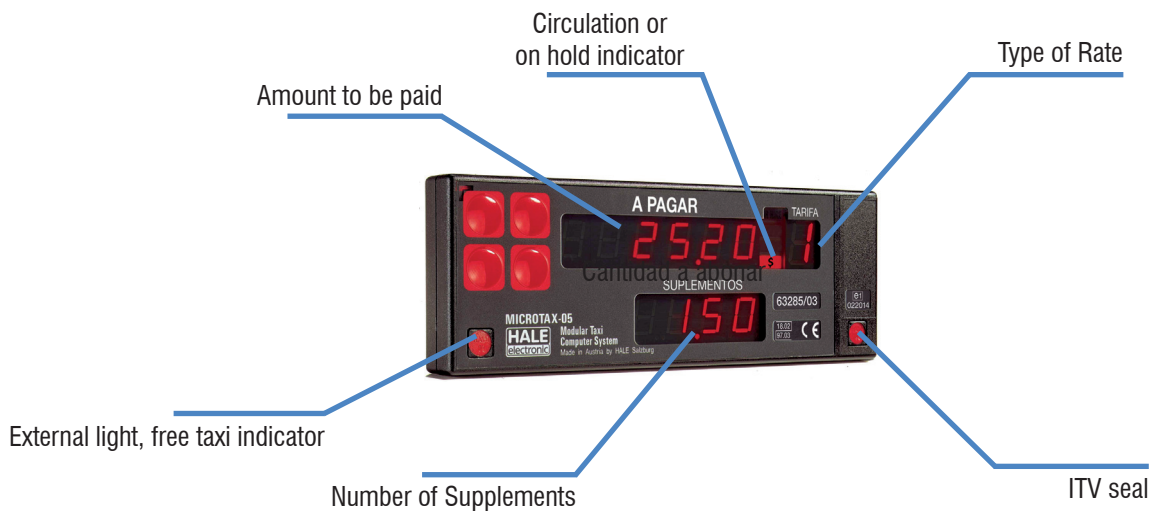
- Content
- Methodology
- Graphic Design

The first expected learning outcome is selected, together with the first assessment criterion. An LO is produced in the form of a working guide, a practical hands-on exercise or a simulation.

Identify the parts of a taxi metre



Answer



Other options

Hands-On Exercise



Simulation



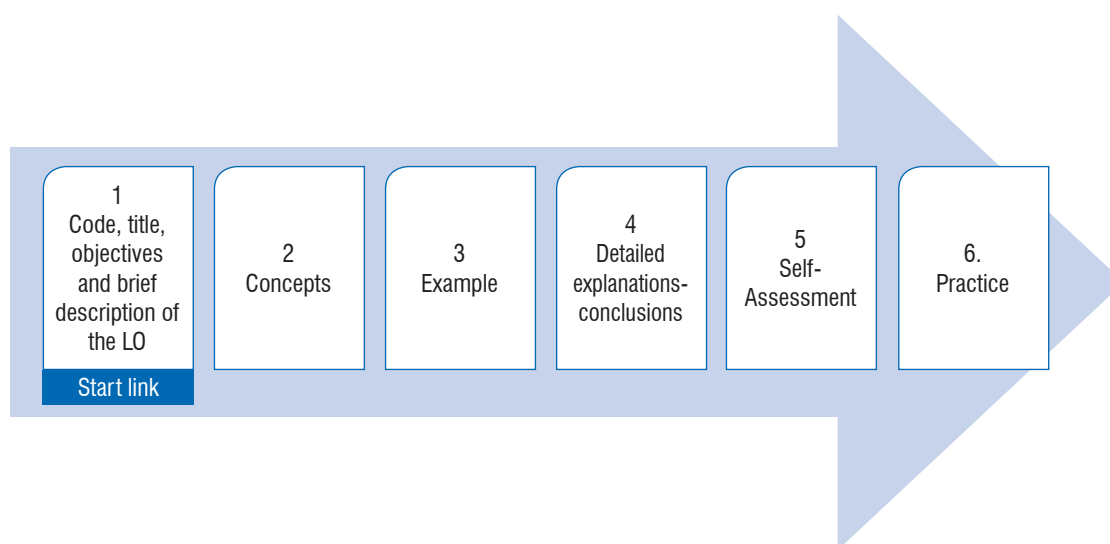
A

Appendix 6

An LO production sequence

Standards constitute a framework to ensure that LOs fulfil the expectations of their producers and, above all, their users. Moreover, they make LOs easy to identify and locate in a repository.

Using standards provides the means to develop content, reducing the time and production costs involved without affecting the creativity of practical and self-assessment activities, nor the independence of an LO. Standards address several aspects, such as interoperability and design³². Section 6 contains further information regarding standards.



First Page

The following shows a pattern that should be maintained in order to ensure that metadata³³ can facilitate the cataloguing and organization of LOs in a repository, thus enabling reuse:

- Type of LO: related to the learning activity it will support.
- Code: the baseline occupational competency and its derivations.

³² Regarding interoperability, see SCORM technical specifications (Shareable Courseware Object Reference Model) <http://www.scormsoft.com/scorm>; regarding design, see specifications at <http://www.imsglobal.org/learningdesign/>

³³ Structured data that provide a short summary of any information resource, printed or electronic, and facilitate locating, identifying or discovering such a resource; see metadata definition standards at: <http://ltsc.ieee.org/wg12/>.

Learning Objects (LO)

- c. Title: this may or may not refer to the occupational competency, but it is essential that it should be motivating.
- d. Objectives: expressed in terms of capacity to acquire specific skills.
- e. Brief description: should refer to the occupational competency to be developed and its field of application.
- f. Authorship: name of producer/s. May also include brief information regarding their job titles.
- g. Date of publication: with a view to providing information on subsequent updates.
- h. Key words: in order to link consultations on a specific subject.
- i. Prerequisites: to maximize the use of content.
- j. For LOs available online, an indication of where to start reading may be included (e.g. a mark, link, etc.).

Concept pages

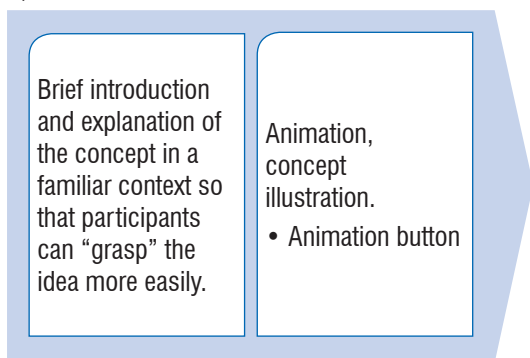
The presentation of concepts is usually preceded by an introduction, which should focus on key points to be addressed. Its length may vary according to the pattern selected in the concept presentation; for example, when cases are introduced, it is enough to refer to or give a brief statement regarding the concepts to be considered.

The **layout of concept pages** is an important aspect to bear in mind when introducing content.

Layout may vary according to the patterns used, but it is suggested that the focus should be on key aspects of content. Use short paragraphs, easily recognizable icons or other devices that may help the user visualize, hear or interact easily when looking for information. There should also be an appropriate and intelligent use of colour.

Possible models for concept presentation may be:

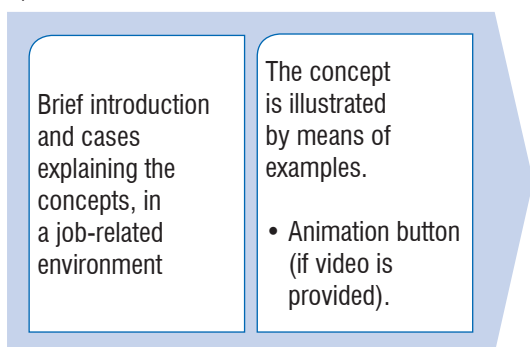
A)



Note that in this model:

- the concept should be addressed in a precise and focused manner.
- a deductive approach is used.
- it is user-oriented.
- the concept ends with a conclusion.
- questions are asked to help pinpoint and contextualize the content.
- the concept may be illustrated by means of a graphic or animated item.

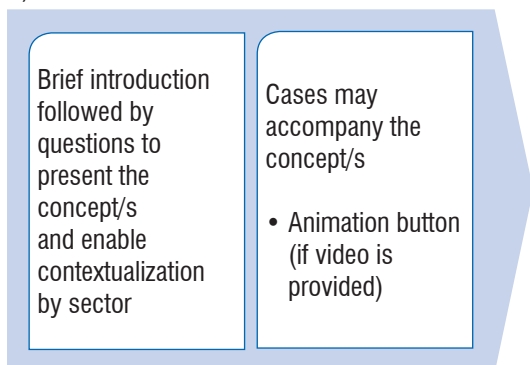
B)



Note that in this model:

- the approach to content presentation is inductive.
- cases help to know how to be and behave, know how with others, problem-solving.
- the concept is described in the introduction.
- cases showcase situations related to the concept.
- questions may be asked in order to help put across the concepts.

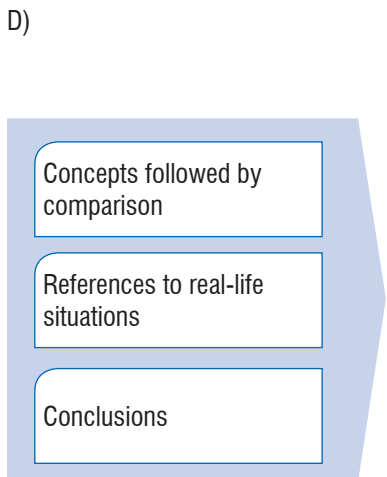
C)



Note that in this model:

- the introduction is preceded by a suitable quotation.
- lists and bullets are excellent ways to briefly indicate key elements and are used in both introduction and questions.
- questions are good triggers, but should be accompanied by cases, examples, and hands-on activities.

D)



Note that in this model:

- there is an introductory purpose, but the term ‘introduction’ is not used.
- a deductive presentation approach is used, from the general to the specific.
- the starting point is an outline, a chart that introduces all of the concepts. Concept maps that provide a general overview of issues to be addressed and their interconnections may be useful. One or more pictures, videos, and other resources may provide a concept presentation.
- blocks with representative headings to display each concept, explained in context, followed by comparisons with other situations and opportunities to practice activities or behaviours.
- concepts are brought to an end with a conclusion.
- self-assessment is included to help learners to assimilate the content, as well as a personal action plan to overcome any difficulties arising in the self-assessment.



Learning Objects (LO)

These models do not constitute an exhaustive list, nor are they mutually exclusive. One LO may include concept pages responding to several different patterns, which may be combined or selected according to the participants' characteristics and learning styles.

Examples

Bearing in mind that LOs target a specific and concrete learning item, it is essential to link them to real work. Examples are key and it is suggested that they be kept brief and accurate.

An example structure:

- Context
- Problem
- Solution

The same structure can be used for other LO pages.

They may be placed at different points of the LO, such as:

- after an explanation, to help illustrate the entire concept;
- interspersed among the content;
- at the beginning, when cases are introduced in the concept pages (examples do not need to appear on a separate page);
- in a hands-on activity, acting as a trigger leading to questions and reflection on the concepts;
- in a self-assessment exercise, to pose and solve problems.

Detailed explanations / Conclusions

The aim of this section is to reinforce and expand on what was conveyed in the concept page or example, by means of charts in order to help contextualize content by creating links to other possible contents and/or applications. Audio or video resources can also be used to provide explanations by experts on the subject.

It is advisable to end the explanation with brief, to-the-point conclusions regarding the points addressed.

Self-Assessment

This activity enables learners to verify and reflect on their own learning processes, while simultaneously producing and collecting evidence. Self-assessment requires bearing in mind the performance criteria described in the competency element. Self-assessment may be interspersed among the content.

A variety of formats may be used (multiple-choice questions, true/false statements, closed questions, problem-solving games, case analysis, action plans, projects, etc.), so long as they lead to the expected outcome.

When self-assessment is followed by feedback from a specialist, it helps users corroborate how close they are to the expected outcome.

Practice

Practice invites users to play a leading role in their learning, identifying challenges and communicating procedures they wish to develop in the area to which they will transfer what they have learned.

To this end, questions should be asked regarding both individual performance and the potential contribution of such performance to the working environment. It is suggested that as the practical component of an LO should be in the nature of a rounding-off activity, it should be placed after the self-assessment exercise.

Practice may also appear as a sequence, throughout the conceptual text or after an example. This sequence is developed by dividing the content into short questions that lead to an immediate reflection on the concept presented. At the end, users should go back to the short questions in order to review or revise their position or pose new challenges or improvements.

Using a sequence creates opportunities to propose collaborative practices that nourish collective knowledge-building and personal development.

Appendix 7

General guidelines for the production of Virtual Learning Objects – VLOs (SENA, Colombia)

Teaching aspects in the production of VLO texts³⁴

Drafting VLO content requires following style and writing guidelines in order to ensure that the language of the objects is easily understood. This means:

Placing main ideas at the beginning of the paragraph
Using simple language and simple-structure sentences (subject + verb + object)
Maintaining the internal coherence of all texts
Using striking titles to attract readers, generate anticipation and motivate learners to read
Writing short paragraphs of no more than five lines
Avoiding the use of long words, and changing them for shorter synonyms
Using a friendly tone
Avoiding the use of all caps and using mixed case whenever possible
Writing passages that hold the reader's attention (inserting breaks to include testimonies, anecdotes, jokes, announcements, highlighting information in boxes, comic strips, etc.), always bearing in mind who the target readers are
Using language that resembles speech or the language used in face-to-face TL interactions

Visual structure

Visual structure is related to information **organization**. Text, images, diagrams and headings must be coherently integrated and follow the same line. Topics and subtopics should follow a hierarchical order. The designer should facilitate the **readability** of the material so that learners can focus on content without being required to decipher presentation formats. This process entails selecting appropriate fonts and colours, and bearing in mind the following recommendations for easy screen reading:

- Use bold type and italics in moderation.
- Line spacing should not be less than 120%.

³⁴ SENA (2102) contributed a number of guidelines to the learning community, for the production of LOs. Available from: <http://evc.oitcinterfor.org/mod/folder/view.php?id=971>.

Learning Objects (LO)

- Paragraphs should be aligned to the left, not right or centre.
- Do not use underlining except for hyperlinks.
- It is advisable to use sans serif fonts such as *Trebuchet*, *Helvetica*, *Arial* and *Verdana*. For titles and headings, serif typefaces may be used, such as *Georgia* or *Times New Roman*.
- Use colour in moderation.

Teaching function

The starting point in the design of an LO is identifying its teaching function. The use of unnecessary pictorial material is not advisable as it may be distracting and make files bulky to download. The regional *Distrito Capital* virtualization team has classified learning objects according to their teaching function as follows:

- **Algorithmic procedures display**; photographic sequences, animations, step-by-step procedures.
- **Non-linear procedures display**; outlines, decision trees, simulations.
- **Explanation of natural or artificial processes**; models, event animations, simulations.
- **Displays that show the passing of time**; timelines, comic strips, tables.
- **Spatial relationships**; maps, sketches, plans.
- **Structures**; organizational charts, concept maps, summary tables.
- **Outcomes and status reports**; interactive statistical charts.

Appendix 8

LO quality assessment

Example of evaluation according to the points scale based on the Learning Object Rating Instrument (LORI) (Otamendi, n.d.).

5 ★★★★★	Content shows no errors, bias or omissions that might confuse students or induce them to error. Statements are based on evidence or logical arguments. Presentations underscore key points and the most significant ideas with an appropriate level of detail. Cultural or ethnic differences are represented fairly.
4 ★★★★	The presentation of the LO is good, but could be improved. Content is exact and sufficient, but the sequence of concepts requires adjustment to facilitate understanding. Content refers to learning objectives. It is possible to interact with the content through links, although some need to be revised as they are not accessible. The language employed in the content is adequate for the students' level of understanding.
3 ★★★	An animation of a heart beating: content is correct, but the omission of significant and relevant information might induce students to error: the animation correctly shows how the blood flows from the right atrium to the right ventricle, and from the left atrium to the right ventricle. The error consists in not showing that the blood emerges from the right ventricle and flows to the lungs, and from the lungs to the left ventricle. Some students, therefore, might be confused and conclude from this animation that blood goes directly from the right ventricle to the left atrium without flowing through the lungs.
2 ★★	Content and presentation require extensive improvement. Information is not sufficient to achieve the objectives and is not relevant to the students' educational level. Content needs to be restructured to incorporate precise concepts and data leading to improved understanding. It is also advisable to include bibliographical references to help students who wish to pursue their studies in further depth.
1 ★	One of the following characteristics makes it impossible to reuse the learning object: <ul style="list-style-type: none"> • Incorrect content. • Omissions or bias in content. • Inadequate level of detail. • Presentations do not reinforce key points or significant ideas. • Information shows bias in representing ethnic groups or cultures.

Evaluation of LO educational and ergonomic dimensions and features

Extract translated and adapted from a research study conducted in a Secretariat of Education school in Minas Gerais, Brazil, published in *Revista Latinoamericana de Tecnología Educativa* (Pereira, n.d.).

In the paper, the authors chose to pinpoint the following three dimensions to evaluate the use of LOs, and described the scope of each:

- *The educational dimension* includes key aspects of the learning process, the definition of concepts and theories on knowledge.
- *The ergonomic dimension* refers to the usability of LOs, their adaptability to anticipated objectives, their navigability and ease of use. That is, their potential to satisfy the needs of their users. To the extent that needs are properly met, it could be inferred that LOs have the capacity to promote faster learning and reduce errors. To achieve this, objects need to be developed with a view to the perceptive and cognitive skills and abilities of their future users.
- *The object characteristics dimension* refers to LOs' basic characteristics of reusability, adaptability, durability, accessibility, granularity and interoperability. In this regard, the technological base of an LO is borne in mind, with software viewed as a learning object and, as such, it is imperative that it should comply with international standards.

The authors emphasize the fact that an association between the ergonomic dimension and standards enables the development of criteria with which to analyse the ergonomic quality of an LO.

A proposal for good learning object management

Extract from a research study conducted by Salamanca University, Spain (Morales, García, Barrón, Berlanga and López, cited in López, *et al.*, 2005). The following steps are recommended in order to standardize entry objects (into the repository) and facilitate the application of quality criteria and measurements:

- **Classify LOs according to their cognitive level:** despite containing one or a few related ideas, LOs may be useful in one context but less so in another. To help resolve this, it is suggested that object goals should be associated with some of the cognitive domain levels of the Bloom taxonomy. Levels are classified as: less complex (knowledge, comprehension and application) and more complex (analysis, synthesis and evaluation). Each of these domains indicates what the student is capable of doing. On this basis, it is possible to define what to teach and how to teach it, thus providing a variety of ways to introduce LO content according to users' needs.

- **Classify objects into three types of content:** data and concepts; procedures and processes; and, finally, reflection and attitudes. The initial learning of content is usually associated with a concept or conceptual framework that includes data and facts. Classifying content as data and concepts targets objects that contain basic information to teach something. Contents of objects classified as procedures and processes are related to the teaching of steps or stages in a certain process, where associated data and concepts need to be considered. The types of content that foster reflection and the adoption of a certain attitude, be it conscious or unconscious, are related to the learning of principles or standards, which in turn are related to Bloom's higher level thinking skills. This classification of objects into these three types of content makes it easier for content writers to handle their instructional design, as they have three possible well-defined classifications for all types of content. Furthermore, this classification makes it possible to select content and adapt it to new educational situations.

Proposed evaluation categories

- **Teaching-curricular category:** this makes it possible to evaluate whether the object is related to curricular objectives according to the context in which it will be applied. It is advisable to conduct an evaluation of objective-related criteria (appropriate formulation, feasibility) as well as content-related criteria (information is accurate, precise, non-discriminatory, topic-structuring, suited to the characteristics of objectives and users). Associated metadata include: *Learning Resource Type, Context, Typical Learning Time* and *Description*.
- **Technical-aesthetic category:** this involves the evaluation of aspects related to object design. Evaluation criteria include appropriate size and duration, which are linked to *Semantic Density* metadata. It should be noted that these criteria are connected to educational category metadata; however, there are other technical-aesthetic aspects, in terms of presentation, that may be evaluated, but are not included in the metadata. Some of these aspects are: legibility, good use of colour, appropriate size and resolution, screen display not overly elaborate, etc. Once the objects are visualized, these evaluations should be included in the information contained in the metadata so that they can guide evaluation when reused in the future.

Other aspects that need to be evaluated are related to LO characteristics, such as, for example, adhering to a certain standard or specification, which also applies to the metadata format (appropriate for automated reading, full and accurate information).

- **Functional category:** the evaluation of how objects function addresses type of interaction (active, lecture-based, combined, undefined), speed, appropriate level of interaction, etc. Associated metadata are *Interactivity Type, Interactivity Level*.

Glossary

Learning Objects (LOs)

Accessibility:	A characteristic that makes LOs easy to identify, seek and find, thanks to labelling by various descriptors (metadata) that enable cataloguing and storing LOs in suitable repositories. If LOs are not accessible, searching for them may lead to loss of motivation and ineffectiveness.
CLOE:	Co-operative Learning Object Exchange. A system for the cooperative exchange of LOs among universities and schools in Ontario, Canada.
Collaboration object:	Developed to facilitate communication in learning environments, with individuals playing an active role.
Competency:	Individual capacity that covers the knowledge, job skills and know-how applied and mastered in a specific context.
Conformity to standards:	Common criteria facilitate integration with other LOs developed by different producers. The lack of standards with which to frame LO development may be risky for both producers and users.
Continuing education:	(Further education; Lifelong learning) This term encompasses all learning activities undertaken throughout life for the development of competencies and qualifications.
Currency:	This refers to an LO's continued usefulness regardless of technology changes, as well as the validity of information without having to resort to new designs.
Curricular design:	A structured series of learning experiences intentionally synchronized in order to produce the desired learning outcomes.
Cybermetrics:	A quantitative analysis of the Internet and network content, particularly when related to the process of generating and academically communicating scientific knowledge. It is a new, emerging field and is also known as webometrics.
Deming Cycle:	A process composed of four phases: plan, do, check, act. LO production is a continuous process, and as such, its desired output is susceptible to improvement; this cycle can, therefore, be put to good use.

Learning Objects (LO)

DublinCore:	Dublin Core Metadata Initiative (DCMI) standard, whose goal is to provide descriptions and the identification of resources by means of metadata, their maintenance and management; to which end it establishes classification categories that empower resource interoperability and help in the search for information.
Employability:	This refers to portable skills and qualifications that enhance an individual's capacity to make use of the education and training opportunities available in order to secure and retain decent work, to progress within the enterprise and between jobs, and to cope with changing technology and labour market conditions.
Evaluation object:	Its function is to assess the status of competencies at a certain stage of the training process.
Flexibility:	This refers to the versatility and elasticity of LOs in combining into different plans focusing on developing skills and fields of knowledge.
Generativity:	LOs' capacity to adapt according to the competencies or group of competencies to be developed, facilitating the generation of ideas and concepts by users. Also understood as the capacity to build content, new objects and be updated and modified, thus increasing their potential through collaboration.
Granularity:	An attribute that refers to content divided and classified into micro information and/or micro applications, selected or produced with an educational purpose, in order to enable nano-learning situations.
Information architecture:	The art and science of organizing areas of information with the purpose of helping users to satisfy their needs. Organizing entails structuring, classifying and labelling content.
Information object:	Any digital resource devoid of any philosophy, or learning or teaching theory.
Integration:	A repository's capacity to combine with others, making it possible to share LOs by means of a protocol that facilitates collaborative work.
Interoperability:	The capacity to be applied in different content and learning management systems.
Learning:	Activities that tend to provide the practical capacity, knowledge and attitudes needed to work in a certain job or group of jobs in any branch of economic activity.

Learning Object:	A digital or non-digital resource, which is independent and reusable, preferably interactive, produced for learning and to contribute to the development of competencies.
LOM:	Learning Object Metadata. A multi-part standard developed by IEEE, which basically aims to enable learners, instructors or automated software to search, evaluate, acquire, and use LOs. It specifies a conceptual data scheme and defines the structure of a metadata instance.
LO process quality:	An LO's contribution to skill development; that is, its impact on the TL process in order to obtain an optimum level of competency.
LO product quality:	The level to which an LO's several characteristics comply with the agreed standards, and satisfy the needs of its users and its previously established skill development purposes.
LO quality dimensions:	These group the principal attributes of an LO and are expressed in terms of process, product and usability.
LORI:	Learning Object Rating Instrument. An individual LO assessment system which may be complemented by collaborative evaluation.
LO standards:	Quality criteria or patterns used to design and assess available LOs, usually internationally. They provide criteria with which to structure data and produce, package and identify a product.
LO taxonomy:	A structure whose purpose is to provide some classification parameters which may be of use in LO design and when producing metadata labelling descriptors, thus facilitating their selection in a repository.
LO usability quality:	An LO's capacity to be used in one or more environments. Some of these attributes are: reusability, generativity, flexibility, granularity, scalability, accessibility, structure, currency and interoperability.
MERLOT:	Multimedia Educational Resources for Learning and Online Teaching. A free and open digital resources repository developed by higher education institutions and members.
Metadata:	Structured data that provide a short summary of any information resource, printed or electronic, and facilitate its classification, location and identification.
Open Access Initiative:	Fosters projects based on open access (open and free) through the Internet to studies published by the scientific community, as well as their use and distribution, while respecting intellectual property laws and rights.

Practice object:	A resource intended for self-learning, with a high level of participant interaction.
Qualification:	The formal expression of the vocational or professional abilities of a worker, which is recognized at international, national or sectoral levels.
Repository:	A collection structured in the form of a database or bank with associated metadata and which can usually be searched through web-based environments.
Repository Accessibility:	This feature is reflected in how easily potential users can access content, including disabled persons, or persons with technologically-based limitations.
Reusability:	An attribute that refers to an LO's capacity to be reused in different situations and learning environments.
Scalability:	The capacity to be incorporated into and synchronized with others of different kinds and extensions. This feature is essential in order to maximize opportunities to combine or assemble LOs.
SCORM:	Sharable Courseware Object Reference Model. Developed by ADL - Advanced Distributed Learning. Its goal is to establish a standard baseline model for the creation of structured training content objects and facilitate sharing them across different educational systems.
Standards:	Constructions (theoretical constructs) that are useful as baseline models or patterns in order to perform activities in a specific setting. They consist of systematized and available information and lead to a sense of security in our daily lives, inasmuch as we are confident that what we expect will happen, will, in fact, occur.
Structure:	The internal logic of information organized in a deductive sequence (on the basis of concepts, examples, practical activities and verification) or an inductive sequence (based on examples leading to concepts and activities).
Teaching object:	Devoted to supporting learning without requiring learners to play an active role.
Training Module:	A set of certain basic technological knowledge and professional practices that make it possible to acquire competencies and offer quantified information, examples, pictures and assessment.
Usability:	A feature that measures the ease with which LOs can be used in one or more web-based environments.

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