# LOCALIZATION AND INTERNATIONALIZATION OF DIGITAL LEARNING RESOURCES

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**Summary:** *The process of localization of the software, and therefore of the digital learning resources, is divided into three parts: the first part is adjusting to the "local environment" (locale), the second part is a translation and adaptation of the user interface and the third part is the translation and adaptation of the documentation. The third part includes the localization of metadata. Metadata contain all relevant information about digital learning resources and therefore they are the most important element in searching and retrieving. The fact is that the discovery of learning resources that have "English" metadata is much easier than in the case of learning objects that have "non-English" metadata. There are two issues identified that generally affecting the search and discovery of the requested data in localized repositories of digital resources: the problem of grammatical rules and the problem of transliteration.*

**Keywords:** *digital learning resources, metadata, localization.*

# LOKALIZACIJA I INTERNACIONALIZACIJA DIGITALNIH RESURSA ZA UČENJE

**Rezime:** *Proces lokalizacije softvera, a samim tim i digitalnih materijala za učenje, podeljen je na tri dela: prvi deo je prilagođavanje "lokalnoj sredini", drugi deo je prevod i adaptacija korisničkog interfejsa, a treći deo je prevod i adaptacija dokumentacije. Treći deo obuhvata lokalizaciju metapodataka. Metapodaci sadrže sve relevantne informacije o digitalnim resursima za učenje i zato su oni najvažniji element u procesu pretraživanja i pronalaženja. Činjenica je da je pronalaženje resursa za učenje koji sadrže "engleske" metapodatatke mnogo lakše nego u slučaju kada su metapodaci "ne-engleski". Postoje dva pitanja koja su identifikovana i koja generalno utiču na pretraživanje i pronalaženje traženih metapodataka u lokalizovanim repozitorijumima digitalnih resursa: problem gramatičkih pravila i problem transliteracije.*

**Ključne reči:** *digitalni resursi za učenje, metapodatak, lokalizacija.*

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## 1. INTRODUCTION

Digital resources i.e. contents for learning are indispensable in the process of teaching. The process of making digital learning resources is long and difficult, resulting in a continuing shortage of quality contents for learning. Because of this, most of the digital resources are adapted to the needs of different curricula and their reusability. This adapting often involves "localization" of digital resources in terms of adaptation to the linguistic and cultural environment. Digital resources - learning contents are known as learning objects and are described with metadata. They are stored in repositories. The paper describes the basic features of digital resources, the procedure for their localization and it gives some ideas about how to resolve the finding of localized digital resources in repositories.

The paper is organized into five parts. The first section describes learning objects as basic digital learning resources, and the second part explains the need for metadata. The third part provides principles for localization and internationalization, and the fourth part explains the procedure and localization problems that can occur. Conclusion and directions for future work are presented in the fifth section.

## 2. LEARNING OBJECTS

There is no single definition of the Learning Objects. We accept David Wiley's definition. According to David Wiley: A Learning Object is any digital resource that can be reused to support learning. He emphasizes that a learning object should be digital and reusable. The size and content of the learning object is associated with reusability, i.e. depends on reusability. Others agree that learning objects are modules or units that should be delivered through or by means of computers, which are independent and that provide a whole learning content in a planned learning. Learning Objects should be independent, i.e. it should be possible to use them independently from other objects and contents, that they should possess at least a minimum amount of information from which something can be learned and that their use is conditioned by computers.
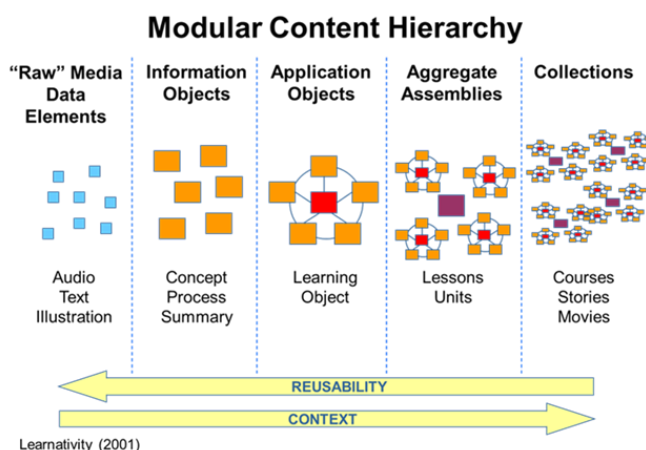


**Figure 1:** *Modular Content Hierarchy*

Generally, regardless of different definitions, learning objects are digital resources, modular in nature and used in the learning process. Their size can vary, they can be applied in different areas and have different levels of granularity. Learning objects can be connected with other learning objects in order to create a greater teaching unit (Figure 1). In relation to learning objects research and development are directed towards their multiple usability and therefore it is obvious that they should be digital resources.

## 3. METADATA

When it comes to learning objects as digital resources it means that they can be, but are not limited only to: texts, simulations, animations, websites, tutorials, tests, multimedia, video clips, sounds, images, illustrations, diagrams, graphs, maps or exams. All digital resources are a huge collection of data, bits and bytes of information. Digital resources are stored in repositories, and are described by metadata.

Metadata is information about an object, either physical or digital. For learning objects metadata represent data about an object. Technically it is the XML scheme used to describe learning objects. The purpose of metadata for learning objects is to support finding learning objects, and thus facilitate their multiple use.

Since most of the learning objects are non-textual (animations, images, video, audio) the locating of learning objects in repositories can be an "impossible task" without metadata. As expected, the number of learning objects in repositories will grow exponentially, and the lack of metadata will be a fundamental and critical limiting factor for the ability to find, discover, manage and use the objects.

To this end Standard for metadata for learning objects IEEE LTSC LOM 1484.12.1-2002 is developed. This standard (LOM) defines the structure of metadata for learning objects, but it does not defined how learning technologies systems represent or use meta-samples, i.e. learning objects. This standard addresses the opportunities for sharing and exchanging learning objects. LOM facilitates sharing and exchange of learning objects by creating conditions for the development of catalogues and lists. Thereto cultural and linguistic differences are taken into account, where objects are used. The objectives of the LOM are to enable students to seek and use learning objects, and to enable them to compile learning objects for each individual student  through automated software processes.
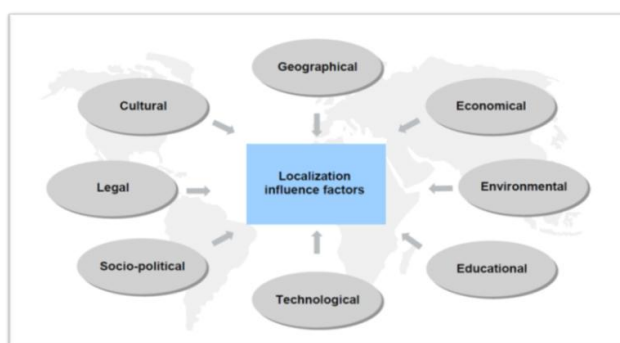
## 4. INTERNATIONALIZATION AND LOCALIZATION

Considering the current trends of globalization, we can generally accept that localization means adapting of products or services in such a way to successfully operate and hold on the market for which the product or service is intended.

In the today's global world, the concept of availability of products or services is an issue that is most important for the functioning of globalization. This is about the availability of products or services of any type, including products and services in the field of education. In terms of ICT, software, operating systems, digital resources and contents are also subject to globalization. Globalization, i.e. availability is ensured through internationalization and localization of products and services.

Depending on the viewpoint, internationalization and localization can be interpreted differently. From an economic point of view internationalization means expanding the market in which economic agents act. Again from an economic aspect, localization can have two meanings depending on context. First it can have a reverse meaning compared to

internationalization, i.e. closing in local frames and limiting the market to a particular region. The second meaning is becoming quite pressing in the era of globalization: localization in economic terms can mean adjusting of the product to a particular country or region.

Due to the great diversity of markets for which products or services need to be localized, a simple translation from one language to another language is not a solution. There are several possible factors affecting localization: geographical, economic, educational, cultural, social, political, legal, technological, other factors of environment, etc.. These factors are graphically shown in Figure 2.



*Figure 2: Possible factors affecting localization*

## 5.  LOCALIZATION OF DIGITAL RESOURCES

The expansion of the Internet greatly influences the rise of the awareness and the need for localization of digital resources. In this sense the term localization is most often used to adapt the software and digital content (such as web sites) to the language and culture of certain ethnic or geographically defined groups. When speaking about learning objects, we mean that they are in a digital form, that they can be software, just as they may well be text documents, videos, presentations, audios, imagse or websites. This means that there is no essential difference between the localization of software and the localization of learning objects and therefore in further text when localization of software is mentioned it is identified with localization of learning objects.

Internationalization is a requirement for localization and implies respect and implementation of international standards and avoidance of contents or symbols that radiate strongly, or are burdened with a distinctive cultural knowledge (knowledge, not meaning).
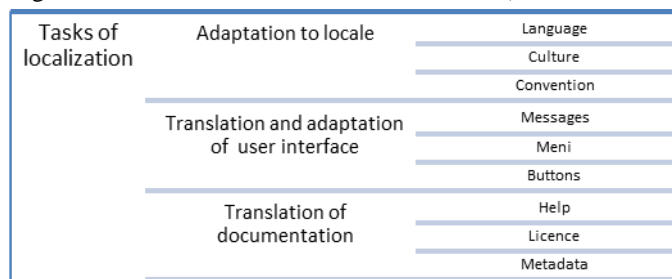
The process of software localization is divided into three parts (Dagiene & Zilinskiene, 2009):

1.  The first part is an adaptation to the "locale""
2.  The second part is a translation and adaptation of the user interface and
3.  The third part is a translation and adaptation of the documentation

Adaptation to the locale is the first and the basic task in the localization process. According to the international standard ISO/IEC 15897 (ISO/IEC 1999), the locale is a "definition of a subset of user information about the technological environment that depend on language, territory, or other cultural traditions". Usually three components are associated with the locale (see Figure 3):

1. Language (which should be understandable to the user and be driven by the software)
2. Culture (non-verbal aspects of the functionality of the product)
3. Local practices and conventions (aspects such as legal requirements, markings, measurement units, etc.)

Information about the locale is usually identified through language, by using a code for the language consisting of two letters (ISO 639-1) and by territory (state) using the code for the territory, which also has two letters (ISO 3166-1 ). This information does not depend solely on the language (eg. they are different for UK and U.S., though these countries use the same language) or it does not depend only on the state (for example, Canada has two official languages, English and French, each of these combinations language/country has a way of showing the date, time, numbers and other elements).

| Tasks of localization | Adaptation to locale | Language |
| | | Culture |
| | | Convention |
| | Translation and adaptation of user interface | Messages |
| | | Meni |
| | | Buttons |
| | Translation of documentation | Help |
| | | Licence |
| | | Metadata |

*Figure 3: Main components of localization of software and learning objects*

POSIX (Portable Operating System Interface for Computer Environments) is the first standard that defines the basic data of the localization. The POSIX model has six main categories (ISO/IEC 9945-2) which define it:

1. Classification of characters (signs) and the manner of conversion.
2. Method of ordering.
3. Money format (monetary).
4. Numerical, non-monetary formatting.
5. Formats of date and time.
6. Formats of informative and diagnostic messages and interactive responses.

This is a minimal package of elements  for environment localization of any software, of course including learning objects as well.

The adaptation of the user interface is the second component of localization and it comprises localization of messages (dialogues) and all menus and their associated elements (buttons, legends, tapes, etc.).

The third component is the translation of documentation, which covers the translation of texts for the license and files for user help.

In the third component, the metadata is left last, but not the least according to their importance. As already explained, the metadata are the most important element in the search. They contain all relevant information about the learning objects. If there are enough good metadata, then the probability of discovering appropriate learning objects is greater. Finding the learning objects in repositories is very similar to the general Internet browsing. Modern search engines can create a wealth of information that is universally available on

the web and that could easily be found. The techniques for finding information used by these search engines are usually effective only when applied to Web collections which are written in English and Latin alphabet. However, there are many challenges to face in using search engines in "non-English" web collections.

Accordingly, the discovery of learning objects that are with "English" metadata is much easier than in the case of learning objects that are with "non-English" metadata. Here two typical cases are isolated:

- ❑ Metadata are written in non-Latin letters – it means it needs to be taken into account whether the query is written in Latin or not.
- ❑ The search should be done on an extended group of related words (eg. work, works, working), which is often not so simple for non-English languages because of different grammatical rules of word formation.

Solving these problems is done by special algorithms for transliteration and words stemming.

## 6.  CONCLUSION

The process of localization is not simple because of the influence of different factors and because it is not completely standardized. The first part of the process, where the local environment (locale) is determined, is standardized and therefore a lot of things are much simplified. However, localization of metadata that are very important for locating and finding resources in repositories or on the Internet is followed by a few problems: transliteration and grammar rules for expanding words. There already exist ready algorithms for solving these problems, but their implementation requires more work. Future research should be conducted in the fields of application of these algorithms, their optimization, improvement or finding new algorithms.

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