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Learning Objects in Geography Education in the Tropics: A Technological Change

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Abstract

The use of Learning Objects (LOs) represents the practice of transmitting highly contextualized information for the construction of knowledge. The proposition of a new technological change by using composite of LOs (cLOs) to improve teaching at both undergraduate and graduate level in geography professional schools is explained through a case study. The activity is a representative problem in Central America that combines economic and physical elements. The cLOs are a combination of digital components manipulated to build more efficient geographic knowledge.

Key words*: Geography education – learning objects – knowledge construction*

1. Introduction

Information and Communication Technologies (ICT) are key components of today professional development for any geographer around the world. The process of systematic formation involves practices related to cartographic analysis, remote sensing, geographic information system, and geospatial visualization, to name a few. However, the importance of new technological applications in the process of teaching and learning geography is not equally developed, even when our students are mostly recognized as Digital Natives (Prensky 2001; Schee 2006). Part of the problem is explained by Prensky when we observe teachers in the schools and professors at the university level who were not born into the

digital world. As Digital Immigrants they lack sufficient skills to develop parallel process and multi-tasks digital activities.

The growth of the Internet and the complexity of the networking process of the World Wide Web have produced new levels of information technology (Webster 1997). More sophisticated learning environments are needed to cope with multiple problems which have to be tackled at once. It is information that has to be taken with much care than before in order to maximize its full condition and meaning. In fact, it is matter of efficiency to deal with the transmission of contextual datasets.

The use of Learning Objects (LOs) represents the practice of transmitting highly contextualized information for the construction of knowledge. Thus, creating a bridge or a set of bridges to manage reliable information to resolve problems

The aim of this article is twofold: First, to explain the importance of new systematic geography education based on LOs which are in turn supported by ICT developed at the university level. Second, to describe a modeling process by way of a combination of LOs that facilitates the construction of new geographic knowledge. Both objectives are demonstrated through a case study analyzed in a tropical environment in Central America.

The proposition of a new technological change by using LOs to improve teaching at both undergraduate and graduate level in geography professional schools might be easily grasped. The contextual information represented by a case study with both a human-economic component (i.e., maritime transportation) and a physical component (i.e., watershed environment), within a tropical environment, is an example that may be replicated in some similar or different environments in other continents. The important point to keep in mind is how the technological procedure is organized in a sequence of steps guided by a defined process of pedagogical conception.

2. The importance of LOs and composite of LOs

As stated by the Working Group 12 of the IEEE Learning Technologies Standards Committee, examples of LOs include multimedia content, instructional context, learning objectives, instructional software and software tools, persons, organizations, or events referenced during technology supported learning (IEEE-LTSC). Sosteric and Hesemeier (2002) tried to elaborate a more plausible definition from the most basic concept presented by the LTSC to point out that a LO is a digital file (image, movie, etc.) intended to be used for pedagogical purposes, which includes, either internally or via association, suggestions on the appropriate context within which to utilize the object. Simplistic perspective or not we have to agree with McGreal (2004) that any LO is anything that has a precise educational purpose. As such, a LO has a certain structure and functionality and the materials are arranged in a meaningful way and creating a logical order (Nash 2005).

The use and application of LOs requires a certain degree of pedagogical orientation to construct knowledge with the LOs and not from the LOs. The learning process is an active task of building rather than acquiring knowledge. The process of systematic instruction supports the construction in such a way that it does not communicate knowledge. Duffy and Cunningham (1996) have stated these two principles as representative of an evident and sound constructivism. A pedagogical conception is then designed based on the presentation of some topic and a problem derived from a case study. This approach guides the technological environment in which a Structured LO should be manipulated. Through Guided LOs (introduction of some topic by the teacher's guidance) and Problem LOs (presentation of a concern to be discussed) the students should reach the stage of object sharing.

More than Functional LOs, the process of object sharing represents the creation of composite of LOs (cLOs). The students construct knowledge while using an organized

combination of LOs with different level of granularity (i.e., size and scale). Then the first approach for problem solving takes place in this dynamic pedagogical exercise (Figure 1).

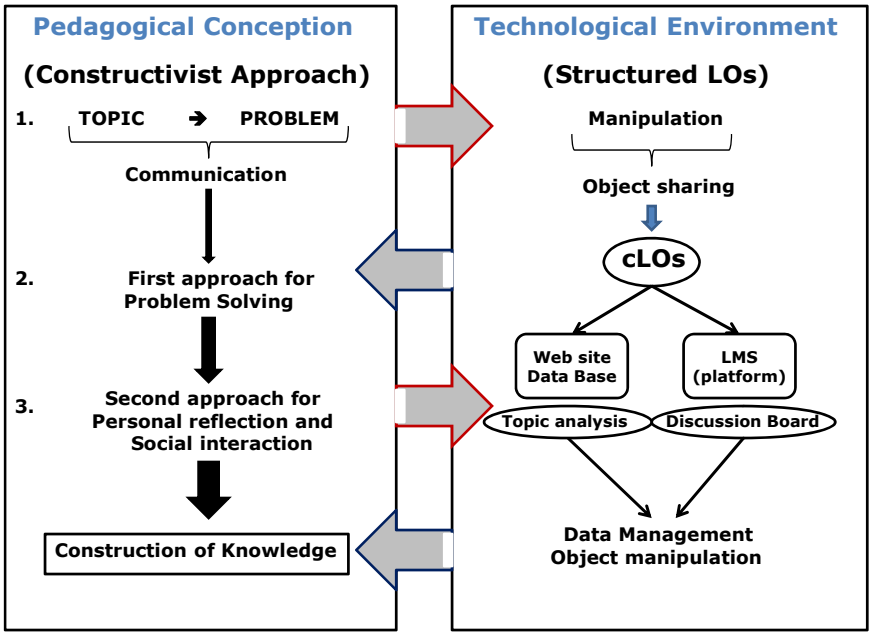

Figure 1: Correlation between a pedagogical conception and the technological environment

Busetti, Dettori, Forcheri and Ierardi (2005) have pointed out the importance of both Structured LOs (Guided LOs and Problem LOs) and Functional LOs, but they did not explain the important stage of object sharing. In fact, the cLO contributes to combine functional properties in order to perceive various dimensions which are critical to understand spatial relationships in geographic problems. Most of the spatial relationships embody dimensions such as density, distance, time and location of defined objects.

The stage of object sharing that leads into the process of problem solving eventually guides the students in their self-centered learning activity toward personal reflection and social interaction. Both activities are developed by a combined effort of several cLOs. Data base has to be extracted from reliable Open Access sources to analyze the problem and a Learning Management System is often implemented to allow students pursue certain level of cooperation and collaboration to resolve the problem. Data management and object manipulation are considered necessary steps to create the final construction of knowledge.

The fundamental condition of the pedagogical conception already described is summarized by the student's ability to exert pressure on personal reflection without direct intervention from an instructor. Within this context of pedagogical development constructivism means the promotion of active learning, or learning by doing. Personal reflection on personal experiences is a critical issue.

3. Reducing the technological gap and updating the learning process

Our contention is that we must create a new learning environment at the university level to prepare self-centered students. Actually, paraphrasing Prensky (2001), new technologies offered to students who are mostly Digital Natives are controlled by professors who are Digital Immigrants in the majority of geography departments in Latin

American universities. This technological gap is exacerbated by a permanent traditional teaching style based on lengthy expositions that reduce the chance to practice self-centered learning.

If we need to build LOs and cLOs to help create a new geography education environment based on ICT in our universities it will be extremely important to measure how effective the LOs and cLOs are. Nash (2005) points out that LO effectiveness is a function of the flexibility of the instructional designer, the intended use, and how central the object is to achieving learning objectives. According to recent experiences at the U.S. college level, all these conditions are focused on changing the role of university professors to deal with the active learning process in the formation of new professional geographers.

In the context of an intelligent participatory democracy the process of changing the role of professors at the university level implies the transformation of the whole educational system. Two conditions are necessary to accomplish this goal. The first one should be characterized by the adaptation of a professor who is used to traditional lectures toward a more flexible type of instructor who can guide and motivate students in the process of self-directed learning. Grow (1991) and Kwan (2003) has explained the basic stages of transformation that a professor must go through in order to accomplish this important condition. From being a traditional expositor in front of passive and dependent students to be a consultant and assist students in their abilities to be self-directed and initiated, there are stages in between characterized by moderate and intermediate self-direct learning when an instructor plays the role of a guide motivator and a facilitator, respectively (Figure 2).

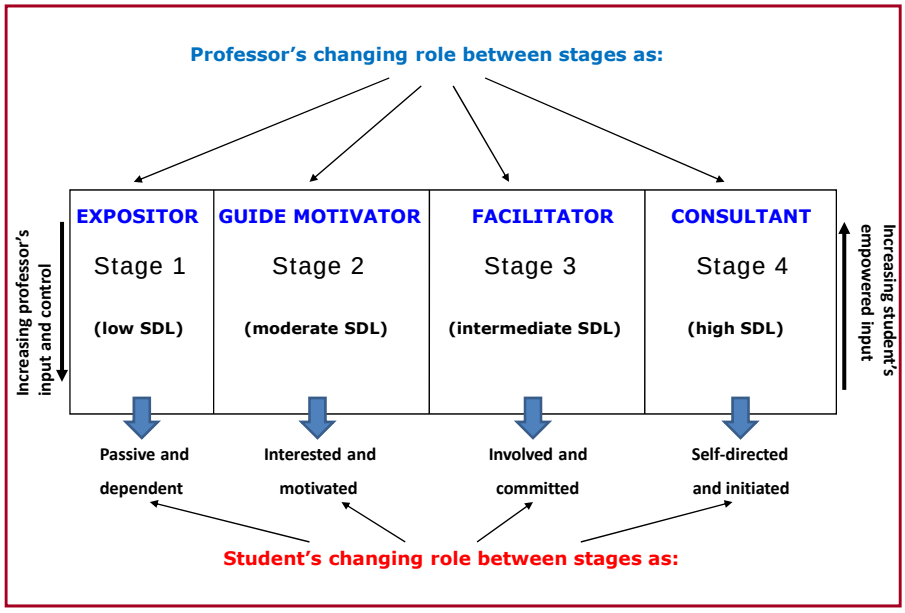

Figure 2. Changing the role of university professors to prepare professional geographers
Source: Adapted from Grow, 1991; graphically modified from Kwan, 2003

The changing role of university professors who have to prepare not only better geographers but also better professionals means a transformation in the state of mind of all participants to a new learning environment based on ICT.

The second condition deals with the evolution of ICT and their effects on how information can be widely used in any learning environment. The Open Access Initiative created the first step to make journals freely available via Internet (SOROS 2002). People,

institutions and organizations from around the world continuously contribute to this initiative. Year after year, new journals have been added to open digital libraries. Archives and search engines are part of this open access movement that was extended to databases and software. Repositories for LOs are examples of the same Open Access Initiative that are retrieved as free access objects to be reusable and operate in different learning environments (Fig. 3).

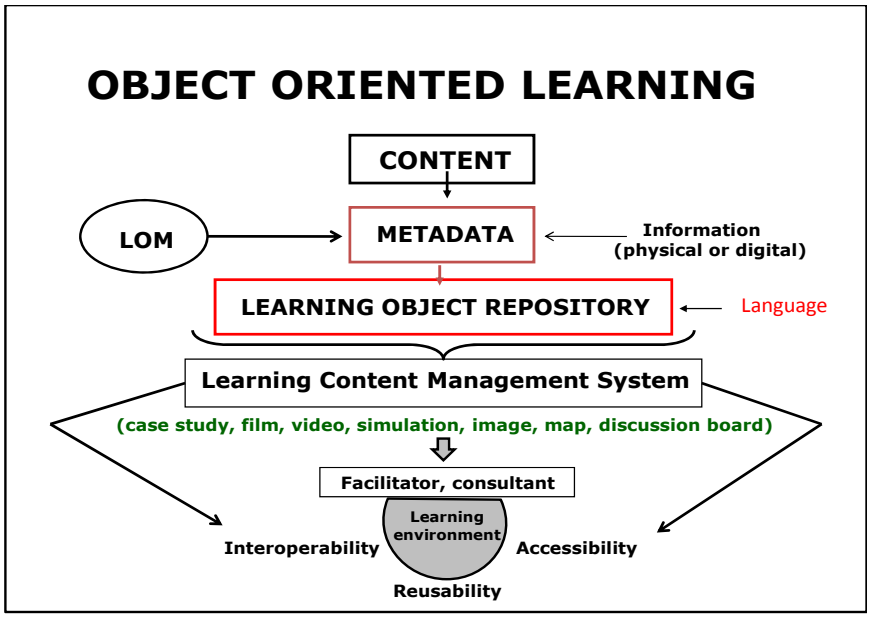

Figure 3: LOs. Metadata, repositories, and management system.

Archives, search engines and free retrieval of information create a special condition that allows professors in more advanced countries and universities act in more specialized academic environment. Information can be updated periodically with two indirect consequences: the continuous reduction of the technological gap, and the increasing tendency toward self-centered learning practiced by undergraduate and graduate students.

Archives and growing accessibility of LOs tells us in part about the effectiveness of these digital objects to create dynamic learning environments. Efficacy and usefulness of LOs could be demonstrated by constant applications in which reusability and interoperability will increase in the future.

4. A practice with cLOs to teach geography in the tropics

For the purpose of this presentation the case study demonstrates a systematic geography education approach to conduct a modeling process based on a composite of LOs by way of alternating with ICT. A regional geography course, GEO 3349 – Geography of Latin America, composed of 60 undergraduate students guided by the author as instructor in the Department of Geography at Texas State University, served the final purpose of this experience. This experience does not include either an evaluation or a final assessment of this practice since the final objective was to demonstrate the pedagogical conception and the technological environment.

The activity relates to a representative problem in Central America and the Caribbean Area which combines economic and physical elements. The cLOs are a combination of

digital components to introduce a geographic problem in a tropical environment. The Panama Canal is chosen for this purpose where transportation and water issues are combined. First, the instructor develops the Structured LO-1 placed as a geographic question: Do we develop Panama or the Canal? The question has a more generalized statement: Do we focus on global demands or territorial needs? (Figure 4.a)

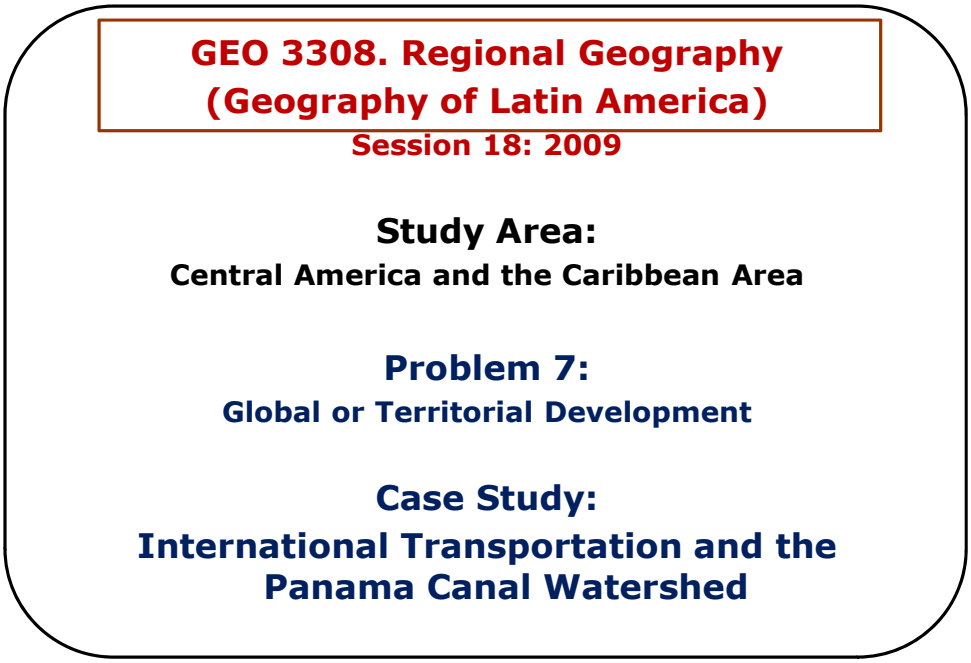

Figure 4.a: Structured LO-1. The study area, the problem, and the case study.

A Structured LO, LO-1 presents two important characteristics typically of a Mixed LO. It is a Guided LO suitable for leading some of the students with less experience in geographical analysis, but it is also a Problem LO to allow the more experienced students some space to create and innovate in their search for a final answer or solution.

As a way of supporting the initial approach, a Structured LO-2 is added. This LO-2 has to be understood as an assistance intentionally given to students in order to perform some task. The term frequently used for this operation is *scaffolding* that creates a special environment for learning. LO-2 is presented in the form of a handout that delivers a basic guideline to operate. This LO-2 guides each student within an Inquiry-based learning principle that eventually helps them along the process of discovering knowledge (Appendix 1).

It is important to keep in mind that the learning environment based on a constructivist perspective is more process-oriented rather than content-oriented where students are expected to observe their thinking process; gather datasets and analyze information; revise parallel information based on different sources; and build their own conclusions.

The Structured LO-3 is presented as a set of images. In this LO, the students watch maritime transportation flows through the Panama Canal via containerization. Information based on hard data is not available yet to create individual and personal impressions about the problem and conditions to be analyzed in the future (Figure 4.b).

Additional information is required to have an initial comprehensive view of the problem. The students receive a digital document that explains the watershed regions of the Panama Canal and the conditions related to sustainable development in a tropical

environment. The digital information is placed on a special folder (Resources) inside the LMS (TRACS platform) available at Texas State University.

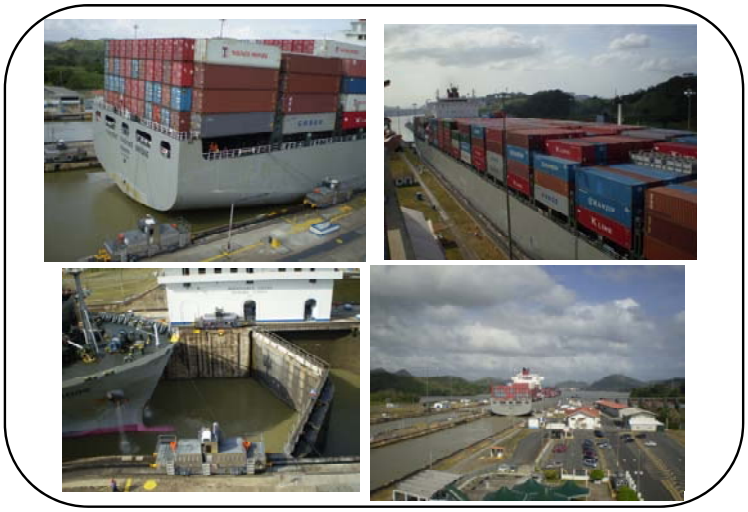

Figure 4.b: Structured LO-3. International Maritime Transportation.
Source: Author, visit to Panama Canal (February 2008) to prepare the LO.

It is the time to introduce the composite of LOs. For this case study the cLOs are residing in both TRACS and a selected webpage that contains the official ACP (*Autoridad del Canal de Panama*) information. Combined LOs (e.g., Statistics, Watershed Information, Panama Canal Locations) guide students to complete statistics into Excel tables, analyze reports via macromedia Flash files, and watch maritime operations with multimedia resources through live cameras (Figure 4.c).

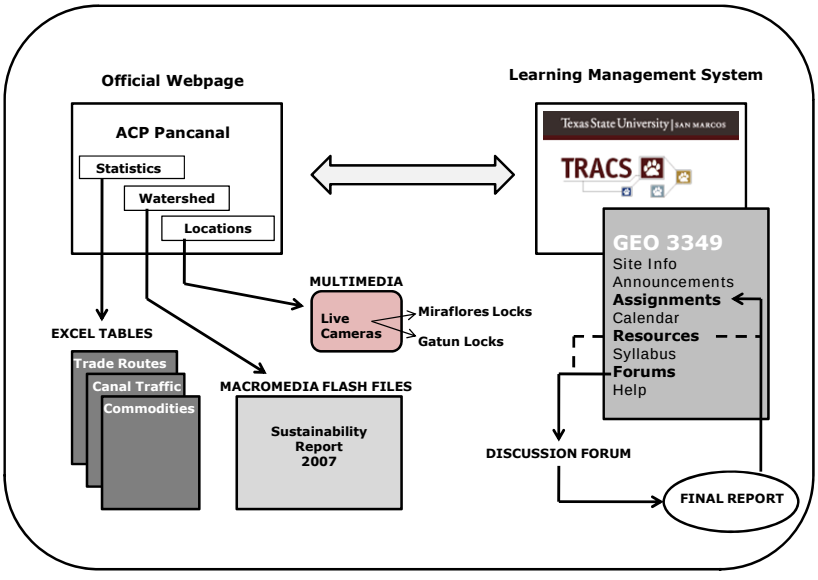

Figure 4.c: A composite of LOs. LOs within ACP and LOs within LMS-TRACS

Initially, each student works alone to study data contained in the cLOs to select the appropriate information and respond to the questions listed on the handout (Figure 5). This is the stage of construction of knowledge. Later on, the students are divided in groups to discuss their findings (i.e., Discussion Forum) and elaborate a final report. Consequently, the LMS-TRACS acts as platform for virtual interaction and collaboration in the final process of production of new knowledge.

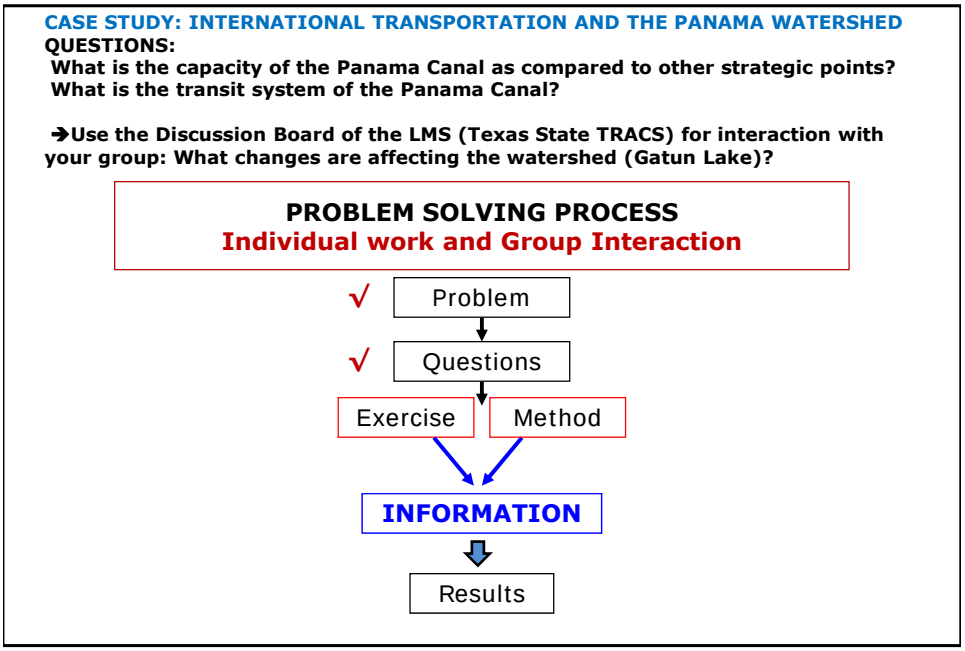

Figure 5: Construction of knowledge. Problem solving process by individuals and groups.

This case study represents a mixed procedure in which face-to-face activities are combined with virtual tasks. Composite of LOs can also take place in a total virtual environment. When the student-centered learning process relies on e-learning strategies and online operations the delivery mechanism seems to work better with a website that is an instructional and a collaborative object at the same time (Muniz and Wranic 2008).

Conclusions

The use and application of LOs requires a certain degree of pedagogical orientation to construct knowledge with the LOs and not from the LOs. The learning process is an active task of building rather than acquiring knowledge. This new approach in learning geography entails a new perspective in the active process of teaching. Professors at the university level must overcome the problem of self-centered teaching to embrace a more dynamic role that opens ample space to students in their new role as self-centered learners.

Professors must eradicate any form of controlled instruction to be replaced by a more sophisticated form of guidance in which they act as facilitators and, ultimately, as consultants. However, this new teaching approach can be applied with efficiency if professors make full use of open access sources and new technologies. In the process of

using open sources such as journals, databases, software, and LOs new technologies must be managed in such a way that ICT are part of the same learning development.

Structured LOs and composite of LOs, as exemplified through a case study in a tropical environment, seem to work well for the purpose of more efficient construction of knowledge. Geography education gains a great deal when using and applying cLOs. In fact, cLOs contribute to combine functional properties in order to perceive various dimensions (e.g., density, distance, time, location) which are critical to understand spatial relationships in geographic problems.

Objetos de aprendizaje en educación geográfica en los trópicos: Un cambio tecnológico

RESUMEN. *El uso de Objetos de Aprendizaje (OAs) representa la práctica de transmisión de información altamente contextualizada para la construcción de conocimiento. La proposición de un nuevo cambio tecnológico por el uso de compuestos de OAs (cOAs) para mejorar la enseñanza de pregrado y postgrado en las escuelas profesionales de geógrafos se expone a través de un estudio de caso. La actividad se enfoca en un problema en América Central que combina elementos económicos y físicos. Los cOAs son una combinación de componentes digitales usados para la construcción más eficiente del conocimiento geográfico*

Palabras claves*: Educación geográfica – objetos de aprendizaje – construcción de conocimiento*

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