

Composite Learning Objects in Geographical Sciences: Experience from On-line Collaboration

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Abstract

This article presents a composite of Learning Objects or cLOs designed for undergraduate physical geography courses or other similar courses which address environmental issues. It is based on a theoretical framework in which social constructivism guides the process of development characterized by structural and functional components for an e-learning setting. The generation and design of the cLOs was performed during an on-line independent study class in geographic education at the Ph.D. level in an US higher education institution. The cLOs is a website that has several different types of learning objects embedded in the website itself and should be considered as an organized combination of Learning Objects.

Keywords: *Learning objects, constructivism, e-learning, on-line collaboration, environmental geography*

Resumen

Este artículo presenta un compuesto de Objetos de Aprendizaje o cOA diseñado para cursos de geografía física de pregrado u otros cursos similares que hablan sobre asuntos ambientales. Está basado en un marco teórico en que el constructivismo social guía el proceso de desarrollo caracterizado por componentes estructurales y funcionales para un ambiente de aprendizaje electrónico. La generación y diseño del cOA fue desarrollado durante un curso avanzado de estudio independiente on-line en geografía educacional a nivel de Ph.D. en una institución de educación superior de Estados Unidos. El cOA es un sitio web que tiene varios tipos diferentes de objetos de aprendizaje insertos en el sitio web en sí mismo y debería ser considerado como una combinación organizada de Objetos de Aprendizaje.

Palabras Claves: *Objetos de aprendizaje, constructivismo, e-learning, colaboración on-line, geografía ambiental*

1. Introduction

What is a learning object (LO)? The most succinct definition comes from Wiley who states, “any digital resource that can be reused to support learning” [1]. Nash provides an elaboration to the definition with,

“A learning object is any grouping of materials that is structured in a meaningful way and is tied to an educational objective. The ‘materials’ in a LO can be documents, pictures, simulations, movies, sounds, and so on. Structuring these materials in a meaningful way implies that they are related and are arranged in a logical order” [2].

An organized group of materials with specific instructional designs could give a LO good flexibility and adaptability, especially when the LO is created in a technology-based environment which is highly dynamic.

When a group of didactical components and complementary materials are provided with structure and functionality the resulted LO is a combination of efficient learning procedures. By using a variety of technological tools the initial LO is then transformed into a new and more efficient aggregation of LOs. A composite of LOs might encourage more active and collaborative participation among learners.

2. On-line Collaboration

Self-directed learning through LOs delivered on-line should encourage teamwork. This implies special conditions to be met. First, learners in their self-directed learning process follow the instructional content with their peers through a second process recognized as collaborative. Second, collaboration takes place once each member recognizes prior personal experiences to contribute with his/her previous knowledge toward more advanced information. Finally, new knowledge is assimilated once practice is performed individually and in group within a given context.

3. Types of Learning Objects

The four major types of LOs include instructional, collaboration, practice, and assessment. The first major category is instructional LOs. This type of LOs gives the learner a clear explanation of educational theory behind the subject matter. The ideas are demonstrated using real-world examples and interactive graphics to encourage a learning process that involves the student. Some examples of instructional objects are web sites, recommended readings, audio, glossaries, graphics, seminars, and E-books. The second category of LOs is collaborative objects. These types of LOs facilitate the learning process by use of human interaction. Some examples of collaborative learning objects include: synchronous or asynchronous chats, discussion boards, on-line meetings, and on-line projects. The third category is practice LOs. These LOs give the learner the experience of applying acquired skills and knowledge in an environment that simulates a real world experience. Examples include software simulations, on-line lab objects, and role-playing. The last major category is assessment objects. This category of LOs is centered on using test taking and objects to evaluate the depth of student knowledge.

Examples are pre-assessment objects, proficiency assessment objects, certificate objects, and electronic portfolios [3].

4. Theoretical Framework

The process of traditional learning has been a basic interaction mostly between an educator and a group of learners to deliver and receive organized messages about new knowledge. With new processes of learning involving new technologies applied to e-learning activities the traditional education has been transformed in a much more complex type of interaction. Passivity has been reduced to almost zero to give space to active environments. When this process is characterized by a learner-centered interaction, messages and events take special development toward new constructions and evolution of ideas. Messages and events of the subject domain of an e-learning environment are concerned with the delivery of content and active knowledge construction. Within this environment the use and applications of e-learning artifacts brings about planning.

E-learning artifacts are built on planned action and are initially subject to the nature, norms, and laws of pedagogy and psychology. Consequently, intelligent e-learning artifacts must be entirely learner—rather than instructor- centered to the student, and attest pedagogical and psychological validity to the instructor [4].

When e-learning artifacts are transformed to obtain more detailed types of objects and events it is possible to identify certain orientation in the process of decomposing entities. An object oriented approach is constructed suitable to special conditions for specific learning environments. Here, the importance of psychological (i.e., cognitive) and pedagogical foundation is precisely defined to be organized as instructional design.

One of the key cognitive components is related to individual's motivation to learn new knowledge and embark on the task to successfully accomplish certain objectives. LOs should be created and organized with the abilities and levels of the users in mind. Otherwise, the users/learners will run into frustration and reduce their motivation to acquire knowledge. Consistency is in fact another component since any learning object must use terminology and instructional strategies that are uniformed with those of the on-line course [2].

Any type of LO can create a wide variety of new possibilities to facilitate knowledge development and enhance student learning through active knowledge construction. Similarly, any LO can also reduce

teaching practices to mere knowledge acquisition without proper social interaction, social collaboration, and knowledge active transmission [5]. Therefore, instructional information has to be understood as part of a context in which a social group plays and executes orders and decisions.

An instructional designer who attempts to include LOs into her/his courses, be they on-line settings, hybrid courses or regular classes, can more easily work with a social constructivist approach as part of a context. Reality is a mixture of constructs or “objects” for a given cultural group in which collective experience tends to play a strong role. We have to keep in mind that in technological settings where the purpose is to use these objects in semi-automated instructional environments, the prerequisite of this type of instructional context is fundamental [6].

Some of the current theories of learning (e.g. cognitive, and social constructivism), which judge learning as active, and motivational, among other characteristics, are not well represented by the prevailing LO approach in several fields. Thus, and according to some researchers, the prevailing LO approach shows a reductionist view of teaching and learning, emphasizing content delivery instead of a perspective with a more special constructivist idea of supporting learners’ knowledge construction [7][8]. This is the case of geographical sciences in general which have developed a typical LO approach based on learning content with effective delivery to the learner instead of maintaining knowledge construction.

This study is focused on a composite of Learning Objects (cLOs) that takes a different perspective leaning toward a more constructivist approach with a pedagogical oriented view. This approach gives rise to defining this pedagogical experience as characterized by both structural and functional components. Thus, the cLOs presented in this article corresponds to the educational modules teachers usually build to address some topic. As such, it is a structured LO which is articulated as a guided LO, dedicated to introduce a topic under teacher’s guidance, and appropriate for leading inexperienced students in the initial study of some topic. Also, it is a problem LO, leaving students space and time to use their ability and creativity on topics where they already have some experience. Complementary material makes the LO very functional as stated by [9].

As both Structured LO and Functional LO this pedagogical experience in geography invite students to collaborate and practice the didactical operations within a technological environment. The tools for manipulating different components allow the students

to be placed within a context-dependent environment (Figure 1).

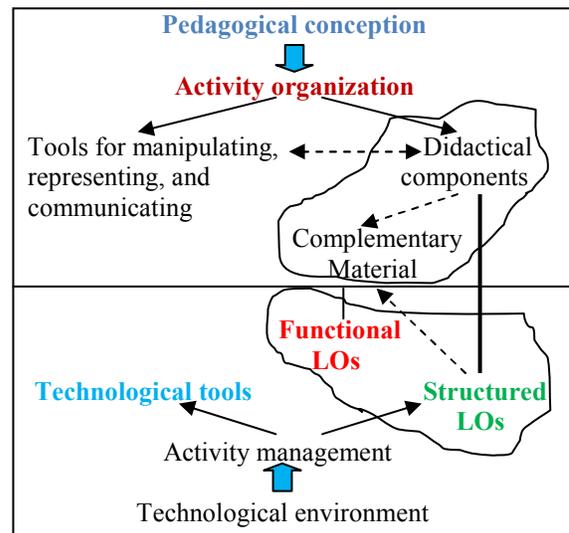


Figure 1: Correspondence between pedagogical conception and the technological environment designed. Adaptation from Busetti, Dettori, Forcheri, and Ierardi (2005).

Finally, it is crucial to understand that the learner is not a passive receiver of information but an active participant in the instructional event. This is the main condition of the generative learning theory which also states that an instructional practice is related to previous experiences and earlier knowledge [10]. The generation and design of the cLOs is based on this assertion.

5. Method: Generation and Design

The cLOs was generated during an independent study class in geographic education at the Ph.D. level at Texas State University, San Marcos. Three students working as a research team and guided by an instructor who acted as facilitator, participated in the class which generated three different LOs. The students did an extensive literature review on LOs before creation of the LO itself and consulted with each other during the process of generation and design. The Global Warming cLOs was chosen to present in this paper for four main reasons. One, it is a cLOs that maintain the constructivist idea of supporting learners’ knowledge. Two, it conforms to the tenants of the literature review. Three, global warming is an interdisciplinary topic which allows for the cLOs to be used in many different types of courses. Four, global warming is a topic of primary concern in society today.

The Global Warming website has several different types of learning objects embedded in the website itself and would be considered as a cLOs.

The cLOs was designed particularly for an undergraduate physical geography class where it would be included with the topic of climate. The cLOs could be used with any undergraduate geography class or other undergraduate class that addresses environmental topics.

What follows is an explanation for the organization of the website and rationale for the design and generation of the website. This includes an explanation of the different types of learning objects and the supporting educational theories.

The website is an instructional and collaborative object. It provides a means of delivery for knowledge and a place for students to work collaboratively. The website has a traditional behaviorism bottom-up design. Students begin with easier tasks and proceed to more difficult projects. The overall LO demonstrates an integrated constructivist approach.

The first part of the LO provides students with some background information on global warming and then proceeds to a constructivist approach by interaction of group members in the message forum to synthesize opinions on the subject of global warming and construction of a wiki about an environmental topic by group members working cooperatively. This approach encourages students to assume responsibility for their own learning and collaboration with other students. Use of constructivist philosophy enables the computer to be used to its full potential [11]. The building of the wiki also provides a real life experience for the students.

The ideal class size for this type of active learning style would be thirty students. If an instructor was supplied help with grading and monitoring wiki construction class size could perhaps be increased to fifty students. Literature indicates that a constructivist learning approach may not be readily adopted in cultures where a traditional instructor-centered approach is prevalent. This does not mean a constructivist approach should not be used, but rather a more moderate constructivist approach would be more appropriate [12].

The home page contains a general introduction to the creator of the website, contact information, and a video introducing the instructor. The video is a way to familiarize students with the instructor and to encourage high tech collaboration between students. The home page has navigation bars to the three others pages: Grading, Global Warming, and Wiki Building (Figure 2).



Figure 2: The website as a composite of Learning Objects

The grading page gives a brief summary of how the general LO is organized. It lists the five stages of the project: pre-test, construction of knowledge through readings, tutorials, and videos, discussion of topic via a message board, and construction of the wiki. The grading page also includes a breakdown of the point distribution for each part of the project. The global warming page includes several different LO's that allow students to construct knowledge on the topic (Figure 3).

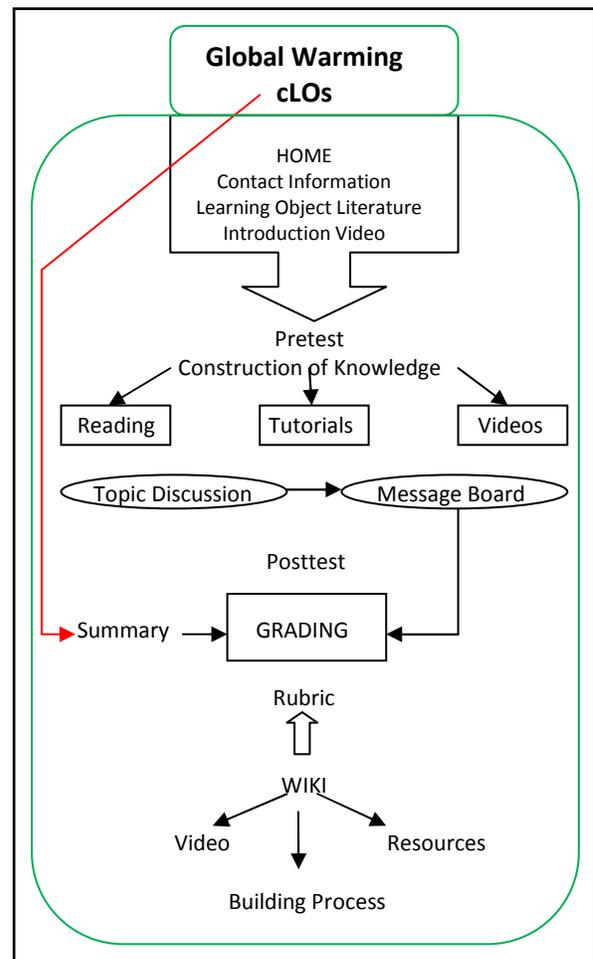


Figure 3: Structure of the cLOs Global Warming

The student begins and ends with a test. The tests are included for assessment purposes and allow the student to reflect on how knowledge has changed over the course of the global warming cLO.

Learner reflection is an important part of constructivist philosophy [13]. The readings, videos, and tutorials are based on the idea of guided practice for students to acquire a base level of knowledge. This is based on behavioral theories of learning, but with some elements of a constructive discovery learning as it has a variety of websites and readings that students can choose to explore. The students are provided a message board and questions they need to address to respond to. This is a collaborative learning object and based on a constructivist educational philosophy where students are now expected to synthesize and exchange opinions on the topic of global warming. Lastly, students work in groups to construct a wiki of their own about an environmental topic they choose. This is the most important LO in this experience for its constructivist characteristic. In fact, it simulates what students can expect to encounter in their future working lives.

The last webpage concerns construction of the wiki. It gives a short video definition of a wiki and gives limited advice on possible resources students can use in the construction of the wiki. Students were given limited advice in order to maximize original thinking by the students.

What made the creation of the cLOs and paper unique was the on-line nature of the process. Participants were located in the states of Kentucky, California, and Texas to interact and collaborate in the process of generating and designing LOs. Furthermore, the cLOs selection, discussion, and final preparation of the paper were performed through an on-line collaboration of the selected research team located in three nodes: California, Texas, and La Serena, Chile.

Communication took place via a SAKAI platform using both asynchronous and synchronous chats, use of Skype for video conferencing, and use of a wiki to organize the final writing process of this article.

The two main characteristics of the cLOs were interoperability and reusability. As a composite of LOs is perceived to be reusable because of its interdisciplinary nature which could be used by any undergraduate class that addresses environmental topics.

In order to increase interoperability the delivery mechanism was a website. This would provide access to anyone with an internet connection and not require any particular technical knowledge on the part of the student or participating instructor.

6. Ways for Improvements

The cLOs presents structural and functional components to be actively used in physical geography, but as with any project there is room for improvement. Some of the most important issues for future progress are listed below.

1. The global warming aspect of the cLOs could be made more interdisciplinary by addition of assignments that were more quantitative and economic in nature. For example, compare emissions of greenhouse gases for different countries by constructions of graphs, calculations of greenhouse gas emissions for various motor vehicles and representing these calculations graphically, and calculation of greenhouse gas emissions for their households. An economic approach could be brought into the cLOs by requiring students to provide a cost-benefit analysis, i.e. estimating damage costs of global warming compared to costs required to help solve the global warming problem. These assignments would also add another constructivist activity to the cLOs. If no links were provided for this information it would also bring a research aspect to the cLOs since students would need to find this information.

2. Additional articles about pedagogy could have been included on the website to familiarize the student with the use of the cLOs and this particular type of learning theory. This allows the student to understand why the material is being presented in this fashion [14].

3. Allowing the information to be available as both a stand alone website and in a form that the individual instructor could upload to their own platform would be ideal. This would increase the reusability and interoperability of the cLOs because instructors who did not have an available platform through their school or the technical ability to maintain a website could still use the information or if they did have available technical support they could modify the information to their needs.

4. The introductory video of the instructor could have been longer in length and better developed. This would be an excellent opportunity for the instructor to discuss what the anticipated outcomes of the cLOs and why this subject matter is important [14].

5. The assignment of wiki building could be modified so that students would be required to have a portion of the wiki devoted to information they gather from other sources on the internet and the other half of the assignment where as groups they create a product of their own i.e. PowerPoint, a survey they administer, crossword puzzle, UTube video, or mock debate. This would ensure a more

active involvement in the project besides just fact gathering. This would require students to use higher level learning skills.

6. The cLOs could be submitted to the MERLOT and the WISC databases so that more educators would have access to the information. It is important that as the cLOs is developed that is made available to other educators. If the cLOs material is shared it will help reduce preparation time and cost for instructors and institutions.

7. Conclusions

As a result of efficient on-line research teamwork this selected cLOs is a good example of an integrated constructivist approach in physical geography. It is a multiple instructional design to develop knowledge with a student-centered perspective. The Global Warming cLOs has a traditional behaviorism bottom-up design in which individual motivation could be reached by developing a series of tasks through interaction, cooperation, and collaboration.

The on-line nature of this research based on participants from different states made this experience very unique. The research team worked in a virtual environment not only to generate and design the LOs, but also to prepare the final study. Here, interaction, cooperation, and collaboration were performed with the assistance of e-learning platforms and with both asynchronous and synchronous interaction systems.

8. Future Research

The cLOs has not been used in a classroom setting. Future research could include a comparison between a face-to-face class setting and an on-line environment or comparisons of audience in different locations throughout the Americas. Some questions to be compared include the following. What are differences in attitudes between the two groups on the subject of global warming? What method provides a better understanding of this difficult subject? Which learning theory provides better working skills for future employment?

Other topics that could be researched with this cLOs would be a comparison of different cultures and their attitudes to an integrated constructivist approach. The universality of constructivist approach still needs to be tested across different cultures to ensure it enhances learning [12]. Research in this area indicates e-learning should not necessarily need to choose between the two extremes of constructed knowledge versus instructed knowledge or teacher-directed versus student-directed learning, but rather a

continuum of both to address the diverse learning needs of the global student. An initial experience related to this issue should be focus on Latin American countries.

Reusability and interoperability are two important conditions which have not been fully addressed in this study. However, future research should be focused on these two conditions if we want to test the cLOs either in a face-to-face class setting or in an on-line environment.

9. Acknowledgements

Angela Wranic would like to express her appreciation to Clovis Perry and Christa Stutz for their participations and contributions as research peers during the on-line Independent Study, Ph.D. Program in Geography at Texas State University, under the guidance of Dr. Osvaldo Muñiz-Solari. Osvaldo Muñiz and Angela Wranic would also like to thank the Department of Geography at Texas State for providing financial support to attend la 3ra. Conferencia Latinoamericana de Objetos de Aprendizaje y Tecnologías para la Mejora del Aprendizaje, LACLO 2008, Aguascalientes, México.

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