



A Conceptual Model of Collaboration Oriented Learning Objects Based on Constructivism

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1. Introduction

The term E-learning refers to a mixture of different preferred learning methods, which delivers to the learner through the use of information technology and is supported with instructional design and engaging content [3]. E-learning makes new knowledge and skills available immediately and reduces the learning time required to master even the most complicated topics. The trend of using E-learning as learning and/or teaching tools is now rapidly expanding into education. Through innovative use of modern technology, e-learning not only revolutionizes education and makes it more accessible, it also brings formidable challenges for instructors and learners. E-learning environments increasingly serve as important infrastructural features of universities that enable teachers to provide students with different representations of knowledge and to enhance interaction between teachers and students, amongst student themselves [4].

Learning objects (LOs), one of the most important aspects of e-learning, are known as a collection of content items, practice items, and assessment items that are combined based on a single learning objective [1]. LOs offer a new conceptualization of the learning process: rather than the traditional "several hour chunk", they provide smaller, self-contained, re-usable, aggregated units of learning [5]. As the main idea of LOs is to break educational content down into small chunks that can be reused in various learning environments [6]. Therefore, they offer great value in terms of saving time and money in course development and increasing the reusability of content. If pedagogically well designed, LOs can help students to better understand comprehensive concepts and the inner working of complex processes to achieve the course learning outcomes.

It is understood that Learning object systems that are designed with sound instructional principles lead to robust learning environments [7]. From the pedagogical point of view, LOs fit nicely into many instructional systems design theories, especially a traditional instructional systems design perspective; nevertheless, there are alternative theoretical foundations that can be applied to learning object systems based on constructivist philosophy of learning. Constructivism is about the process whereby knowledge is constructed through the learners' own ability to process information and assign meaning to that information. Learners do not passively receive knowledge, but are actively involved in constructing their own knowledge.

This paper attempt to propose the integration of collaboration in constructivist learning with the conventional characteristics of Learning objects. So that, the learning process of supporting knowledge construction such as collaborative learning, knowledge sharing, are integrated into the LOs which conduce to a new LOs model, a new perspective on the development of learning object systems.

Given that the focus of this study was on pedagogical perspective, the following sections describe LOs' characteristics, the importance of collaboration in constructivism and a conceptual model of Collaboration oriented Learning Object based on Constructivism (CoLOC) respectively.

2. Characteristics of Learning Object

Learning objects model was developed based on its identified characteristics which are provided from the pedagogical well-founded definition of LOs. The absence of a comprehensive LOs model is partly due to the absence of solid definition where there's absence of important learning object features in existing definitions that would aid in LOs model construction [8]. From the literature reviews based-on pedagogical points of view, LOs' characteristics and the well-founded prominent definitions of LOs are summarised and then classified into common characteristics of learning objects as illustrated in table 1.

Table 1. Characteristics of LO

No.	Characteristics	Description	Reference
1	Digital resource	A review of various definitions from the current literature shows that learning objects are digital resources. Although the IEEE (2002) [9] includes non-digital resources in its definition of learning objects, but following Wiley (2002) [6], non-digital resources are excluded from the concept of learning objects.	[6] [8] [9] [10] [11] [12] [13] [14]

2	Reusable	Learning objects must exhibit flexibility in order to reuse learning objects for multiple purposes, in different applications, in different products, in different learning contexts, using varying devices, for numerous markets [17]. If learning objects are designed to be used in multiple contexts, then they can be reused easily rather than having to recreate material that has to be rewritten for each new context [7].	[7] [8] [9] [10] [12] [14] [15] [16] [17]
3	Adaptable [Customisable, Able to be aggregated]	This characteristic refers to the ability to recombine pieces into any number of objects adapting them perfectly to meet individual knowledge, skill and attitude gaps.	[8] [15] [5] [16]
4	Interoperable [Transportable]	A major tenet of learning object theory is the ability to use content developed by one organization on a given platform with one set of tools at a completely different organization on a different platform with another set of tools [17]. The interoperable notion is imperative for learning objects to be useful, accessible, and reusable by other organizations. Therefore, using an interoperable model while constructing a learning object is an important factor to consider. Metadata and learning object standards enhance the interoperability of learning objects.	[8] [15] [16]
5	Accessible [Retrievable]	“Accessibility” implies that learning objects are available to users from different locations [18] which mean that the ability to search, identify, access, and retrieve learning objects is also necessary [17].	[8] [10] [15] [16] [17] [18]
6	Learnable with single learning objective	This refers to the ability of learning object to provide a sense of achievement that learning has occurred upon usage completion [8]. More than that, a learning object should satisfy one terminal objective (sometimes called a performance objective) that has been stated objectively and measurably [16].	[6] [8] [9] [11] [12] [13] [14] [16] [19]
7	Granularity [or Self-Contained]	Granularity refers to how rigorously learning objects are break down and store. The unit of a learning object can be a program, a course a module, a lesson, a segment, or a raw object. Generally a finer level of granularity will promote reusability, by allowing for use in multiple contexts. Of course, a greater number of smaller objects requires more cataloguing and therefore increases the costs associated with manageability.	[5] [14] [15] [16]
8	Metadata	Every learning object has descriptive information allowing it to be easily found by a search. Metadata, literally ‘data about data’, is descriptive information about a resource. Metadata tagging means linking or tagging objects and assets with specific metadata.	[5] [14] [16]

3. Collaboration in Constructivism

Constructivism is a theory about how people learn. Based on the work of Piaget, Vygotsky, and others, constructivism reflects a paradigm shift from a teacher-centered pedagogy based on behaviourism to a learner-centered educational approach based on cognitive theory [20]. Constructivism contends that learners construct meaning through their interpretive interactions with and experiences in their social environments. It presumes that prior knowledge and experiences play a significant role in learning and form the basis for subsequent actions. Constructivism provides the basis for co-operative and collaborative learning. In recent decades, constructivist theorists have extended the traditional focus on individual learning to address collaborative and social dimensions of learning. Refer to the constructivist epistemology which state that learners construct their own knowledge on the basis of interaction with their environment. Knowledge is socially constructed by learners who convey their meaning making to others and theoretically constructed by learners who try to explain things they don't completely understand [20]. Furthermore, the importance of collaboration in constructivism is more obvious as collaboration is also included into the primary propositions that characterize constructivism which are presented by Savery and

Duffy. The propositions indicate that cognition occurs as people share their understandings with each other and knowledge evolves through social negotiation, either independently or in collaborative groups [21]. As already described, it can be seen that collaboration relate directly to constructivism. Constructivism often utilizes collaboration as a way of provoking students to reach a new level of understanding. Sharing understandings and social negotiation are key components of constructivist learning approach.

4. A Conceptual Model of CoLOC

From the advantages of collaboration in constructivism and learning objects that support learner's knowledge construction, a conceptual model of Collaboration oriented Learning Object based on Constructivism (CoLOC), a new perspective of LOs model to enhance the capabilities of conventional LOs model, is proposed. CoLOC is developed by integrating constructivist principles that emphasizes the need for collaboration among learners to arrive at a shared understanding of the truth in specific fields, together with LOs' characteristics in order to take advantage of these concepts simultaneously. The key attributes of CoLOC are summarized and outlined as in Figure 1.

The primary attributes of CoLOC can be divided into two aspects; the technical aspect and pedagogical aspect. The technical aspect indicates that CoLOC-based LOs are digital resources which can be reusable, adaptable, interoperable and accessible as explained in section 2. To focus on the pedagogical aspect, CoLOC-based LOs must have the following attributes:

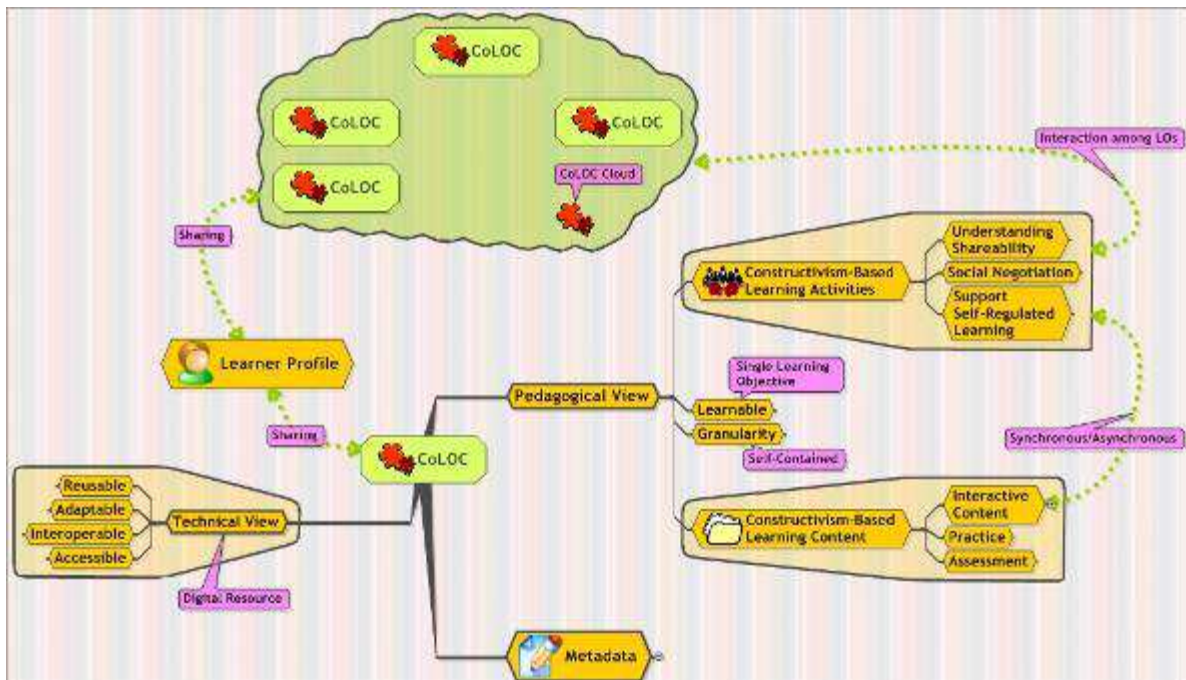


Fig1. A conceptual model of CoLOC

- Learnable: The ability of LO to provide a sense of achievement that learning has occurred upon usage completion to meet a single learning objective.
- Granularity: Granularity or self-contained refers to how rigorously the LOs are break down and store. In the pedagogical point of view, Granularity or Self-Contained CoLOC-based LO is smallest possible but still understandable and complete learning objective so that the LO can be taken independently.
- Constructivism-Based Learning Content: As LO is a collection of content items, practice items, and assessment items, all of these items must be designed to be interactive and based on the principle of constructivism in order to engage the learner in meaningful activities, simulate learning experiences and promote motivation of learning.
- Understandings Shareability: In constructivist learning theory, when people share their understandings with each other and test the degree to which they are compatible, the cognition occurs. Thus, to initiate the constructivist learning activities, CoLOC-based LO must have a clear means of how the learners can conclude and share their understanding with others through LO.
- Social Negotiation: Alternative views and additional information enable learners to test the viability of understandings and to build new propositions that are compatible with those understandings. Initiating social negotiation in learning process of CoLOC-based LO's learner groups, either synchronous or asynchronous, is vital to the success of evolved knowledge.
- Support Self-Regulated Learning: This refers to the ability of CoLOC-based LO to encourage learners self regulation. Such Learners can regulate their own learning by observing what they are able to do (Self-



observation), then comparing this what they have observed to a standard of some kind and making judgments about the quality of this performance (Self-judgment), and finally making plans regarding what to do next (Self-reactions). To support this ability, the design and development process of CoLOC-based LO should thoroughly investigate on these important characteristics of self-regulated learning.

Nevertheless, the conceptual model of CoLOC results from integrating the LOs' concept and collaboration in constructivist learning theory. Therefore, the use of the CoLOC-based LOs should be considered the assumptions of these concepts as well.

5. Conclusion

In this paper, a conceptual model of Collaboration oriented Learning Object based on Constructivism (CoLOC), a new perspective of LOs model to enhance the capabilities of conventional LOs model, is proposed. CoLOC is developed by incorporating the characteristics of LOs together with constructivist principles that emphasizes the need for collaboration among learners to arrive at a shared understanding of the truth in specific fields, in order to take advantages of these concepts simultaneously. As a result of that, teachers and students with different skills and backgrounds who interact with their CoLOC-based LO environment to achieve the specific learning outcomes, not only benefit from the LOs' advantages but also construct their knowledge from synchronous and/or asynchronous collaborations in tasks and discussions and sharing endeavor with others through the potentialities of CoLOC-based LO. In this regard, the key attributes of CoLOC are synthesized and outlined as described in Section 4. Focus on a pedagogical perspective, it is clearly seen that the constructivist characteristics such the constructivism-based content and constructivism-based activities are added into a CoLOC model and play as an important role in knowledge construction. However, the degree of compatibility of all attributes in CoLOC model, particularly between collaboration in constructivism and LO's concept, and the efficiency of CoLOC-based LOs are still an interesting issue for future research.

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