Learning Objectives for E-Learning Instruction

F. Alonso, J. Couchet, D. Manrique* and **F. J. Soriano**

Facultad de Informática, Universidad Politécnica de Madrid, 28660 Boadilla del Monte, Madrid, Spain

This chapter presents a new concept called learning objective for an e-learning instructional model that combines objectivist and constructivist learning theories. A learning objective is composed of learning objects, a concept inherited from the object-oriented paradigm, which permit to reuse educational content across different e-courses that are accessible over the Internet. The instructional model proposed structures the educational contents on the basis of the concept of learning objective, mapping constructivist principles to the instructional design by means of a more pragmatic approach that focuses on the principles of moderate constructivism. Collaborative activities are also included to create a social environment that acts as a scaffold for collaborative learning and dialectical constructivism.

Keywords learning objective; learning object; e-learning instructional model; constructivism; objectivism

1. Introduction

With the development of the Internet, Internet-based computerized learning, known as e-learning, has attracted the attention of educators. Initially, e-learning systems tended to focus exclusively on the management and measurement of training processes. They did not provide any means to support content production processes, e-content management or even maintenance [1]. Later, e-learning systems addressed the issue of educational e-content reusability throughout the concept of learning objects, an idea inherited from the object-oriented paradigm. These learning objects can then be combined in different ways, what makes potential reuse across multiple learning objectives is feasible. Thanks to this potential, learning objects can be used as reusable adaptive learning materials [2].

All this technology developed around the e-learning paradigm is beneficial for improving the quality of learning, but is useless if it is not based on psycho-pedagogical principles [3]. There is now a serious dysfunction between the profusion of technological features that are put forward and the shortage of pedagogical manners and teaching principles for e-learning [4]. Pedagogical principles are theories that govern good educational practice, and, as far as e-learning is concerned, good educational or instructional practice is implemented by the instructional design. Instructional design has evolved on a par with the development of the three basic learning theories: behaviourism, cognitivism, and constructivism.

The theory of behaviourism [5] concentrates on the study of overt behaviours that can be observed and measured It views the mind as a “black box”. So it is unable to understand learning, what is precisely one of the limitations of behaviourism. The cognitive theory emerged in response to this limitation. It views learning as involving the acquisition or reorganisation of the cognitive structures through which humans process and store information [6]. Constructivism builds upon behaviourism and cognitivism in the sense that it accepts multiple perspectives and maintains that learning is a personal interpretation of the world. Constructivist theory sustains that learners construct or at least interpret their own reality based upon their perception of experiences [7].

This chapter presents an original concept, the learning objective, based in learning objects, for an e-learning instructional model supported by the eclectic combination of these learning theories. The educational contents are structured on the basis of the concept of learning objective, defined as a set of learning objects that can be evaluated according to performance goals to develop coherent information structures that help to build knowledge schemata in the learner’s mind. The target learning objectives are linked with the underlying contents, knowledge and skills, employing a structure that depends on their class: facts, concepts, procedures and principles. A collaborative environment is developed, including

* Corresponding author: e-mail: dmanrique@fi.upm.es, Phone: +34 913366907

activities designed to create a social environment for collaborative learning [8]. The proposed instructional model maps constructivist principles to the instructional design by means of a more pragmatic approach that focuses on the principles of moderate constructivism [9].

2. Learning objectives based on learning objects

A learning object is small-sized, reusable instructional component, designed for distribution over the Internet [2]. Each learning object deals with a very specific item of knowledge: educational content, a problem to be solved through group work or evaluation exercises. Learning objects can be combined to support instructional objectives to serve different contexts. Sharable content objects (SCO) is, for learning objects, the most commonly accepted term with regard to learning and reuse elements.

A learning objective is the specific knowledge that the learner has to acquire about a concept or skill and the tasks to be performed. A learning objective includes several learning objects. Each learning objective will be defined by a set of interrelated SCOs. These relations can be represented by means of an and/or graph, where the nodes represent SCOs and the directed lines indicate learning sequences: having learned the source SCO, learners can start to work on the target SCO. OR learning occurs when two or more lines are directed at a node: the target SCO can start to be learned when either of the source SCOs have been completed. AND learning occurs when two or more directed lines have the same target node: this indicates that all the source SCOs need to have been completed before starting on the target SCO. An arrow without a source node indicates that the learning objective can start to be learned as of the SCO to which it points.

A learning objective should be composed of SCOs that contain: educational contents, a “good problem” for group problem solving, and evaluation exercises to evaluate the knowledge acquired by learner. The knowledge state demanded for a learning objective is considered to have been attained when its evaluation exercises have been passed, for which purpose the good problem necessarily has to be solved. A good problem is required to stimulate the exploration and reflection necessary for knowledge construction.

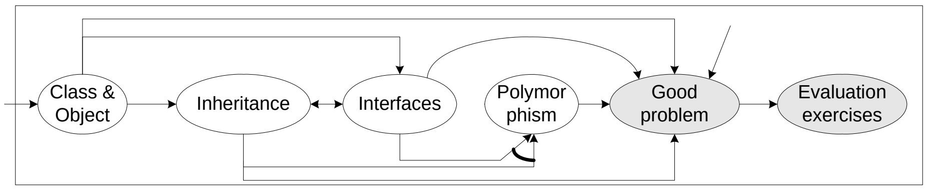

Fig. 1 OOF learning objective.

By way of an example, suppose a group of learners are to be trained in Java programming. We defined a learning objective, called Object-Oriented Fundaments (OOF). Fig. 1 shows the OOF learning objective, illustrating the interrelations between its six SCOs mapped by the and/or graph. Looking at the graph, we find that learners can start with Class & Object or directly get on with the good problem, which is the target of an OR learning sequence. If the learner opts for the first alternative, there are three available learning sequences: after having learned this SCO, the learner can continue the learning process by choosing between the SCOs on Inheritance or Interfaces or tackle the good problem. Examining the and/or graph, it is also clear that there is an AND learning sequence from Inheritance and Interfaces to Polymorphism: the first two have to have been completed before starting on the last.

2.1 Learning objectives and instruction

From the instructional viewpoint, learning objectives include features inspired by different learning theories. On the one hand, they cover the key characteristics of constructivism: the requirement that any learning objective should contain a “good problem”, a meaningful and realistic problem, and that problem solving should be collaborative so that learners learn through interaction with others; and the possibility, albeit with some constraints, of the learner being able to choose his or her own learning sequence to attain the knowledge state provided by a learning objective.

On the other hand, the learning objectives include features proper to objectivism (behaviourism and cognitivism). The very term learning objective indicates that teaching is objective driven and, also, that these objectives can be evaluated, for which purpose evaluation exercises are included. These last two features overcome the most widely criticised drawbacks of using a purely constructivist philosophy, namely, the absence of specific learning objectives and outcomes, leading to an inefficient and ineffective learning process, and the notion of there not being “right” or “wrong” answers, which strikes fear into the heart of an instructor [10].

3. The instructional model based on learning objectives

The e-learning instructional model is based on the fact that training should enable learners to apply the concepts learned and evaluate the methods to be used, which they can judge both qualitatively and quantitatively. This instructional model is composed of five phases: analysis, design, implementation, execution and evaluation.

3.1 Analysis

This phase defines what to teach, and therefore analyses the educational contents to be taught. It outputs the learning objectives with their educational contents and their interrelations. These define the knowledge and skills to be learned and the tasks to be performed to acquire the goal knowledge state. The learning objectives and their relationships are represented by means of a *knowledge graph*. This is an and/or graph. In this case, however, the arrows represent learning objectives learning sequences and the nodes are the learning objectives. The proposed model is an objective-driven instructional model with constructivist learning, giving the learner the chance to choose, subject to some constraints imposed by the content structure.

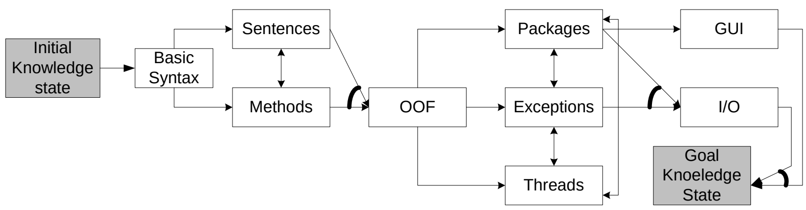

Fig. 2 The knowledge graph for the Java Programming example.

Fig. 2 shows the knowledge graph for the Java Programming example. A characteristic of this particular example is that it has a great many OR learning sequences, which gives the learner greater freedom.

3.2 Design

The design defines how to teach. Good problems are designed for each learning objective as a condition for attaining the target knowledge states. These are problems have to be solved through group work, setting up a realistically complex collaborative learning environment. The aim is for learners to learn authentically through the development of associations between concepts and reflective meta-cognitive processes. Also the problems should be able to be solved in different ways to give learners multiple and alternative perspectives. Evaluation exercises must also be set to assess what knowledge has been acquired.

The learner's learning process is also specified together with the educational activities that will take place within this process, execution criteria and achievement expected of the learner. This instructional model involves a *self-paced learning* approach, which is an interactive mode of learning over the Internet. The self-paced learning process is designed by means of a *road map*, which is a graph that represents and interrelates the learning objectives and their learning objects leading to a knowledge state. The road map can be automatically produced from the knowledge graph by subdividing the learning objectives into their learning objects and adding the good problem and evaluation exercises as shown in fig. 1.

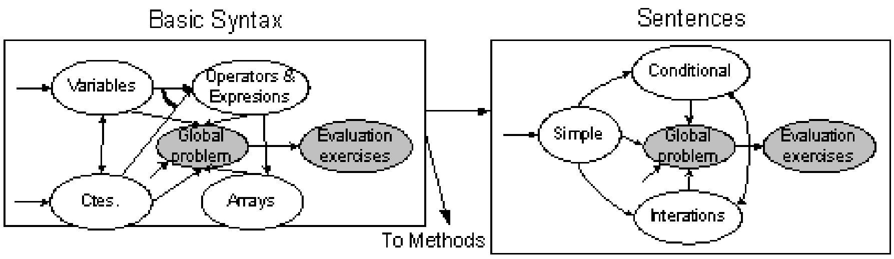

Fig. 3 Road map for part of the Java Programming self-paced learning process.

Fig. 3 shows the road map for the Java Programming example, only covering two learning objectives: Basic Syntax and Sentences. Both learning objectives are included in the knowledge graph shown in Fig. 2.

3.3 Implementation, execution and evaluation

Implementation phase involves building the road map into a learning management system platform at design time. Then, the execution phase involves the learner executing the learning process, providing information on the problems encountered and the knowledge acquired. We have been training Spanish central and local administration computing specialists for over 11 years through the Master in Information and Communications Technologies Management. We first applied classroom learning. Self-paced learning was added over the last three years. From this experience we can say that the proposed instructional model is well adapted to an eight-week course of 80 learning hours (ECTS).

Finally, for monitoring purposes or to determine successes and ascertain the learning product quality, information output during execution is gathered and the results are analysed in the evaluation phase. This information permits to find out whether an educational content learning object should be revised or to ascertain whether any learning objective has been poorly designed.

4. Conclusions

This chapter presents the concept of learning objective, which permits to decompose the educational content into parts: learning objects. Whereas a learning object is a small shareable piece of content that can be learned, a learning objective represents a knowledge state that can be evaluated through evaluation exercises.

Based on this concept, an instructional model for e-learning is also proposed, combining objectivist and constructivist learning theories. From objectivist, we have borrowed the objective driven philosophy. From a constructivist point of view, the instructional model includes so-called “good problems”, which simulate and recreate real-life complexities and occurrences, can be solved in different ways and should be solved through group work to create a collaborative learning environment and give learners access to multiple perspectives. These characteristics endow the model with the four most important constructivist strategies, which are, respectively, authentic learning, active learning, collaborative learning and multiple perspectives.

Taking an approach mid-way between the above two, the design of the self-paced learning process does not lead to a fixed learning sequence as traditional instruction states, nor is the learner given complete freedom to choose his or her own learning route as proposed by constructivism. Nevertheless, the learner does have the chance to choose, subject to certain content structure-based constraints, from a number of learning routes established in the road map.

Therefore, we can conclude that the proposed instructional model translates pure constructivism into moderate constructivism in an attempt to make the most of the benefits of this theory and avoid its drawbacks.

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