

# *A Conceptual Model for Collaborative Learning Activities Design*

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**Abstract**—This paper presents the Advanced Collaborative Educational Model (ACEM) for conception of collaborative learning activities. It is based on collaboration between teachers through virtual interactions, reutilization, interoperability and adaptability of learning activities. The definition of learning activity is oriented to a constructivist approach. Tagging collaboration and ontologies are also considered in order to facilitate sharing knowledge in a more effective and personalized way. The main goal of this research is to describe teachers' procedures when interacting with the collaborative environment and to develop mechanisms to support teachers in their tasks, mainly in the creation of learning activities to be used in an e-learning context. The model will be implemented through a high-level graphical tool that facilitates synchronous and asynchronous communication.

**Keywords**- collaborative learning activities design, learning design, educators' online teamwork, knowledge sharing, graphical tool, tagging.

## I. INTRODUCTION

Nowadays, we witness the emergence of a new generation of learners with different patterns of work, attention and learning preferences [1]. Meanwhile, the innovations and improvements achieved in Collaborative Working Environments (CWEs) applied to educational settings are fostering the scientific research in the design of creative mechanisms in order to promote effective learning. Expressions such as collaboration, cooperation, knowledge construction and knowledge sharing are a common denominator of many recent educational systems. In contrast, there is little research describing models of collaboration between educators. In Portuguese Higher Education Schools, it is common to have different types of classes, such as lecture, practical and/or laboratory classes, assigned to the very same discipline. Consequently, several teachers are allocated and thus some articulation is needed to develop learning activities. Technological advancements foster different types of educator's interaction towards this articulation. Furthermore, the virtual communication brings several advantages, namely no particular time and space constraints. This way, the educational settings have a possibility to vary considerably the traditional face-to-face approach and adapt the curriculum content to the intended pedagogical goals.

The main focus of this paper is the collaborative work between educators supported by a shared virtual environment for collaborative learning activities design. In this sense, the collaboration between eProfessionals is emphasized.

In many organizations, the collaborative work knows a new era (e.g. [14] [15] [16]). However, in the educational sector, this practice between educators has a long way to go. There are several reasons that can be pointed out. Firstly, the educators have in general some difficulty in sharing knowledge and pedagogical experiments. Secondly, the reuse of content material is not yet a common practice. Finally, educators who are excited about new digital technologies are often seen as not pedagogically effective [3]. Caution, time restrictions and curriculum content [2] are some usual justifications for this professional behavior.

We argue that rational planning and logical sequencing of learning activities supported by a collaborative work environment is profitable to educational settings in order to promote sharing knowledge and experiments. To cope with this goal, the proposed collaborative environment is enriched with synchronous and asynchronous communication to share knowledge and resources between educators in an effective way.

Two main research questions that drive our motivation in this work are, on the one hand, to know to what extent a collaborative work system can be more effective compared to the traditional writing of learning activities and on the other hand to study the importance of the online interactions approach between teachers in this context.

Finally, this paper aims to bring out a model for a collaborative work environment to assist teachers to design collaborative learning activities supported by a high-level graphical tool. In terms of communication, synchronous and asynchronous ways are considered. The main ideas that sustain this model are collaboration, reusability, adaptation, collaborative tagging, deployment and orientation to services.

The structure of this paper is as follows. After an introduction of the main research questions, section 2 provides the theoretical background of our research, namely a brief overview of learning design, learning activities' design and computer-supported collaborative work issues. In section 3, we

present our model of collaboration describing its goals and the underlined methodology. The conclusions and future work are presented in the last section.

## II. A BRIEF OVERVIEW OF RELATED CONCEPTS AND WORK

### A. Learning design and e-learning

Learning design can be introduced as follows: "it aims at providing teachers with a framework capable to bridge the gap between rich, descriptive models and technologies, and the everyday practice and understanding of teachers" [7]. It has the potential to go beyond the learning content creation itself and proceed to the "process" of education. In other words, learning design helps to bring to the stage the learning issue while the technological aspects come after. In turn, the contributions of the new technologies to the learning design also need to be underlined once usual teaching-learning methods and pedagogies that were previously taken for granted can now be reconsidered [4].

Another definition of learning design is presented in [9]: "as the application of learning design knowledge when developing a concrete unit of learning (UOL), e.g. a course, a lesson, a curriculum, a learning event". The meaning of learning design knowledge is transmitted by a series of prescriptive rules with the following format: "if situation, then method". The left-hand side of the rule is the learning situation which accommodates the situational factors. The main objectives of these factors are twofold- firstly, they may represent the requirements that any new learning design method has to meet – secondly, they can be seen as descriptors of the situation in which an existing learning design method has been applied. The term situation factors is justified by the assumption that one method may behave best in one situation whereas one other method may behave best in a different one. Learning outcomes and learning conditions are the two subclasses of situational factors. The former is related to the level of effectiveness, efficiency, attractiveness and accessibility of the learning design method. The latter is related to the characteristics of some elements, such as the learning objective (knowledge, skill, attitude, competence), the learners (pre-knowledge, motivation, situational circumstances), the setting (individual and/or group work, work at school and/or work and/or home) and the media (bandwidth, synchronous/asynchronous, linear/interactive, media types) [9].

Concerning the aforementioned learning design method, it describes basically a teaching-learning process. This process has several components, namely metadata, roles, plays, acts, environment, role-parts, sequence of activities and conditions. This conception may be compared to a script of a film or a theatrical play. The comparison is self-explanatory. The Figure 1 presents a structure of a learning design very familiar to e-learning domain.

It is worth stressing that the term learning design is used to describe a learning experience supported by tasks to which students should be engaged to. For example, students may be formed into groups and required to discuss the relations between two given topics; they may be asked to gather some information about a theme and then write a report.

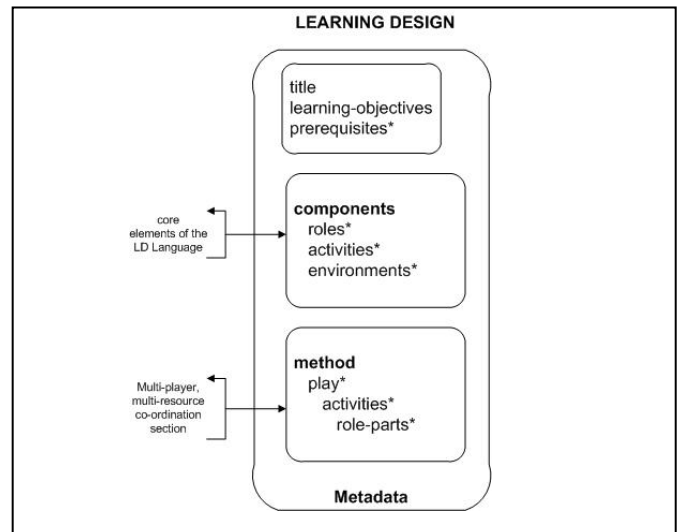


Figure 1. The basic structure of the learning-design (adapted from [20])

Another main issue related to learning design, and e-Learning in general, is the use of standard notations. These notations facilitate searching, sharing and reusing of learning design methods, and consequently promoting accessibility, interoperability and reusability supported by computational systems. One of the most acknowledged notation being used is the IMS-LD specification, or simply LD [5]. Combining all these features, it can be said that learning design offers a new approach to re-use e-Learning [8].

### B. From Learning Design to Learning Activity issue

There is no single definition of a learning activity concept. We believe the following is a good one to frame this issue: learning activity is "a specific interaction of learner(s) with other(s) using specific tools and resources, orientated towards specific outcomes" [4]. Following this definition, an outline for a learning activity is presented in Figure 2.

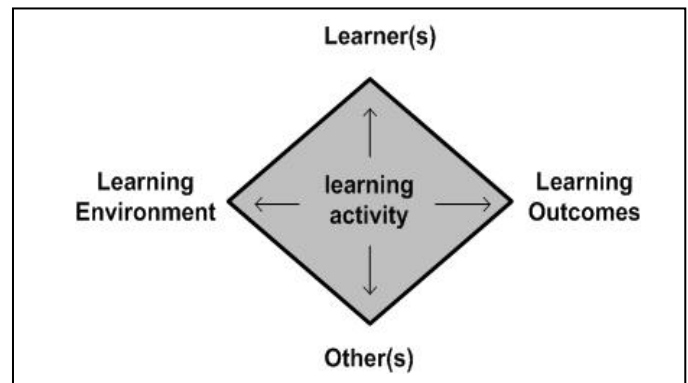


Figure 2. An outline for a learning activity (adapted from[4])

The four components comprise the following elements:

- **Learner(s):** This component combines identities (preferences, needs, motivations), competences (skills, knowledge, abilities) and roles (approaches and modes of participation).

- Learning Environment: The focus are available tools, resources and services. Virtual or face-to-face mode are considered.
- Learning outcomes: It comprises new knowledge, academic and social skills, and abilities.
- Other(s). Other people involved and the specific role they play in the interaction, e.g. support, mediate, challenge and guide.

The acknowledged LD specification for e-learning embraces in its model very similar components and elements.

The range of pedagogical approaches to the learning design process should be of a large spectrum using different perspectives on learning. The Associative, the Constructivist (individual and/or social focus) and Situative perspectives are considered a helpful support to create and sequence learning activities [6]. The learning outcomes to be achieved underpins the pedagogical decisions that educators should reflect carefully.

The outline for a learning activity presented above, underlines the strength of the collaboration process promoted by the interactions between learners. Consequently, different types of problems may be performed, such as abstract, ill-defined and open-ended problems. Furthermore, other learners' skills may be practiced namely the discussion of problems, searching, explanation and evaluation of information in order to construct new knowledge.

In traditional educational settings, some pedagogical methods, namely those based on the constructivist and situative approach, are very difficult to put in practice unless appropriate tools and platforms are available to help teachers in this trend. Through computer supported collaborative learning educators may vary their pedagogical methods and strategies in a very enriched way. These virtual environments allow teacher-student interactions to be more balanced and promote higher levels of learners' attention and motivation as well (cited in[17]).

### C. Collaborative learning

Collaborative learning design emerge from learning design field and in the last decade it has attracted much interest in the scientific community once it can promote high level collaborative environments in educational settings [11]. The main features that drive these environments are the learners-centered approach and the support by learning theories, namely the constructivist branch, which claims that the learner should have an active role in his/her knowledge construction. Consequently, the diversity and nature of learning design have evolved accordingly [12] [13]. On the other side, the technological innovations in different fields of science are fostering the development of dedicated frameworks to assist learners in the development of their skills and knowledge. In addition, we have witnessed the emergence of knowledge communities as well. These communities highlight the collaboration between users and facilitate the development of some active pedagogical methods, for example problem-based learning and inquiry based learning, which are difficult to implement in the traditional classrooms. In this sense, the

steady accretion of different computational systems has been a great help to implement these concerns. CSCL (Computer-Supported Collaborative Learning) systems make part of that group of frameworks serving as a great platform to deal with different models for knowledge creation, accumulation and sharing [10].

The aforementioned issues (knowledge sharing, collaborative knowledge construction, and online communities) should also evolve to learning activities and curriculum design to complement the traditional ways of lessons planning. We advocate that the design of collaborative learning activities endorsed by a community of teachers and researchers from learning and human intelligence fields can bring extra-knowledge combining teaching practices and acknowledged pedagogical methods. We add that this conception goes beyond the CSCL domain and may be framed as CSCK (Computer-Supported Collaborative Knowledge) embracing learning as well teaching issues in collaborative tasks.

In the education area, there is a lot of research in collaborative learning environments supported by computers that promote the creation of learning activities to engage the students in collaborative tasks (e.g. RELOAD[21], CopperAuthor[22], CoSMoS[23], MOT+[24], ASK-LDT[25], COLLAGE[26] and LAMS[27]). Briefly, the first three set of tools are general purpose systems more oriented to LD experts than teachers. MOT+ and ASK-LDT tools provide a graphical representation approach and their audience is also practitioners in LD. With regard to COLLAGE[29] and LAMS, they are graphic-based high-level tools more oriented to help teachers developing collaborative learning scenarios. In general, the reuse and sharing of learning activities are two of the most important features underlined to those tools.

Concerning the interactive design of learning activities realized by a virtual group of teachers, current research is scarce. The features of collaborative work environments that embrace interactive tasks to be performed by e-professionals may vary considerably and some important decisions need to be considered. The type and sequence of steps a group of persons is allowed to perform, the level of adaption, flexibility and personalization one intend to implement, which tools are needed to support the operations inherent to persons' tasks, these are some examples of important issues to reflect. In the case of the education domain, we can also include contextual knowledge, such as pedagogical models to support teachers in the design task. One main research area that deals with these concerns is the computer supported cooperative work, which we introduced briefly in the next section.

### D. Cooperative work supported by computers

The research field of computer supported cooperative work (CSCW) emerged in the 1980s joining researchers from different fields of science, namely computer science, information science and social science. The underlined motivation is to study both how people work and the technology's role in the work environment [18]. In [19] an explanatory description of the CSCW' is presented "CSCW is concerned with understanding social interaction and the design, development, and evaluation of technical systems supporting social interaction in teams and communities – or in other words

it is about researching the use of computer-based technology for supporting collaboration". Following these statements, the CSCW field spreads to two research areas. On one hand, the technology and computer hardware and software and on the other hand, group work and social phenomena [19].

A series of questions are inherent to this research domain, as showed in [28]: "What characterizes cooperative work?; How can we model cooperative work?; Which computer facilities should be provided?; And what are the basic characteristics of useful platforms for CSCW-systems?". The answers are not simple rather very complex depending on the problem we are faced with (see [28] for a good overview).

CSCW technologies are often described by means of a matrix(2\*2) crossing two measures of dispersion: time dispersion (synchronous vs. asynchronous communication) and geographic dispersion (distributed actors vs. non-distributed actors). Concerning synchronous communication, several facilities can be considered, for example: shared whiteboards, video conferencing systems, collaborative writing systems, chat rooms. Some current examples for asynchronous communication are e-mail and forum services.

Different approaches can be found in this field concerning the type of formalization and implementation we need to. It can vary from a more formal construction of a system (Distributed Artificial Intelligence scope) to a more informal approach (Cooperative-Supported Collaborative Work (CSCW) scope). These mainstreams have different requirements and goals, which should be considered carefully.

In the next section, we describe the main features of ACEM which comprises several aspects of the mentioned issues introduced in this section.

### III. THE ACEM MODEL

#### A. The context

In Portuguese Higher Education Schools, it is very common the classification of classes into different types, namely lecture, practical, laboratory and tutorial class. These formats are not fixed and they can vary slightly from discipline to discipline, and from educational institution. Furthermore, the very same discipline may have one or more teacher responsible for all teaching-learning activities, namely the preparation of curriculum content, the pedagogical methods to be applied, the assessment component, the needed resources, the type of tasks to engage learners in their learning, among others. Moreover, the coordination of the educators' work intra discipline context is not a simple task. For instance, it is necessary to examine whether a learning activity designed by a group of teachers with responsibility for a practical class do not enter in conflict with other learning activities proposed by other group of teachers that are teaching the same discipline but with responsibilities for other type of classes.

#### B. Description of goals

The main goal in our research is the design of a collaborative work model (ACEM) to support online interactions between a group of teachers using synchronous and asynchronous facilities. The collaboration aims at facilitating the interactions between teachers during the

learning design process. To achieve the above goal, some tools are considered, namely a specialized shared whiteboard to support the creation of learning activities. In addition, a chat room and a forum facility are also planned in order to promote easy exchange of point of views between all participants in the design task.

A list of sub-goals is now presented:

- The development of an educational system more specifically a high-level collaborative graphical tool. This authoring environment owns several facilities, namely a specialized shared whiteboard to assist teachers in their learning design tasks.
- The conception and maintenance of a digital repository to keep educational resources (Educational Resources Repository – ERR), namely learning activities, multimedia elements (e.g. texts, graphics, images, videos).
- The conception and maintenance of a digital repository to keep learning activities templates. These templates should follow good pedagogical methods that teachers may reuse to develop their own designs.
- The construction of a searching mechanism to allow teachers to seek learning activities as well as educational resources based on a multi-criteria process. To accomplish this goal, tags and domain ontologies will be considered in order to achieve a more efficient recovery of learning designs. The tags are written by teachers. This information aims to reflect teachers' experience in the teaching-learning process.
- The creation of a tool to translate the learning activity design to an intermediate language. From this point, other tool is envisioned to produce the translation of the learning activity written in that intermediate language to a e-learning specification.

An overview of ACEM is presented in Figure 3.

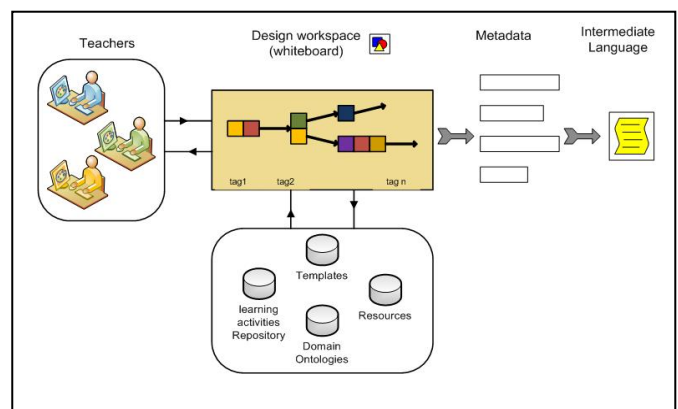


Figure 3. An overview of ACEM

Following these ideas, we present a model for conception and implementation of collaborative learning activities based on several requirements, namely collaboration between teachers and instructional designers, reutilization and

classification of learning activities. The model will be implemented through a high-level graphical tool.

Some features of this graphical tool need to be accomplished, namely the design of learning activities should be intuitive, adaptive, easy to develop and supported by good teaching-learning practices. Furthermore, the automatic translation of the learning design final product will be realized to an intermediate modeling language, to be defined, focused on specifications but at the same time, maintaining some independence about them. An additional tool will be devised in order to create the final translation of the learning activity design based on the output of intermediate language phase. Concerning this issue, the well-known IMS-LD specification and the SCORM (Sharable Content Object Reference Model) reference model are both highlighted.

To facilitate searching and maintenance procedures of a repository of learning activities and resources, tagging collaboration and ontologies are considered. The former allows a practical human contribution based on the experiences of the teachers. The latter consists of a very important framework to represent entities and their relationships, and consequently, useful to produce new knowledge to help in this trend.

As mentioned before, our model is sustained in a set of ideas that we believe they are relevant for a collaborative learning environment oriented to teamwork between educators.

### C. An example of use

Firstly, any teacher who wants to enter into the collaborative system needs to make his/her registration. Then, a form will be showed. After filling out the presentation form, the next step is the validation and confirmation phase. The system uses an authentication procedure providing different roles for accessing data. After that, the teacher can now proceed to the login phase.

At this moment, the teacher can begin by checking who is logged on. We believe the meetings will be schedule in advance in order to initiate the intended cooperation. Nevertheless, this procedure is flexible and a teacher may decide to begin her/his task whenever s/he wants.

The chat tool will facilitate the verbal communication between teachers promoting an important support to their design decisions. From this point, several situations can occur, namely:

- The teachers may prefer to seek a learning activity design that fits their requirements and then adapt them as they want to. A set of meaningful words can now be entered through a text field. A search procedure will return the learning activities, if any, more suited to the mentioned requirements.
- The teachers may prefer to work on a shared template. This method allows to scaffold the teachers' work.
- The teachers may choose to initiate their work from scratch and then produce their own learning activity design.

After finishing the design of learning activities, the final design may pass or not through a process of validation. To do this step, it may be needed that a teacher responsible for a given discipline examine the final design in order to be more effective the coordination between classes (that is, lecture, practical and/or laboratorial one).

The final step will be the translation and deployment of the final design to an e-learning specification. We are considering the IMS LD specification.

## IV. CONCLUSION AND FUTURE WORK

In this paper we present a collaborative model to learning activities design. The main features of this model were introduced underlining the importance of the online interactions approach between teachers. The definition of learning activity is centered in the constructivist approach and tagging collaboration and ontologies are also considered in order to facilitate sharing knowledge in a more effective and personalized way.

This research aims to describe teachers' procedures when interacting with the collaborative environment and to develop mechanisms (i.e. tools and procedures) to support teachers in their tasks, mainly in the creation of learning activities to be used in an e-learning context. The informal online interactions between teachers are underlined. The implementation of the ACEM model will consider the use of web service standards in order to fulfil all the needed requirements for this model.

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