

The Potentiality of the Teaching-Learning Objects (T-LO) and Teaching-Learning Virtual Environments (T-LVE)

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Abstract—The pedagogical mediation in Distance Education (DE) is supported by principles such as interaction, cooperation and autonomy. We have investigated the potentiality of the hypermedia T-LVE and in the T-LO, utilized to implement these pedagogical principles. The Meaningful Learning Theory categories have been methodologically chosen to analyze the elaboration and implementation process of potentially meaningful didactic materials with interactive tools like Lesson (Moodle module) and Articulate Present/Quizmaker (integrated to Power Point). The theoretical-methodological results about the methods and tools of content adaptation in T-LVE and T-LO clearly demonstrate the presence of the hypermedia character in these resources. We highlight that these interactive tools allow the systematized elaboration of hypermedia didactic materials. The Lesson and the Articulate provide connection between technological mediators, pedagogical principles and curricular contents. T-LVE and T-LO became potentially meaningful due to a didactic-methodological plan that includes progressive differentiation, integrative reconciliation, sequential organization and consolidation of the curricular contents.

Index Terms—hypermedia materials, teaching-learning objects, virtual environments, meaningful learning.

I. PEDAGOGICAL MEDIATION IN DE

Distance Education (DE) is constantly characterized considering the space and time distance between students and teachers [3; 19; 20]. In this modality the flexibility and elasticity of synchronous and asynchronous interaction in the trajectory between the didactic and learning timing create new references for the teaching and learning work. While a modality of its own characteristics, it implies the establishment of new fields of research concerning institutional, management, methodological, communicative, and supervisory and tutorial systems, as well as the financial technological and pedagogical aspects.

In DE the multiplicity of the mediation is a composition of pedagogical concept, education contents, levels of management autonomy, intrinsic competencies and motivations of the actors involved. The teaching-learning process is the result of constant steps in elaboration, implementation and evaluation of the pedagogical strategies localized in didactic.

DE creates a continuous alert situation both for teachers and students in so much as each is required to be available for action and to show high levels of responsibility with

regard to the objectives to be realized. The satisfaction or frustration indexes a proportionate to the capacity of moving within this new scenario reorganizing the modes of being, teaching, learning, interacting, evaluating and cooperating.

The references of theoretical-methodological framework and face-to-face practice are not sufficient to support the meanders and tonalities of the DE know-how. The mediators are no more the blackboard, the school desks, the chalk and the printed book. The space-timing of the interaction is no longer set only in meetings with the previously scheduled dates and time-tables for all of the group components. In DE the human and not human mediators [13] generate a series of happenings that imply in an emerging reorganization of the teaching function.

The teaching performance in DE initiates new modes of creation, of sharing knowledge, collective proposition and resolution of problems. In the place of the classes individuality, shared with the students only in the face-to-face mode, the pedagogical mediation at distance implies in: a) conceptual maps and previously organized planning and b) didactic materials supported by different interferences within the scope of a multidisciplinary team.

In team work, the pedagogical knowledge is blended with the contents of each specific area. It becomes apparent, therefore, that there are different approaches of getting closer or far away for each of successive steps of revision of text and didactic-methodological activities for seen in the mediation.

The didactic materials acquire hypermedia characteristics when they become programmed like T-LO and available in T-LVE within the possible virtual environment activities. These activities are hypertexts, animations, simulations, illustrations, internal and external links, glossaries, lessons, tasks, forum, chats, videos and curricular objects that consist in didactical sequencing of the specific course program units [28].

In this university lecture innovation scenario, pushed on by DE, one of the actual challenges is to guarantee quality, this means to guarantee meaningful potentiality of the hypermedia pedagogical mediation. The didactic-methodological elaboration of these mediations deserves inquiry about the process of technology selection and material production in the multidisciplinary teams.

II. T-LVE: ELABORATION OF DIDACTIC MATERIALS IN MULTIDISCIPLINARY TEAM

The expansion of DE in the national and international scenarios raises ever more discussions about its interdisciplinary character. The historical progress indicates that the process of teaching-learning in this modality has been changed and perfected as a consequence of the use of information and communication technologies.

After the arrival of Digital Communication Technology (DCT) the virtual interaction generates a series of interferences in the pedagogical mediation. The dynamicity of elaboration, dissemination and management of the scientific and educational knowledge creates hereto unknown conditions for the process of teaching-learning augmented of hypertextuality and hypermedia. This multidimensionality increases the senses and meanings both of written as well as visual culture [6]. The elaboration of hypermedia didactic materials is contextualized by the urgency of the informatics cultural implementation within the scholar spaces and the scientific-technological education. The didactic transposition [8] in the scope of the insertion of TCD in pedagogical mediation is a challenge for higher education and extends to the lowest education level. This became evident in the public policies.

Besides providing a fast dissemination of didactic material and information of interest to the country, teachers and students, the new technologies allow among other possibilities – the interdisciplinary construction of information produced individually or by a team of students, the collaborative development of projects by geographically dispersed students and the exchanges of didactic projects between educators from different regions of the country. As the network transmission speeds are increasing, new educational applications became more viable, for instance virtual laboratories [27].

In DE the pedagogical mediation optimized by DCT is organized specially around the tools available in the Learning Management System (LMS) [31] renamed by us as Teaching-Learning Virtual Environments (T-LVE) [7]. An T-LVE always includes the intentional organization of didactic materials and teaching-learning activities in line with different digital communication tools. The synchronous and asynchronous interactions fulfilled the pedagogical proposal defined for a given course or a formally installed program [16]. The organization of teaching-learning situation and their respective didactic materials and the T-LVE complies with the necessary converging between the pedagogical concept, the object to be study and the methodological process.

The technological development permits the increase the distance educational systems through the interaction tools of the T-LVE, videoconference, reutilization of T-LO, intelligent systems and wireless equipment. This differentiates structurally the e-learning from models based exclusively on printed communication.

In the present context of the development of DCT principally of those of T-LVE the pedagogical mediation acquires new meanings. [6]. One of the major challenges is represented by the elaboration and implementation of teaching-learning strategies that include the potentialities of synchronous and asynchronous interaction available in the T-LVE. When the didactic materials concentrated in

the printed model, principles such as interaction, autonomy and cooperation loose space weakening distance communication. These principles, largely discussed in DE, as in the Transactional Distance Theory of Ref. [19], acquire a new impulse when the pedagogical mediation is supported in interactive tools available in T-LVE.

Therefore, the pedagogical mediation requires from teachers and instructional designers and performance guided by political, didactic, scientific and ethical dimensions within the scope of multidisciplinary teams [15]. They are the ones that create and extend the teaching action to materials and activities in T-LVE planned in line with the pedagogical postulates and the content of priority. A didactic-methodological performance of teachers and instructional designers is a key element to be analyzed when the signification and the potentiality of the distance modality is investigated.

The pedagogical investment is high in each of the steps of elaboration of didactic material which may be potentially meaningful. Within the multidisciplinary team the steps of the progressive differentiation and the content sequencing, the revision of texts, the creation and adaptation of illustrations, elaboration of aims, frames, abstracts, maps, glossaries, consolidation activities, are successive and strategic. A junction between proposed principles in the pedagogical project, the disciplinary contents, the educational policies, the technological resources and a references practices of actors involved take a considerable time for maturation and possible re-programming. Teachers and instructional designers plan, create, develop, implement, revise, supervise, and re-plan the didactic materials and activities for T-LVE successively. An educational work with many of cycles, which is constantly re-supplied, and differentiates itself from the face-to-face communicative movement.

The process of elaboration of the didactic material for DE includes the dynamics of didactic transposition sustained in the collectivity of authorship within the multidisciplinary team. The interferences of each member generate permanent cycles of the assimilation, accommodation and re balancing in the text produced by many authors.

The instructional designer [24; 25; 20; 26] acts within the multidisciplinary team interfering directly in the creation of the didactic-methodological strategies, selection of the content, organizational of supplementary items, proposals of the interactive activities, evaluations, and creation of animations. The International Board of Standards for Training, Performance and Instruction [11] published a list of twenty two competencies considered essential for those ho act in the planning of didactic materials, elaboration of projects, identification of the environment characteristics and the public to be reached, selection of technologies, creation and evaluation of distance educational products.

The instructional design understood as a process, discipline or science[5], involves beyond planning, preparing, projecting, producing, text producing, images, graphics, sounds and movements, simulations, activities and tasks related to an area of study – major personalization of individuals styles and rhythms for learning, adaptating to institutional and regional characteristics, updating and constant feedback, access to

external information and experiences for the learning organization, and favoring also the communication between process agents (teachers, students, technical and pedagogical team, community) and electronic supervision of the individual and collective and construction of knowledge [30].

The multiplicity that characterizes the process of the didactic materials elaboration for DE compromises the multidisciplinary team from the selection of priority concepts until their implementation. The pedagogic design of the didactic material that takes in consideration the previously knowledge of the students and principles such as progressive differentiation; integrative reconciliation; sequential organization and content consolidation; [4] requires ontology within the team itself. The heterogeneity and multireferentiality originating from the different professionals involved in the elaboration teams augments the challenges of the didactic transposition. The necessary harmony for proposing problems, reflections, case studies, exercises, auto-evaluations and T-LO [9] demands a certain time for interaction. One performance grown under the light of sensible listening exercises, decision taken, mobilization of knowledge and the propulsion of new action.[15].

The variety of tools is available in the T-LVE as a strong partner in principles such as autonomy and cooperation in the pedagogical mediation at distance. These tools potentialize the didactic materials activities unmystifying of the digital didactic book. The T-LVE includes the hypermedia and the hypertextuality as characteristics which are specific to the T-LO conditioning. Flexibility in the access to and revision of contents of the activities in harmony with the previous knowledge of students made the T-LVE potentially meaningful.

III. POTENTIALLY MEANINGFULL T-LO

The analysis of meaningful potentiality of T-LO makes it necessary to identify the origin and the meaning of the term. This new definition derives from different terminologies already in use: "learning objects", "knowledge objects", "objects teaching", "objects intelligent", "objects instructional" [10] and "schools objects"[1]. The emphasis in introducing the term "Teaching" in the T-LO, as well as in the T-LVE, shows the presence of the instructional character in these resources elaborated with didactic-methodological intent. This intent characterizes these objects as belonging at the same time to teaching and to learning. Their conception in this manner has implications in the selection of technological tools used for their evaluation, development and implementation.

Ref. [17] calls the T-LO "knowledge objects" defining them as "containers consisting of compartments (slots) for different related elements of knowledge". (p.402). Furthermore, for the author a Knowledge Object is an assembly of knowledge components. These components are a "set of defined containers for information" [18]. Ref. [10] use the terminology "instructional objects", defining them as any element, of architecture for model-centered instructional products, that can be independently drawn into a momentary assembly in order to create an instructional event. Instructional objects can include problem environments, interactive models, instructional

problems or problem sets, instructional function modules, modular routines for instructional augmentation (coaching, feedback, etc.), instructional message elements, modular routines for representation of information, or logic modules related to instructional purposes (management, recording, selecting, etc.).(p.5).

Ref. [29] talks of "Learning Objects" (LO) defining them as "elements of a new type of computer-based instruction grounded in the object-oriented paradigm of computer science". The contribution of programming oriented towards the object is its most value fundament: the re-using of objects in different contexts. "This is the fundamental idea behind learning objects: instructional designers can build small (relative to the size of an entire course) instructional components that can be reused a number of times in different learning contexts". (p.1)

The LOs are generally defined as digital methods for distribution to all the entire internet. This differentiates them from traditional instructional media (such as the video band, or a printed book) due to the possibility of simultaneous use by thousands of persons. In resuming the definition of LO, Ref. [29] considers that they are "any digital resource that can be reused to support learning". On the other hand, the Learning Technology Standards Committee defines the LO as "any entity, digital or non-digital, that may be used for learning, education or training".[23].

Differently from a LO, that may have expressly informational function on a given matter, a T-LO is a didactic material always with a specific educational function. This means that besides defining the approach of a concept, a meaningful potentiality of T-LO makes it possible to have a solid connection between the concepts that the students already knows and those that it is pretending to teach. A T-LO is inserted in the context of a specific course present at a given moment on the learning path, with a defined pedagogical intention, with well outlined assumptions, in view of a given Instructional Project (IP).

The meaningful potentiality of T-LO resides in the cognitive interaction that is established from its elaboration until its use. Ref. [4] state that the assimilation, while an essential category of the meaningful learning theory, implies in the establishment of new meanings by interaction of the new knowledge with the concepts and the propositions learned beforehand. The essence of the assimilative process is in the construction of an "interactional product" (meaning) which comes from this interaction between the new knowledge and of relevant aspects of the previous cognitive structure.

The theory of meaningful learning has permeated the creation of T-LO. In this theory, the didactic materials are unconditionally co-responsible in the success of meaningful learning. In the same manner that the disposition of the students is seen as a condition for learning, the cognitive organization of the materials is an absolutely necessary attribute in the pedagogical mediation.

For the instructional point of view the theory of meaningful learning makes large contributions for DE [12]. The postulates of the progressive differentiation; integrative reconciliation; sequential organization and consolidation of curricular contents are especially important for elaboration of T-LO.

The learning process for Ref. [4] consists in the approximation that the new concepts establish with the knowledge structure already owned by other students, and called subsumptions. "The subsumption is a concept, one idea, a proposal, already existing in the cognitive structure, capable of serving as an anchor for new information, in such a way that this becomes meaningful for the individual [i.e. that he has conditions to attribute meaning to this information]". [21].

In view of this concept the potentiality of T-LO and the previous knowledge of the students are supported by Ref. [4] and are especially important in pedagogical mediation for DE. The modern theories of instructional design can find echoes and postulates in learning theories that inspire the elaboration of potentially meaningful T-LO.

The T-LO together with the T-LVE represents a promising prospecting for pedagogical mediation at distance. In addition to attributes such as reusability criteria and parameters of adoption may be established to the different contexts and demands covered by DE.

IV. PLANNING AND DESIGNING THE T-LO

The process of elaboration of didactic materials, within the scope of development and implementation of T-LO, requires analyses and theoretical-practical reflection on the methods and tools for adoption of contents. This is a territory composed by the entwining of teaching theories, learning theories, models of instructional *design*, didactics models, pedagogical orientations, technological resources and infra-structure. The elaboration of potentially meaningful T-LO constitutes a challenge for the multidisciplinary teams involved in the production of didactic material for DE.

Furthermore, the team that elaborates this didactic material should also care for the essential steps that precede the development and the implementation of T-LO. In this case, the thought focused on the meaningful potentiality of learning results in the definition of two important steps: the **Planning** and the **Design** do T-LO.

A great variety of technological tools may be used for the elaboration, development and implementation of T-LO. Among these, the option falls on analyses of the tools Lesson and Articulate Presenter. These applicatives permit the systemized elaboration of didactic materials proportioning a junction between available technological resources principles of the pedagogical project and the specificity of curricular contents.

A. Planning

In this step, for elaboration of potentially meaningful T-LO it is necessary to include them in the planning for posterior designing. The Planning is based on the identification of what we call Macro Vision composed of three fundamental elements related to a specific course:

- Pedagogical Project (PP) of the course.
- Conceptual Map (CM) of the discipline or of the course.
- Teaching Plan (TP): objective of the course, summary (structure), methodology, activities and evaluation.

In the Planning of the potentially meaningful T-LO, these three fundamentals elements converge with the four meaningful learning principles: progressive

differentiation, integrative reconciliation, sequencing and consolidation.

B. Design:

Is the step that occurs only after establishing the information included in the elements of the course and the identification of the pedagogical intention based on meaningful learning, the potentially meaningful T-LO may be design. For the realization of this design it is necessary to construct the specific instructional elements comprehending the Micro Vision. These are:

- Conceptual Map of T-LO (T-LOCM).
- T-LO Plan (T-LOP): instructional objective and methodology of the T-LO.
- Storyboard.

When the T-LOCM is the first instructional element to be developed in the elaboration of a T-LO a global panorama of concepts to be prioritized is obtained [22]. This panorama is in accordance with the Macro Vision structured on the planning step. The construction of the map (conceptual structure) helps in the posterior definition of instructional aims of T-LO. The methodological definition is also in argument with the Macro Vision. These instructional elements become the key for elaboration of the storyboard of the T-LO permeating pedagogical and conceptual question pertinent to the Instructional Project.

In the elaboration of the *storyboard the conceptual organization prioritized in the T-LOCM* is taken into consideration as well as the pedagogical definitions of the T-LOP. In this manner the storyboard becomes an instructional element that permits to take into consideration the four principles of meaningful learning. The design of the T-LO elaborated of the storyboard in function of the aspects defined in the Macro and Micro Visions becomes a central element for the dialog on T-LO within any multidisciplinary team involved in its development. In as much as the T-LO is developed in accordance with each of the elements defined in the T-LOP and T-LOCM, reworking and reprogramming are less frequent.

The analyzes with regard to different elaborations of T-LO aiming at meaningful potentiality, is based on two cases of different courses developed with the support of technological tools Lesson and Articulate Presenter. The instructional elements of the Instructional Project (PP, CM, TP, T-LOCM e T-LOP) are different in the two examples in as much as two courses are involved.

In the elaboration of the *storyboard* of both T-LO it was necessary to obtain the understanding of possibilities of interaction and the flow of information in using the technological tools selected. Although the courses had their particularities and also the use of their specific tools, both T-LOCM where constructed on the bases of the same informational flowchart offered by the technological tools:

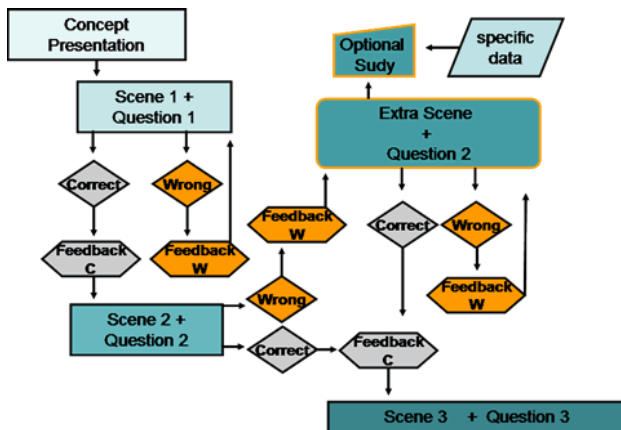


Figure 1. Flowchart-guide for help in the design of potentially meaningful T

It was necessary to elaborate the flowchart in order to observe and understand the possibilities of sequencing the T-LO explaining their meaningful potentiality:

- 1) Concept Presentation.
- 2) Scene 1 and interaction 1 (question).
- 3) Feedback for desired result in suggested interaction 1.
- 4) Feedback for undesired result in suggested interaction 1.
- 5) Scene 2 and interaction 2 (question).
- 6) Feedback C for desired result in suggested interaction 2.
- 7) Feedback W for undesired result in suggested interaction 2.
- 8) Extra Scene with additional possibilities of study and again interaction 2.
- 9) Repetition of feedback for the desired result in suggested interaction 2.
- 10) Different Feedback W for undesired result in suggested interaction 2.

The elaboration of informational flowchart of technological tools permits the comprehension of their proximities and distances of the institutional elements defined in the Macro and Micro Visions of the Planning and Design of the T-LO. In considering the four principals of Theory of Meaningful Learning in the design of a T-LO suggests as strategy the elaboration of some questions whose answers are useful in the orientation and definitions instructional elements:

I – Focus on **progressive differentiation** (inclusive concepts or ideas).

- What concept was used in the T-LO that precedes the actual T-LO? The concepts that precede the Scenes 1, 2 and 3 have inclusive ideas?

II – Focus on **integrative reconciliation**. Correlation between ideas and scenes.

- Are the concepts used in Scenes 1, 2 and 3 minimally related with the previously presented concepts?

III – Focus on **sequence**.

- Are the concepts and interactions used in Scenes 1, 2 and 3 following the sequence designed in T-LOCM?

IV – Focus on **consolidation**.

- Are the Scenes 1, 2 and 3, evaluation questions, feedbacks and Extra Scenes suitable within the aims and methodological strategies designed in T-LOP?

The elaboration of these questions after the organization of the *storyboard* it is useful for the evaluating step from the Planning and Design constructed within the multidisciplinary team.

V. THE EXPERIENCES: LESSON AND ARTICULATE PRESENTER/QUIZMAKER

A. Lesson

The Lesson is a module tool integrated in Moodle platform (Learning Management System). This tool permit the elaboration of T-LO aggregating hypertexts, multimedia materials, videos, animations, images, links, Power Point or Open Office presentations, create navigation panels, evaluate answers, generate written reports and detailed log statistics, time logged in and students performance.

Planning and Design are indispensable to create a T-LO using the Lesson tool. The instructional aims and the methodology in the T-LOP that are defined by principles that orientate the selection of the prioritized concepts in Macro Vision are highlighted in the T-LOCM. Without these aspects previously defined, the creation process of the lesson turns hard working and expensive for the multidisciplinary team. The Lesson tool in Moodle allows the elaboration of the sequencing of contents and activities, which the didactic-methodological character can be defined under the light of principles of the: PP, CM and TP. With this tool it is possible to elaborate T-LO characterized for a didactic transposition which takes in consideration the particularities of the context and individuals. The possibility of the reconfiguration of each one of the navigation pages permits that the contents and the materials admit changes and adaptations contributing to fortify aspects like reusability of the T-LOs.

The indicators of some experiences sinalize that the creation of T-LO using the Lesson implies in the necessity of the precede steps of Planning. To exemplify, some screenshots of a Lesson are presented. The Lesson was created on the legislation subject in the course “Licenciatura em Física na Modalidade a Distância”. In this case the methodological steps that orientated the elaboration of the Lesson in sequence are highlighted in accordance to the informational flowchart that the tool permits.

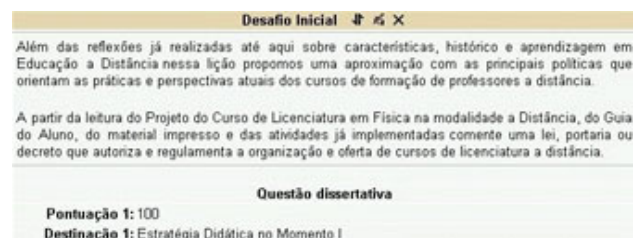


Figure 2. Scene 1 of the lesson – Inicial Chalange

On the Figure 2 the image is presented in the beginning of the Lesson which is proposed for the students. Which is

in the methodological moment called *Inicial Challenge* according to Ref. [14]. The path of the Lesson starts with one question to be answered by the students in accordance with their previously knowledge, or subsumptions, that already have on the subject and concepts that are focalized. All the answers stay registrated allowing for the teachers the access for the elaboration of a good diagnostic about the learning conditions of the students before them made new activities or readings. Wherein, in this case, it was used a question that demands only in this case, it was used a question that demands only dissertation the imediate feedback wasn't chosen as a configuration option.

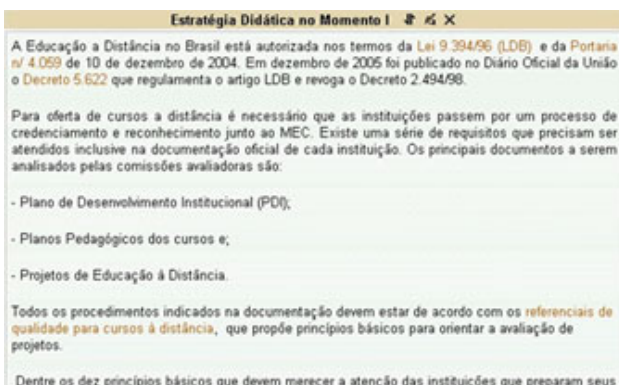


Figure 3. presents the sequence of the lesson

in the methodological moment called *Didactic Strategy in the Moment I*. This is the step in which the lesson path already verticalize the discussion around the theme and the concepts proposed to be studied. The Lesson is composed of various moments that can be grouped in I, II, III in accordance which already showed in “destinação” of the Figure 4.

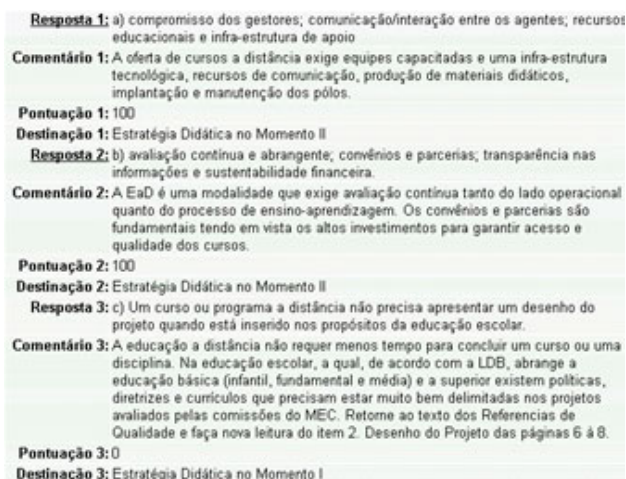


Figure 4. Questions of the Scene 2- Didactic Strategy in the Moment I

The “in the moment”, methodologically used as a didactical strategy, it is consonant with the T-LOCM and predetermined objectives in the T-LOP. Another didactical strategies are also elaborated when emerge different conceptual maps and objectives defined by the Planning and Design of the T-LO.

For each one of the answers from the questions like Multiple Choice, True/False, Short Answer, Numerical, Matching or Essay is elaborated one feedback accessed immediatly by the students in accordance of the

Comments 1, 2 and 3 of the Figure 4. That permits mobility inside the lesson comprehending their proper learning movement and extreme situation in front of the used concepts. Within the feedbacks, alternatives of extra materials are also elaborated to be complemented for the themes and concepts that can be accessed by students in the case if they felt difficulties on chosen the write options from the presented question.

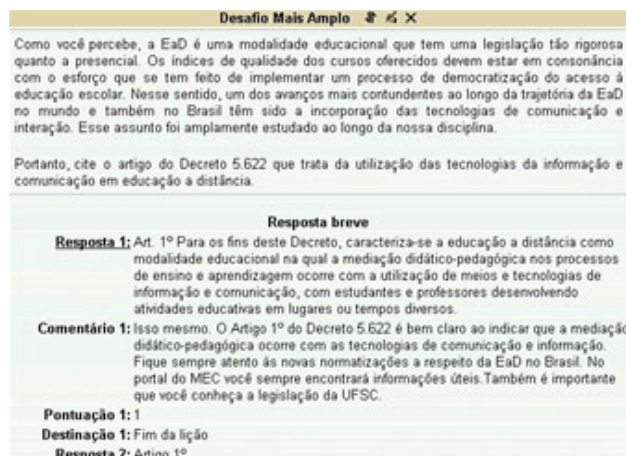


Figure 5. Scene 3 of the Lesson – Wide Challenge

The Figure 5 presents the methodological moment that finalizes the lesson, called “*Wide Challenge*”. The elaboration of this step have the focus on consolidation of the knowledge. Before finish the lesson path students elaborate synthesis from the concepts studied. And so on, short answer questions can be proposed which the answers will be registered and accessed posteriorly by the teacher. In this moment is analysed, in accordance with the students answers, if the didactic strategies in the previous moments contributed for the learning of the students.

B. Articulate Presenter authoring tool

The T-LO developed with the Articulate Presenter tool, software integrated to Power Point, also need to have the steps of Planning and Design. The Articulate Presenter is a software that enables to convert files from Power Point (.ppt) to files in the animated format (.swf). The advantage of this is that to elaborate a T-LO animated with a given screen and interaction sequence, it is not always necessary to have an animation program specialist participating. In this manner the Articulate, with Power Point, may be used as an authorship tool, facilitating the planning, the designing and, consequently, the development and implantation of the T-LO.

The context of the course in which this TL-O was developed is the entrepreneurship. An automobile company requested in the DE modality, entirely e-learning, for the post-sale sector (salespeople of distributors or representatives). This course aimed to motivate these salespeople to buy the solution Trip Manager from the construction of meanings related to the quality of the product, besides the technical knowledge. This solution consists in the electronic monitoring of truck transfers. The course is composed of various steps, of which the first one is called "Ambientação" - adaption in the environment -, and the second one is called "Lesson 1 – Introduction" (Figure 6).



Figure 6. one of those Scenes of T-LE Lesson 1 – Introduction (previous presentation of the concept “quality”)



Figure 9. Scene 2 of OEA “Lesson 2 – The Trip Manager Technology”



Figure 7. Presentation of the T-LO Concept "Lesson 2 - Trip Manager Technology" (the saving of the "quality" concept)



Figure 10. Scene 3 - Feedback W

The T-LO chosen (selected) for the exposition in this article was the third step of the course called "*Lesson 2 - Trip Manager Technology*" (Figure 7). After the design of the object of Lesson 2, from the flowchart-guide and the creation of the storyboard, the experience resulted in a T-LO potentially meaningful, when analyzed on the basis theoretical suppositions of the Meaningful Learning and when compared with the T-LOs of the course.



Figure 8. Scene 1 of OEA “Lesson 2 – The Trip Manager Technology”

VI. FINAL CONSIDERATIONS

One of the biggest challenges in DE is the elaboration and implementation of hypermedia materials because of the strong influence of the face-to-face educational practice that was essentially characterized by the model of the didactical printed book. When proposing T-LO and activities in T-LVE, the teachers and students actions are underlined by synchronous and asynchronous interactions, and by an investigative, autonomous and cooperative profile. The hypermedia character of T-LO and T-LVE transposes the traditional linearity and the chronological organization and imposes one communicative and collaborative movement at the virtual environment.

Initially, in this article the discussion was about the tonalities of pedagogical mediation in DE in a context, in which the implications of digital communication technologies are ever more emerging. The tasks of the teachers acquire new outlines and perspectives within the scope of multidisciplinary teams which elaborate and implement the didactic materials. The communication

between teachers and students about the knowledge that needs to be taught and learned is supported by pedagogical strategies created in the printed didactic materials and T-LVE.

In this scenario a reflection is prioritized about the meaningful potentiality of the (T-LO) elaborated with technological tools Lesson (Moodle module) and Articulate Presenter (integrated to Power Point). The materials developed in both of the tools, one an *open source* and the other one a proprietary, may be used in a T-LVE to increment the steps of synchronous and assynchronous interaction. in the pedagogical mediation at distance.

The presentation of two examples of T-LE created from the emphasized tools signalizes the necessity of successive steps of planning, implementation, observation/record, evaluation and re-plannings. The design and development of a T-LO require actions of the multidisciplinary team supported by two plans: a) Macro Vision that involves the pedagogical principles of the Course Plan, the Conceptual Map and the Teaching Plan of a given discipline/course and b) Micro Vision, that referes to the specific instructional elements like the Conceptual Map of the T-LO, the Plan of the T-LO with the objectives and methodology and the storyboard. Starting the development of a T-LO without accomplishing these steps implies in risking the generation of material that does not attend to the specificity of the principles of progressive differentiation, integrative reconciliation, sequencing and consolidation that support the theory of meaningful learning.

The methodological orientation from theories like the didactic transposition, the meaningful learning and the instructional design has much to contribute in the process of didactic materials elaboration, specially the elaboration of T-LO and pedagogical mediation in DE. The didactic-methodological performance of the teachers and instructional *designers*, within the scope of multidisciplinary teams divides itself in joining plans, that demand **autonomy** for a potency of action, **desire** of intrinsic motivation that leads to action, **competency** in mobilizing practical know-how, synchronous and assynchronous interaction, hypertextuality and hypermedia for a flowchart.

T-LVE and T-LO became potentially meaningful due to a didactic-methodological planning that **meets the requirements** of the progressive differentiation, integrative reconciliation, sequential organization and consolidation of the curricular contents. The T-LO conceptual structuring and didactic-methodological interactive modeling and the hypermedia materials available at T-LVE imply on: a) constant dialogue about interaction, collaboration and autonomy in T-LVE and T-LO; b) utilization of workgroup tools, lessons, hypertexts, media library, glossaries, simulations, animations, tools to publish tasks; c) use of e-mails, questionnaires, instant messages and virtual tutorials connected to T-LVE. All these items speed up the teaching-learning process **assuring** more **rapidity**, flexibility and systematization of the didactic materials and study activities, producing learning movement and collaborative practical tasks.

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THE POTENTIALITY OF THE TEACHING-LEARNING OBJECTS (T-LO) AND TEACHING-LEARNING VIRTUAL ENVIRONMENTS (T-LVE)

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