GUIDELINE THAT WILL BE ADOPTED IN THE LEARNING PROCESS AS WELL AS IT WILL BE TAKEN INTO CONSIDERATION IN THE PROCESS OF CONTENT DEVELOPMENT

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INTRODUCTION

As electronic communication technologies advance, online and blended learning is quickly becoming an alternative for traditional face-to-face Classroom. Blended learning is commonly defined as a "combination of online and face-to-face instruction in which students learn part-time in a supervised location away from home and part-time through an online delivery, with some element of student control over time, place, path,
and/or pace" . The content within the online setting is presented either synchronously or asynchronously. Synchronous formats present content in real time with the teacher and students interacting simultaneously but in different locations, whereas asynchronous formats deliver the content any time, any place, with the teacher and students interacting via discussion boards and other forms of written communication to archive their thoughts and ideas.

Simply transferring pedagogy or instructional practices from the face-to-face classroom does not always convert to appropriate instruction in the online classroom.

It is imperative to recognize that there are distinctive pedagogical practices for online learning environments.

Pedagogy is the standard term for the instructional practices or strategies in the classroom. For generations, the term pedagogy had been restricted to describe the educational strategies practiced in a

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physical classroom. It describes the interactions between the teacher and the students concerning the content and methods used to facilitate the learning process.

With the addition of online learning environments, teaching began to contend with different elements of instruction, including interactivity, active learning, and collaborative learning. Based on numerous research studies, online learning requires an adjustment of instructional practices or pedagogy from the face-to-face environment to the online educational context.

1. Analysis of the target group

This phase is the starting point in the definition of the pedagogical methodology for the learning process. The most relevant features of the target group will be taken into account.

First of all the cognitive structure will be analyzed in order to settle the cognitive style, motivational factors, the attitudes and the socio-psychological factors. SIVECO will base their analysis on the data and information received from the specialists from CTC and IBA, in order to get a proper picture of the target group and their needs.

A key criterion with a major contribution to the quality of the instructional process is the extent to which it addresses and meets

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the identified learning objectives/targets/goals of the target groups. Information about the target group strongly impacts the development of eLearning software. Thus, we take into consideration the following factors when analysing the target population:

1. **Demographical**. Which are the general characteristics of the learners? Is there (or not) uniformity to gender, age, educational or cultural background?
2. **Psychological**. Which is the cognitive structure, the level of cognitive development, intellectual ability, the cognitive style? Do they want the information provided in a very direct manner or do they prefer a more time-consuming but engaging like a game format?
3. **Attitudinal**. Which will be the learners' attitude towards the content presented or to training itself? Which will be the attitude towards the use of technology-based training?
4. **Experience with technology-based training**. Are the learners already accustomed to using online materials? Are they comfortable with this approach or do they need an ITC abilities/skills training before?
5. **Motivational**. Which are the learners work and career goals? How can the instructional program assist them with the realization of those goals?
6. **Prior knowledge and experience**. What will the learners bring to the training in terms of specific skills and knowledge? To

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what extent are they currently working toward achieving the desired goals?

7. **Organizational culture**. Which are the organizational culture features for different groups' members?
8. **Accessibility**. Which are the general requirements of accessibility?

The learners profile can be used to direct the instructional design. For example, an older audience might not respond well to a music video theme or review questions embedded within a game and a classic quiz format should be used. A young audience may not understand allusions to historical events that occurred before they were born in which case the events need a more detailed explanation.

According to the data available for all these factors, we design software adapted to the target group concerned. Any significant information from the list above will be reflected in the Storyboard Matrix and influence the development direction.

The modular structure (Reusable Learning Objects-RLOs) and the SCORM packing also offer the possibility to build different instructional paths, in accordance with target group characteristics, giving a post development control upon the eLearning content.

The starting point in developing content is the curriculum, a sequence of learning experiences which contains the "specific content" and the objectives to be fulfilled by the instructional process. Every time SIVECO has queries regarding the curriculum

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aspects they address to IBA or CTC specialists. Content development is a process which involves research activities, because it is based on the data gathered and analyzed in the research process. Therefore, on the whole process of developing content, IBA researchers and SIVECO researchers should be in contact , whenever a clarification appears.

This stage means dividing the specific content, received from the specialists into small fragments, the result being a coherent sequence of independent learning experiences.

Therefore, we plan an intellectual 'journey' for the learner - a series of multimedia experiences that will contribute to develop his/hers abilities, skills, attitudes and behaviours and not only mere memorizations of provided information or behavioural routines.

The most important characteristic of this process is that the divisions are autonomous fragments, in order to provide the necessary specifications for the development of corresponding reusable learning objects and ensure autonomy and reusability for each RLO. The autonomy of each fragment also comes from the establishment of independent instructional objectives.

To each fragment we attribute a name or/and a code and we retain as important its instructional objective. From this stage on, every

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instructional activity will be based on its corresponding fragment of curriculum content.

This approach allows us to define the course structure as a collection of independent and reusable RLOs which can be grouped and regrouped in a multitude of instructional paths.Our instructional designers conceptualize content as granular and part of the larger whole in order to develop competency-based instructional paths.

2. Definition of operational objectives

Taxonomy of educational/instructional objectives is a system of classification and ordering of the general objectives based on their content and specific degree of complexity of mental operations (cognitive processes) involved in the learning process. B. Bloom has developed the taxonomy for the cognitive domain in 1956. Our model is based on Bloom' s taxonomy revised by Anderson and Krathwohl (2001).

The operationalization of educational objectives is a strategy applied by the instructional designer in collaboration with the course developer for the analysis of the goals of the learning process, relying

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on two complementary actions in order to maximize learning/assessment efficiency:

- To derive concrete objectives from the general and particular aims of the course;
- To define these objectives as educational tasks to be carried out by the learner during an instructional unit (course, module, lesson, etc.) stated as (1) content objectives (mainly informational) and (2) psychological (cognitive) objectives (mainly formative), adapted to the particularities of the learning environment.

The strategy of operationalization of educational objectives is designed and achieved in order to specify "the end behavior" of the learner, expressed by a verb – describing the concrete action carried out by the learner – and a concrete performance, expressed in terms of learning outcome (content).

The operationalization of educational objectives also implies the specification of criteria necessary and sufficient to enclose the manifold modifications and transformations in terms of human personality, of a category of competences, viewed as the outcome of the learning process, triggered by the educational activity. To define an educational objective on the operational level means to specify the ways in which the learner's behavior is expected to be changed.

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Operational objectives are those which state most accurately the knowledge, skills and competences of the student at the end of an instructional activity. Operational objectives are about learning, understanding or applying something new, unknown before to the moment of training. Thus, operational objectives anticipate an observable and measurable change of behavior, obtained during instructional activities.

Therefore, operationalizing objectives provides the connection between the components of an educational activity and helps facilitate the transition from general to particular, from concrete to abstract.

Although the objectives may be specified in an almost unlimited number of ways, the learner behaviours involved in these objectives can be represented by a relatively small number of classes. Therefore, the taxonomy is designed to be a classification of the learner behaviours which represent the intended outcomes of the educational process. (Lorin Anderson, University of South Carolina).

Objectives provide a purpose for training. This moment of the Instructional Design phase is, for sure, the most important. It is based on the Revised Taxonomy Matrix developed by Anderson and

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Krathwohl on the Bloom' s taxonomy of cognitive processes. Out of a rather static classification given by Bloom, Anderson and Krathwohl imagined a dynamic Matrix that can be drawn for every course, no matter the character of the specific content involved.

The structure of the Revised Taxonomy Matrix "provides a clear, concise visual representation" of the alignment between educational goals, objectives, products, and activities" . (Krathwohl, 2002)

An objective is classically defined by two categories: Verb and Knowledge (VK) which provide information of the curriculum content that the Subject (learner) has to learn using a certain cognitive process. The objective refers to the content using a verb. The Verb provides clues as to the cognitive process category intended by the course designer to be attained /obtained by the learner.

Adopted from the original Bloom' s taxonomy of educational objectives, the Revised Taxonomy Matrix six cognitive process categories:

- Remembering — produce the right information from memory
- Understanding — make meaning from educational materials or experiences

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- Applying — use a procedure
- Analyzing — break a concept down into its parts and describe how the parts relate to the whole
- Evaluating — make judgments based on criteria and standards
- Creating — put pieces together to form something new or recognize components of a new structure.

Each of the six cognitive processes categories was divided into specific cognitive processes. Nineteen (19) specific cognitive processes were identified; the most important aspect of these cognitive processes being that they are expressed throughout verbs. One of the verbs bellow is mandatory in the definition of any operational objective:

- Remember: recognizing, recalling
- Understand: interpreting, exemplifying, classifying, summarizing, inferring, comparing, explain
- Apply: executing, implementing
- Analysis: differentiating, organizing, attributing
- Evaluate: checking, critiquing
- Create: generating, planning, producing

These verbs or their synonyms contribute to the definition of objectives. Even if the objective' s definition verb is not among these

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verbs it can easily be reduced to one of them. Throughout this verb we identify the cognitive process for every instructional outcome (objective).

Curriculum content represents the core of learning; it exists outside the learner as defined by the instructional designer. Learning is, in the end, integrating the content in the learner' s mental system. When content is integrated it becomes knowledge. This transformation of content to knowledge takes place through the cognitive processes used by the learner.

For several reasons, content was replaced by Knowledge in the matrix. There are four Types of Knowledge:

- Factual Knowledge: The basic elements learners must know about a subject, even solving problems from that subject;
- Conceptual Knowledge: It refers to a learner' s representation of the major concepts in a system;
- Procedural Knowledge: the knowledge exercised in the accomplishment of a task;
- Metacognitive Knowledge: Metacognition is defined as "cognition about cognition", or "knowing about knowing" or "learning how to learn" . It can take many forms; it includes knowledge about when and where to use particular strategies for learning or for problem solving.

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Anderson and Krathwohl combined the two major concepts in a Matrix: the columns are the 6 Cognitive Processes and the lines are the 4 Knowledge Dimension as in the following one.

How we use the Revised Taxonomy Matrix

Knowledge Dimension	The Cognitive Process					
	REMEMBER recognizing, recalling	**UNDERSTAND** interpreting, exemplifying, classifying, summarizing, inferring, comparing, explain	**APPLY** executing, implementing	**ANALYSIS** differentiating, organizing, attributing	**EVALUATE** checking, critiquing	**CREATE** Generating, planning, producing
Factual Knowledge	Path 1	Path 2	Path 3	Path 4	Path 5	Path 6
Conceptual Knowledge	Path 7	Path 8	Path 9	Path 10	Path 11	Path 12
Procedural Knowledge	Path 13	Path 14	Path 15	Path 16	Path 17	Path 18
Metacognitive	Path 19	Path 22	Path 21	Path 22	Path 23	Path 24

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Knowledge						

e.g. PATh - recalling a factual knowledge, etc

The instructional designers work on every autonomous fragments of curriculum content, each fragment having one or more objectives already attached by the course designers and implicitly one or more verbs (see above).

For each fragment they will determine the knowledge dimension (from the content characteristics) and the cognitive process (from the objective' s verb attached). From the Revised Taxonomy Matrix they choose the Path that corresponds to the intersection of the two categories.

There are 24 Paths. A Path of a certain content fragment, in our approach, is composed of:

- the knowledge dimension
- the cognitive process
- the optimal combination of multimedia resources

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These optimal combinations of multimedia resources for the 24 cases of the Revised Taxonomy Matrix represent our original contribution to the development of interactive, multimedia content. It is the output of 10 years of work in eLearning capitalizing the research of our specialists.

To the identified path we will add all the attributes and information necessary to completely describe the instructional process (e.g. level of interactivity, inputs about the targeted group, software tools, assessment level or pedagogic strategy, etc.). All these attributes will be defined at their corresponding development stage.

Multimedia resources

13 categories of multimedia resources were defined. We consider them primary resources (even if they are complex objects, e.g. simulations) because they are not stand alone instructional materials but only components of a pedagogic scenario.

1.Text

Text is an item present in all RLOs in various ways and with different roles.

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In addition to the specific text that supports the educational approach there are also texts that provide navigation or contextual help (ensuring the necessary support to users).

The display of the text on the screen and the optimal text ratio on a screen are determined according to international standards aimed at maximum results in memorizing or assimilating information. The text itself takes up between 25 ~ 50% of the total page space. The rest of the information is distributed as hypertext. Hypertext conceives text information in linked pages which the user opens as he/she goes through the main text, forming navigable paths that can be toured, returned to and referenced.

2.Additional sources of information

Additional Sources may be web addresses to which the learner has access during the instructional process in order to receive information considered important. They provide accurate information in harmony with the course strategy. The decision to use these additional sources belongs to the course designers and it is validated with the specialists from IBA, to take into consideration the instructional policies.

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Additional sources may be hypertext that conceives other objects beside text (images, maps, charts, etc)

3.Graphics

Graphics are the first contact of the learner with the subject at hand. Hyperlinks (hypertext) generally direct on the text or graphics type items provide adjacent information, in additional screens. Image contributes to memorize, understand or clarify notions. The use of graphics contributes to the representation of reality.

The content and character of the graphics is carefully checked, as is their page layout and their quality in terms of resolution.

4.Map

Map is the first interactive item. The map offers various degrees of interactivity and is a basic instrument used to develop the sense of orientation and the decision taking abilities of the learner. The map will allow the learner to quickly and easily locate various targets, to discover, to explore and to participate. The map provides solutions to the issues related to the difficulty of representing large size data.

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5.Diagram

Conventional diagrams are static data interpretations; they do not use the full analysis, imagination and creativity power of the learner.

The interactive diagram uses an information format much closer to the mental representation of the user and allows for the operations closer to the real ones; it is a high-level description action, eliminates the difficulties implied by real representation and allows a higher level of abstraction. The interactive diagrams offer the possibility to view information and are richer than text displaying. Graphic specifications will describe easily and more intuitively complex actions.

The degree of interactivity is decided by the nature of the processes and the ability of abstraction of the target population.

6.Audio files

Sound is used to enhance the educational message in combination with other multimedia resources. The signal level is not strictly

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considered as a quality indicator of the audio content. However, the result of the record -> transport -> play -> listen process very much depends on the correct selection of the signal levels throughout the informational path.

To obtain audio files that meet the most stringent requirements, studio equipment are operated at maximum performance parameters. Audios are considered good, when impeccable in terms of content and technique.

The audio files are delivered at IBA specialists' requirements as often as their need is evident for the optimal deploying of the instructional strategy. If necessary audio files can be accompanied by subtitles.

7.Video files

Video material is generally available in larger files that are difficult to transfer on the learners' terminals and increases the waiting time: that is why only small sized of video files, with great impact in conveying information (sequences of the film) are usually used.

8.Animations

Whereas video takes continuous motion and breaks it up into discrete frames, animation starts with independent pictures and puts them together to form the illusion of continuous motion.

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Animations are used to provide a more dynamic and attractive aspect for learners, by the visual impact they have on the receiver. The learner can visualize the sequence, coherence, duration, variety of the data received by the channel of transmission - the computer screen – a process that will influence his perception and his vision of the subject treated. Animations are present in all courses being one of the most important items of learning. Animations contribute significantly to create the sense of real space and real-time of the multimedia lessons and are regarded as a constructive element of the virtual education environment.

9.Simulations

Simulation is a type of interactivity that models various processes and phenomena from real life. They are developed to help the learner understand and remember complex principles and relations.

Instructional simulations usually come in one of the following categories:

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- "live" simulations (where "real" events are taking place in a representation of the real world);
- "virtual" simulations (where "real" events are taking place in a simulated environment);
- "constructive" simulations (where simulated events take place in a simulated environment);
- "instructional" simulations which model some abstract concept rather than simulating a realistic object or environment, or in some cases model a real world environment in a simplistic way so as to help a learner develop an understanding of the key concepts;
- "work place" simulations incorporate dynamic model enable experimentation with different strategies related to the learner' s workplace in a risk free environment and provide a useful extension to case study discussions;
- simulation systems used to acquire various skills;
- procedural simulations are simulations used in particular to build habits, e.g. to drive a car fly a plane, or to acquire algorithms or to learn procedures
- "problem situations" simulation: the user is placed in a context: he is asked to analyze the given context and to take a

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series of decisions, e.g., to conduct a research project, to find the best route, in the best conditions etc.

- Simulation games or serious games, as opposed to other types of video and computer games, represent or simulate an environment accurately. Moreover, they represent the interactions between the playable characters and the environment, realistically. These kinds of games are usually more complex in terms of game play.

Perceptive-visual instruction is implemented mainly by simulation.

The use of simulations makes it possible to obtain certain elements of training that traditional courses cannot provide:

- intuitive on-screen reproduction of processes that took place in very long or very short periods of time,
- individual involvement of the learners, with personal responsibility in research projects,
- avoiding situations dangerous to the learner
- observation of phenomena impossible to follow "live",
- repeat /resume sequence,
- control over the model proposed, simulations permitting the learner to change some parameters

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10.Interactive material

Various *interactive materials* are designed to serve the learning process. Simple interaction techniques are used to specify the value of a single input variable. Complex interaction techniques allow the input of much more comprehensive, field oriented, information.

An example of the interaction techniques it the one that enables the *learner to enter and exit the program.* The user will enter by means of actions at the level of the input devices that can be text or graphic. The actions involving the graphic input devices, such as mouse or keyboard, are called input events. Input events are, for example, pressing a mouse button, scrolling with the mouse cursor, releasing the mouse button, pressing a key, etc

The specific type of interaction is selected according to the connection between the input events and the communication concepts. As a general rule, input events are not interpreted separately, but in sequences called gestures. The most frequently used gestures in graphic user interfaces are: action (click), press (press-down), release (release), time (press-timer), field (range) and move (drag).

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Simple interaction - simple tools, used to state the input value of a single variable. The elementary interaction techniques are present in most graphical user interface: button option (radio buttons), option boxes (check boxes), button command (command button), push button (push button) and scroll bar (scroll bars or slider).

Complex interaction - tools that define and operate complex information by combining several elementary interaction techniques (dialogue boxes, menus - in every existing form: basic menu bar, pull-down or pop-up, fixed or floating, text or graphic, working areas move by dragging).

11.Problem solving

These multimedia resources are designed, by instructional means, to apply a strategy that will ensure, by adaptive interaction, the achievement of the objectives they were designed for. Some of them integrate simulations of objects, processes, procedures. Permanent feedback and control lead to the individualization of the path, according to the learner' s level of education.

Solving problems is a complex process that brings together, in a unique pedagogic vision, the degree of adequacy and inventiveness

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of the learning scenario, the existence of various possible solutions and the way to manage errors and provide feedback.

12.Educational game

The education game takes the shape of a game, meant to achieve a goal, by intelligently applying a set of rules - this type of activity involves the learner in a process of solving problems. Usually, the simulation of a real phenomenon is provided, giving the learner various possibilities to influence the achievement of the purposes proposed.

The training strategy uses the inventiveness of the game and error management to reach certain objectives.

13.Test (assessment/evaluation)

Tests provide a new vision on the assessment of learner progress, by introducing certain examples of assessment items into the lesson, developed according to behavioural objectives; this will give the trainers easier access to a more relevant view on the learners'

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progress, hence the possibility of adapting the training-learning process and to differentiate instruction. They also ensure error management and a high instructional value feedback.

Designed to assess the training level of the trainee, according to certain standards, criteria or performances, tests are meant in our vision both to educate and to assess. Objectives are used to define interactivity and to build the tools for formative and summative assessment that are the guiding poles in determining the training strategy as well as an incentive for learner motivation.

3. Pedagogical strategy definition

Once the knowledge dimension (from the content characteristics) and the cognitive process (from the objectives), are determined it is possible to proceed to the definition/description of the interaction and to find the optimal combination of multimedia resources.

In this stage the instructional designer applies the chosen training strategy (deductive or inductive approach, learning through discovery, problems solving, drill and practice, etc) and integrates the possibilities of individualization to the various sequences of the software. According to the strategy adopted, the concatenation of

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the interaction units is carried out in sets of varying sizes - modules that cover the conceptual area (of content).

The learner response to a request of the computer, usually determines the next request and so on. There is therefore a feedback (of confirmation, correction, explanation, diagnosis or design) and a certain adjustment at the level/within the interaction units. At the same time, assessments can be carried out at the end of each module (modular assessment) or when the whole course is covered (final evaluation), assessments that can provide the data required for adjustments at the next levels: relating the learner performance to the objective indicators (possibly their grading), suggestions for the use of adjacent materials, recovery, development of creative potential, etc..

The designer is required to have a simple and distinct vision of the final output – the subject is not "learning an application" or "from an application" but uses an educational object as support in order to acquire specific knowledge in a specific are, not related to computers.

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This stage in the development of the eLearning course clears up most of the problems that are likely to occur, such as:

- Compliance with the individual and social particularities of the target population, "customizing" the software so as to meet the subject' s needs related to age, style, knowledge, aspirations, etc as well as the socio-cultural context;
- Achieving a correct training dynamic, by maintaining the attractive-gripping psychological balance, by correlating the application sequences with the degree of difficulty of the material, the iconic/symbolic/abstract content, the type of formal / non-formal training, the pace of training, the subject' s effort, attention, fatigue, stress, etc.;
- Correlation of duration and degree of interactivity with the interface, according to the characteristics of the instructing message expected from and triggered in the subject: the texts, graphics, animations, audio-video information or combined processes will depend on the sensorial and perception particularities of the user receiver at a given moment;
- Adapting to conditions of the collective use of the eLearning course, taking into account that, under the influence of psychological and sociological phenomena and effects, the same subject may act differently when in a community then

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when alone; in such cases it is advisable to create a bank of articles in the phase of research and support of self-standardization in the phase of usage.

4. Instructional Strategy

An important problem in defining all the elements of the Paths (as described in the Revised Taxonomy Matrix) is to decide the instructional approach we will use in order to obtain the optimal combination of multimedia resources and therefore optimally fulfil the instruction objectives.

By "strategy" we understand all the sequences of learner - software interaction, with specific tasks, which provide an effective technological support to achieve a specific purpose, namely to ensure learning objectives. The **instructional strategy** focuses on a particular theory of learning / training.

Constructivism

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Modern education is based on discovery rather than on the mere transfer of information, thus, the learning situations created have the important role to create practical skills and to transfer integrated competences. Therefore, the learning theory that supports our methodology is *constructivism.*

Most of the contemporary cognitive psychologists believe that learning is an individual construction of knowledge, generated by the interaction with the environment and cannot be dissociated from the social and cultural context in which it develops. In recent decades, several strategies / systems / theories / models / designs have been developed, each with specific characteristics, however, keeping the constructivist approach (rather than the behavioural for instance) as a common denominator/platform.

This common platform has the following characteristics that define constructivist instructional environments:

- it provides multiple representations of reality, avoiding simplifications and representing the complexity of the real world,
- it favours authentic tasks in a significant context rather than abstract ones out of the context instruction,

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- it provides learning environments such as real situations or case studies instead of pre-established learning sequences,
- it stimulates reflection on the experience,
- it ensures the construction of knowledge in relation to the context and depending on it,
- it encourages collaborative construction of knowledge through social negotiation, not through competition.

1. **Cognitive constructivism (Jean Piaget)** is based on two assumptions:
    - learning is an ***individual*** approach; Characteristics: *learning through discovery, operating with objects, tasks that require operating with existing concepts and the techniques of Socratic dialogue.*
    - learning is an ***active process***; Characteristics: assimilate and adapt *direct experiences; errors, solution searching*
2. **Social constructivism (L. S. Vîgotski)**
    - learning and development are *social activities, based on collaboration;*
    - *the proximate development area* may be a guide for training plans;
    - training should take place in a *significant context;*

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- *external experiences* should be related to the learner' s instructional experience.

The overlap between the constructivist platforms and the opportunities offered by an educational approach based on multimedia resources is obvious. This is why the constructivist paradigm was successfully used in the definition of the instructional strategy for our eLearning content.

From this perspective, the instructional strategy is structured on some basic conclusions of constructivism. Thus, the instructional strategy for a multimedia course:

- refers to learning and not training
- encourages and supports learner autonomy and initiative,
- regards learners as creatures having their own will and aim
- considers learning a process,
- encourage the learner to explore,
- admits the role of experience in learning,
- stimulates the natural curiosity of the learner, takes into consideration the learner's mental model,

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- takes into account in assessing the learning both performance and understanding
- uses extensively the cognitive terminology, such as: prediction, creation, analysis,
- takes into account how the learner learns,
- encourages the learners to engage in dialogue with other learners
- encourages learning through cooperation,
- involves learners in critical situations,
- takes into account the context in which the learning occurs,
- takes into account the learner's beliefs and attitudes,
- provides learners with the opportunity to build new knowledge and understanding through an authentic experience.

5. New Instructional Paradigm

The classic *training-learning* paradigm is radically changed. In the constructivist approach this process become instruction, the trainer no longer offers information but mediates knowledge, his role is now in the designing the eLearning content and, maybe in tutoring the learner.

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In designing the eLearning content we ask the trainers, participating to the design phase, to:

- create eLearning content targeted to the experience and interests of the learners, so that it corresponds to the learner' s expectations, interests and needs
- encourage learners to take an open attitude towards learning, stimulate interest by acting as a facilitator in understanding, not explaining,
- use scientific models as often as possible,
- leave time for reflection, learners must have time to reflect over new ideas and resolve conflicts when concepts do not correspond with the scheme / frame of reference,
- provides the learners with opportunities to discuss with each other,
- ask open questions and reveal contradictions to stimulate investigation,
- use more group activity,
- recommend learners to be aware of their thoughts and actions, and not to be uncomfortable in the presence of what is yet unknown.

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Accordingly to all these results we established different kinds of eLearning content and the multimedia resources to be used for each type. All the combinations of multimedia resources will be evaluated in order to determine the optimal one for a certain Path. Finding the optimal combination means for the instructional designer the improvement of the learning performances as some media stimulate/ensure/support spontaneous information processing to a higher degree than others.

Examples:

- *images* can be more intuitive than text,
- *simulations* offer an ideal way of learning for procedural knowing by partial immersion in the learning environment,
- *serious games* – the immersive environment significantly contributes to a rapid acquisition of different skills, behaviours or procedures in the context of simulated conditions or situations.

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6. Types of Instructional Software

The development of the Storyboards, which are the starting point in developing content, is based on the following types of instructional software:

- ***Presentation Software***: it addresses subjects from various curricula providing information and knowledge in an expositive way: screen based presentations, pod-casts, video or audio materials;
- ***Thematic software***: it addresses themes from various curricula, providing the opportunity of enhancing the horizon of knowledge in various domains or the independent acquisition of certain professional abilities (procedural, theoretic, etc.);
- ***Simulation software***: it allows the controlled reproduction of a real phenomenon or system, by using a pattern with analogous behaviour. The use of a model makes it possible to alter certain parameters and to observe in what way the behaviour of the system is altered; the simulation facilitates understanding.
- ***Investigation software***: the learner is not given structured information; he/she is provided with an environment where he/she will extract the information (both declarative and procedural) necessary to solve the proposed tasks, according to

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a set of rules. Thus, the followed way greatly depends on the learner (on his knowledge level and his way of learning).

- ***Assessment/testing software***: is, probably, the most varied type, as its specificity depends on many factors: the moment of testing, the aim/goal, the type of interaction (with or without immediate feedback), it is defined for every situation.
- ***Instructional management software***: Data bases, catalogues, etc., holding various information, documents regarding the planning/management of different real world situations.
- ***IT Application software***: procedural simulation or interactive presentation of IT Application of different type. The presentation strategy is established in accord with the instructional objectives.
- ***Project-based software:*** based on a complex scenario which includes the participation of a group of learners for the fulfilment of a common goal with or without a tutor, it involves communication, debate, brainstorming etc.
- ***Interactive learning software***: provided with an embedded strategy that enables feedback and permanent control and determines an individualization of the path according to the instructional level of the learner. This is the most complex type, from a pedagogic point of view, as it proposes, by means of an

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adaptive interaction , to ensure that the user will attain certain educational objectives

- ***Instructional (Serious) Games***: a game is used to achieve a goal by applying a set of intelligent rules involving the learner in a problem/situation solving process.

The last two software products can have two different kind of presentation:

- Sequential combination of different multimedia resources
- Immersive (serious games type with avatar)

7. Assessment

Learners' assessment plays an important role in structuring a course. Assessment can be an independent RLO or only a constitutive part of a RLO. The assessment is designed in such a manner as to provide immediately and continuously user feedback - some responses of the learner to software stimulus are analyzed, assessed and contributes to the adjustment of the individual path.

- **Knowledge Checkpoints**

There are very rapid tests at the end of a chapter or knowledge unity. Every fragment of content should have at least one Checkpoint.

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- **Error- Based Assessment**

(a) errors become a necessary part of the learning process, the error being a feedback of what the person does not know yet. Errors give the subject the opportunity to learn about the subject, to build an adequate mental model over it. Thus, feedback information is necessary to detect and understand what goes wrong, why and how to reduce the chances of error,

(b) errors may stimulate exploration and creative solutions. When the error occurs, the subject can be led to the part of the subject he has no knowledge of and is invited to explore it. Error encourages the use of "risky" strategies to study and experiment aspects not yet covered.

(c) errors prevent premature automation and usually result in re-intellectualization of the action patterns: when someone uses a strategy of action automatically, without thinking, the error will force him and therefore help him to re - think.

(d) the methods of learning and error - tolerant interfaces that permit errors, increase the transfer of what is being learned by recognizing the error and fully integrating the correct answer.

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The eLearning content will rely on assumed personal assessment, and less (only for avatar software) on reward or punishment.

- **Assessment for an Instructional Unity**

It can be carried out at the end of a stage of training, whether it is an intermediate stage or a final stage; the content can highlight the characteristics of the route taken by the user and, in relation to certain criteria, can assess this route.

Assessment holds a powerful instructional role in our vision, thus becoming a method of learning, not only a way of assessing a learner' s progress.

8. Various types of user feedback

The eLearning content is designed so as to provide the user with the opportunity to give immediate and continuous feedback - each learner' s response to a stimulus of the software is analyzed, assessed and contributes to the correction of the individual route.

This kind of feedback stimulates:

- learner' s participation, he is active and answers questions, through educational stimuli he is made to take part in activities,

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- creative thinking: the learner has his own solutions / suggestions, proposes new interpretations of the subject discussed and becomes able to apply previously acquired knowledge to new contexts,
- applied learning: the learner is able to pursue a strategy of learning,
- construction of knowledge rather than passively receiving information, the learner performs certain tasks that will lead him to understand and learn.

When learning takes place by means of a *correcting feedback,* the learner receives suggestions or information about how to operate improvements in order to obtain a correct course. This information is meant to assist the learner to carry out the activities proposed, to refresh notions previously studied and amend certain mistakes. The number of hints given to the learner may vary depending on the extension of the theme proposed, on the instructional strategy of the course or the operational objectives that must be achieved.

STORYBOARD (SCRIPT)

The Storyboard (or the Script) is the detailed, conceptual view of the course. It provides a screen by screen illustration of the instructional

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strategy, complete with detailed description of actual multimedia resources that will be developed and gives the technical team a complete roadmap of the course.

The instructional designer writes the Storyboard which will be the support for the content development.

The development of a Storyboard follows a standard flow which defines, first, the structure of the course (number of RLOs, frames, time, etc.) and then describes in details each multimedia resource that will be developed by the technical team. The developed storyboards will be validated before entering the development flow. The storyboards will be developed in the language of the course, which in our case is Romanian.

The development process for the specific RLO submitted for validation will be applied to the rest of the learning activities (with specific test and quality control procedures applied for the development of each RLO). At the end of the development flow all RLOs will be integrated in the global pedagogical strategy of the course.

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