Instructional Design Oriented Towards the Development of Competences

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***Abstract*— This article presents instructional design oriented towards the development of competences. First, the competence concept is developed showing its pertinence in the business as well as in the academic field. In the second part, we develop the definition, properties, evolution and components of the instructional design. In the third part, competences and instructional design are integrated and a methodology with basic aspects of design and strategies oriented to the development of competences is proposed. Finally, we present a series of guidelines for applying this model in the development of courses.**

***Index Terms*— Competence, instructional design, methodology**

I. Introduction

THE purpose of this paper is to describe a methodology for doing instructional design , with basic aspects of design and strategies oriented to the development of competences, this methodology fulfills a need in the higher education environment which nowadays is oriented in many countries towards the use of competences. This new paradigm implies different ways of approaching the problems in the learning environment, and also different didactics and methods, in other words instructional design must be adapted to this new paradigm to assure the development and the evaluation of the competences.

II. Competences

This word comes from the latin word ”competere” which has two meanings to compete and to be competent The first one means a dispute between two persons, opposition or rivalry between two or more persons that work towards the same objective. The second one refers to aptitude or expertise in performing an activity or in participating in a specific matter. The first reference of the use of the word competence in education is Noam Chomsky. Chomsky’s theories about language acquisition are based on the concept of competence and performance, competence is the genetic capacity of language acquisition according to grammar rules, and performance is the act of communication with the language [1].

Chomsky’s basic postulate is that a child has an innate disposition for learning a language, this learning cannot be explained by external factors, this is called linguistic competence [2]. In the mid 60’s, [3] proposed the idea of communicative competence as the capacity to deal with different kinds of speech , this competence is reinforced by the social experiences, motivations and actions.

This concept was interesting for the cognitive psychologists, they focus their work in the mental activity made by humans in certain tasks. In this respect, the central thing is what the person does, the mental processes that the person develop and the strategies for solving problems. This point of view put in evidence the important of the environment in human acts . A cognitive competence can be defined as a ”know-how that every human being receives in his education that is different for each individual and that can only be assessed in action. It is an accumulative domain of formal and informal day to day experiences of different kind that help human beings to interact in real life and lead to the construction of a socio-cultural horizon that allows living in community. In this case, knowledge is not enough, it is necessary to apply this knowledge (procedural intelligence) in different contexts, for solving problems that deal with knowledge” [4].

The word competence had acquired new meanings in psychological and educational settings, R White defines it as a conceptual sum of three basic concepts: achievement, proficiency, and knowledge of a particular domain, but none of the three concepts is a competence, the competence emerges as a unity when the concepts are joined in a particular action [5].

Outside the education environment, in the business world there is an agreement in the definition of competence, Organizations like OIT, CINTERFOR, POLFORM, FUNDACIN CHILE, SENA and countries like Mexico, Spain, Canada, Argentina, Australia, Germany and United Kingdom agreed in defining competence as an identifiable and measurable set of attitudes, knowledge, values, skills , socio affective behavioural , cognitive, psychological, sensorial skills relate to each other that enable satisfactory results in real work situations, additionally competence is capability in performing a task or holding a job, effective capacity to develop a well defined labor activity.

In higher education there is an intense debate about what the ”professional competences” are. Universities are working in a profound revision of the University courses to adjust the graduate profile to the development of competences without ignoring the changing business world. Additionally, it is important to generate new learning methods and strategies not only for the development of competences but also for its evaluation.

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III. Instructional Design

"The term instructional design refers to the systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources and evaluation" [6].

An on-going debate within the instructional design community about which of these aspects of design (creativity or engineering) are most prominent and relevant to instructional planning and implementation is now in action [7]. The view herein is that instructional design principles, rules, guidelines and heuristics do exist, although they are sensitive to local conditions(learners, instructional setting, support resources, learning cultures, and so on). Instructional design is fundamentally an engineering enterprise, although many creative aspects are involved. It is important to observe and assess the quality of the design process, and subsequently to determine if the development and implementation processes are consistent with the system, course, or lesson specifications that emerged from the earlier design activities. Finally, it is worthwhile to try to link learning outcomes with decisions made during the design activities. Careful, systematic planning is important no matter what media of instruction is used in the implementation. When the medium of instruction is is different from a teacher, and when it is possible that a teacher may not be available, careful instructional design is critical.

Advantages of using systematic instructional design

- **Encourages advocacy of the learner**: To a very large degree the learner is the focus of the instruction. Designers spend a great deal of effort trying to find about the learner. Information about learners should take precedence over other factors that might drive design decisions, including the content itself. Often the designer is not a content expert.
- **Supports effective, efficient and appealing instruction:** All of these factors are considered indicators of success. The process of design itself focus on effective instruction. Efficiency is particularly facilitated by the process of instructional analysis in which inappropriate content is eliminated. The consideration of the learner and the concentration on designing appropriate strategies promotes the appeal of instruction.
- **Supports coordination among designers, developers**, and those who will implement the instruction: The systematic process and resulting written documentation allow for communication and coordination among individuals involved in designing, producing and delivering instruction. It allows for common language and general procedures.
- **Facilitates diffusion/dissemination/adoption:** Because the products of systematic instructional design are in fact physical "products" ,they may be duplicated distributed, and used in the field, design and development have employed information about the learners and setting, products will have a high likelihood of being practical, workable, and acceptable solutions to the instructional problems they are designed to solve.
- **Facilitates congruence among objectives**, activities and assessment: The systematic approach to instructional design helps to ensurehat, what is taught , is what is needed for learners to achieve stated goals for learning , and that evaluation will be accurate and appropriate.

Limitations of Systematic instructional design

Instructional design has limits of applicability; its not the solution to all the ills and problems of education.Instructional design has limited applicability to educational experiences in which:

- Learning goals cannot be identified in advance.
- No particular goals are ever identified.

An example of such a situation might be an advanced graduate class or other educational environment in which the learners have exceptional prior knowledge of the content. These students would have well developed cognitive strategies and be required to identify the goals of the course, devise the educational strategies, and assess their learning themselves.

Teachers as designers

Some individuals employed as teachers are directly involved in the design of new instruction (or new "curricula"). These teachers may be involved in long-term projects. Instructional design procedures and principles can be employed effectively in their curriculum design and development activities. Teachers select or develop activities and information sources that will assist learners in reaching their goals. The development of engaging activities seems to be a particular strength of practicing teachers. Teachers design assessment and use information from their testing to revise instruction. Most often these instructional design activities are conducted mentally with little documentation of the decisions made.

The instructional design process (a general model)

Another way to define instructional design is to describe the process involved in the systematic planning of instruction. At the most basic level, the instructional designers job is to answer three major questions:

1) "Where are we going?. (What are the goals of the instruction?.)
2) How will we get there?. (What is the instructional strategy and the instructional medium?.)
3) How will we know when we have arrived ? (What should our tests look like? How will we evaluate and revise the instructional materials?)". [8]

To answer these questions the designer engages in three major activities, analysis, strategy development and evaluation. These three activities are the essence of most instructional design models. One attribute of the model that is more apparent than we intend is sequentiality. In Figure 1 we have

listed some more specific activities of design within each major activity in a particular sequence. We have presented the model in what appears to be a linear sequence in order to simplify a discussion of the activities of instructional design and linear order. Many times the steps within a particular phase may occur concurrently . Indeed, we might depict the activities of practicing instructional designers- especially their mental activities- to resemble more nearly the representation of figure 2.

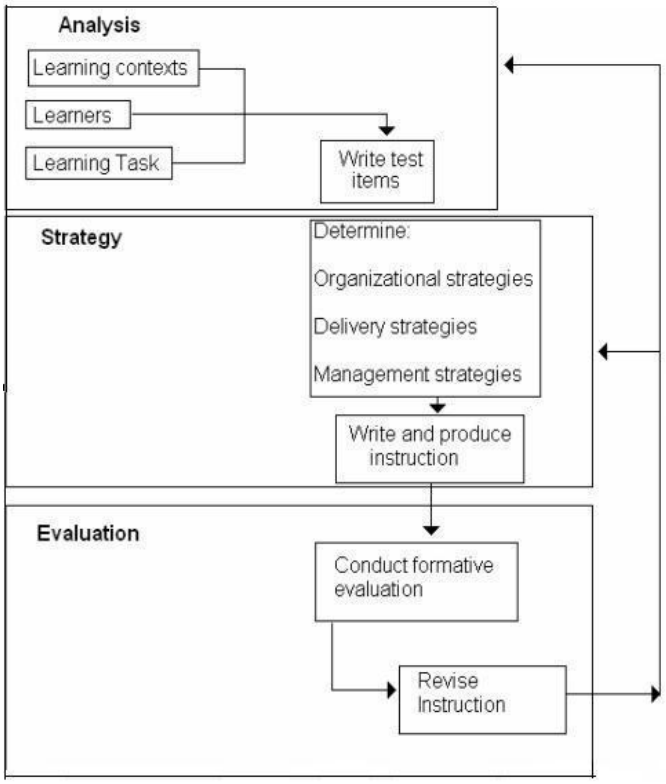

FIGURE 1. ACTIVITIES OF INSTRUCTIONAL DESIGN

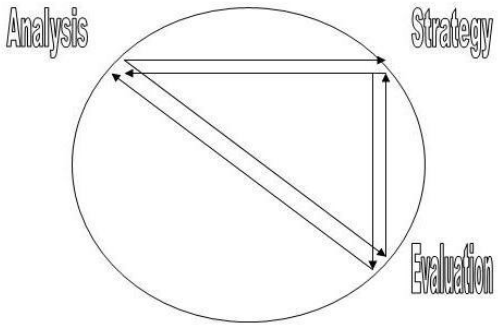

FIGURE 2. MENTAL ACTIVITIES OF INSTRUCTIONAL DESIGN

IV. COMPETENCES AND INSTRUCTIONAL DESIGN

We have adapted this general model to build our methodology of instructional design oriented toward the development of competences. Now we describe in detail our model of instructional design in each of its phases: Analysis, Strategies and evaluation:

Analysis

Analysing the learning context: The analysis of the learning context involves two steps:

- *The substantiation of a need for instruction to help learners reach learning goals*: Designers often conduct a "needs assessment" to find out whether instruction should be designed. Violations of this principle is common in the development of instructional materials
- *A description of the learning environment in which the instruction will be used:* The primary task at this point is to think about the "system" in which the instruction will be implemented. This "Learning System" is composed of all factors that affect and are affected by the learning that takes place: learners, instructional materials. The teacher, instructional equipment (computers, video, slide viewers etc), the instructional facilities and the community or organization.

Analysing the learners: The most important factor for a designer to consider about the audience is specific prior learning. Thus, instructional designers must ask many questions about the target audience members:

- Do they have some background knowledge or competences that will help them learn the current task?
- Is there a wide variation in knowledge and competences among prospective learners?
- Do some prospective learners already have some of the competences and knowledge that the instructors plan to teach?

The following list contains the major competences that should be used in a target audience description:

1) Cognitive competences
   - General aptitudes
   - Specific aptitudes
   - Language development level
   - Reading level
   - Cognitive processing styles
2) Affective competences
   - Interests
   - Motivation
   - Motivations to learn
   - Attitude toward learning
   - Anxiety level
   - Beliefs
3) Social Competences
   - Relationship to peers
   - Feelings toward authority

- Tendencies toward cooperation or competition
- Socioeconomic background

A careful consideration of the general competences of the target audience maybe what elevate a piece of instruction into compelling, memorable instruction. These factors are considered when the designer determines what strategies to use in the instruction.

Analysing the learning task: The final product of the learning task is a list of goals that describe the competences the learners should develop at the completion of the instruction, and the prerequisites skills and knowledge that learners will need in order to achieve them.

After conducting a needs assessment, the designer has a list of learning goals such as:
"Learners need to be able to.". After you have written a learning goal, it is valuable to identify the type of learning outcome the goal represents. For example the learning task of memorization requires attention and perseverance, as well as a particular type of mental effort. In contrast, to prove geometric theorems require a different kind of mental effort. A student must keep many principles or laws (relational rules) in mind at one time, select and decide what principles should be applied.

Bengamin S. Bloom [9], described these differences with a taxonomy of objectives in the cognitive domain: recall, comprehension, application, analysis, synthesis and evaluation.

Robert Gagne [10], divided possible learning outcomes into five large categories or "domains": Verbal information, intellectual skills,cognitive strategies, attitudes and psychomotor skills. Whether you are designing a course, unit, or lesson, once you have identified the learning goal and determined what type of learning outcome it is , you will find an analysis of the goal a useful tool in determining the needed content of that instruction.

Conducting an information processing analysis is the first step in "decomposing" or breaking down the goal into its constitutient parts, identifying what the students need to learn to attain the goal. In conducting an information processing analysis , one asks:

What are the mental or Physical steps that someone must go through in order to complete this learning task?

Strategy

The strategy we use for our model is fundamentally strategy applied to problem solving since we can only verify that a competence is acquired by the learner only if we propose him a problem in which to apply his knowledge , competence is "knowledge in action".

Cognitive requirements of problem solving learning.

To solve problems in a domain, learners must possess and apply three kinds of knowledge: principles, declarative knowledge and cognitive strategies. The ability to apply principles seems to be the most critical component to problem solving. The type of knowledge are used in varying degrees to support four components of cognitive processing in problem solving: Knowledge representation, solution planning, solution implementation, and solution evaluation.

What is the generic task analysis for problem solving? It seems that in problem solving the following stages often occur:

- Clarify the given state (conditions) including any obstacle or constraints.
- Clarify the goal state, including criteria for knowing when the goal is reached.
- Search for relevant prior knowledge or cognitive strategies that will aid in solution.
- Decompose the problem into subproblems with subgoals.
- Determine a sequence for attacking subproblems.
- Consider possible solution paths to each subproblem using related prior knowledge.
- Select a solution path.
- Evaluate to determine if the goal is achieved. If not, revise by returning to the previous step a above.

Instructional events for a problem solving lesson.

When instructional designers begin to design the instructional strategies for a problem solving objective, they imagine that there is really nothing to teach, as all of the principles may have been learned prior to the problem solving lesson. They suggest that the only thing remaining is for learners to practice combining principles. Indeed, practice is a critical part of problem solving, however there are additional instructional events that can support the acquisition of problem-solving skill. The design of problem solving instruction will vary depending on how well defined the problem is.

Introducing problem solving lessons.

1) **Deploy attention**: Presenting an interesting and challenging problem that the learners will learn to solve can gain attention and begin to identify the purpose of the instruction.
2) **Establish instructional purpose**: The instructor may describe the nature of problems that the students will learn to solve.
3) **Promote interest and motivation**: Suggesting how problem solving in this domain may assist learners in everyday problems can promote interest. Problem solving can be motivated in itself. The instruction should be constructed o provide successful practice as quickly as possible.

4) **Preview Lesson**: The instruction should inform the learners that they will be going through a succession of problems with increasing complexity. The instruction may preview the primary strategies that will be employed and the learners responsibilities within the strategies.

Body

1) **Reviewing relevant prior knowledge**: the conception of prior knowledge that the designer should hold for problem solving is more critical and complex than for other types of learning, especially when working with ill-structures problem, if learners have solved problems that have similarities to the current class of problems, then this similarity should be explicitly mentioned and the difference between these class of problems should be clearly identified.
2) **Processing information**: The more generative strategy is presenting tests of increasingly complex problems for the learners to solve, with the guiding questions of the instruction used to evoke the processing, attention focusing, and strategies described in these events.
3) Focusing attention: The instruction can use guiding questions or direct statements to focus learners attention on key aspects or the problem state. Learners may also need assistance in focusing attention during the pattern recognition task of identifying the critical features of the given state and the goal state.
4) **Employing learning strategies**: Learning strategies may be taught through direct instruction, modeling, or guiding questions. The initial strategies taught may not be the strategies that experts would use, as their knowledge is consolidated and organized differently from novices.
5) **Practicing**: After learners have experienced the solution of example problems, they should have the opportunity to solve problems of similar difficulty. Instructional guidance, such as hints, guiding questions and suggestions for strategies should be phased out gradually. Practice should start with problems that have easily, recognizable, distinctive features in given and goal states. More ill-structured problems should be introduced gradually.
6) **Processing feedback:** Feedback should include information regarding not only the appropriateness of the learners' solution but also the efficiency of the solution process. Feedback on the efficiency or speed of problem solving is necessary to the extent that genuine expertise is often expected as part of the learning goal. Feedback information, especially early in the instructional process may also include whether the learner has correctly identified the problem, correctly defined the goal state, appropriately decomposed the problem, selected a viable approach and reached the goal state.

Conclusion

1) **Summary and review**: Should include the following:
   - A review of the characteristics of problems that make them members of the class of problems that can be solved in a similar manner.
   - A summary of effective strategies for this domain of problems.
   - Suggestion of methods for organizing the problem for storage and later retrieval.
2) **Transfer**: Transfer of problem solving skill does not occur spontaneously. Learners need explicit hints that point to the utility of this learning.
3) **Remotivation and conclusion**: A product of problem solving learning is frequently knowledge of how to use knowledge.

Assessment

The assessment of problem solving skills should require learners to solve problems of the class that the instruction has targeted. The problem should be from contexts similar to those that were used as examples and practices in the lesson. Domain specific problem solving involves: identifying the problem, selecting principles, applying a procedure, confirming the correct application of principles, and "fixing up". Each of these steps can be assessed separately or all of the steps can be assessed together in a recognition or constructed response form.

Recommendations

1) To design instruction, the designer must have a clear idea of what the learner should learn as a result of the instruction.
2) The best instruction is the one which is effective, efficient and appealing.
3) Students may learn from different media: a "live teacher" is not always essential for instruction.
4) There are principles of instruction that apply across all age groups and all content areas. For example , students must participate actively, interacting mentally as well as physically with material to be learned.
5) Evaluation should include the evaluation of the instruction as well as the evaluation of the learner's performance. Information from the evaluation of instruction should be used to revise the instruction in order to make it more efficient, effective and appealing.
6) There should be a congruence among goals, learning activities and assessment. Along with learning characteristics and learning context, learning goals should be the driving force behind decisions about activities and assessment.
7) Get to know very well the target audience, the environment and have clear the competences to develop.
8) Instructional design must approach the following questions:

- How?: Resources and methodologies for tackling the problem and the evaluation.
- Why?: The answer of this question lies in the disciplinary context.
- What for?: Goals, objectives, purposes and competences that are going to be developed.

9) Instructional design is a dynamic process, the methodology is not linear but cyclic and possibly requires adjustment at every stage of the process.

V. Conclusion

The development of competences is an important topic in education and we consider instructional design based on this concept can be a very fruitful approach for both educational and business settings. The methodology we have described is general and can be used in multiple contexts. It is very important that this instructional design is based in learning theories coherent with the actual view of education which is student-centered . If competences are clearly defined, and the instruction is well designed we can assure the development of courses would be an easy task.

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