Designing Electronic Learning

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The success of electronic learning depends on many factors, one of them being the quality of the design of the learning system. In order to achieve its objectives and goals, electronic learning needs a rigorous design process. This may solve challenges like performance level, adaptation issues, dropping school. Also, a rigorous design leads to lower development costs, consistent quality control and standardization. The instructional design is a process that analyzes the needs and goals in the development of a training system.
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Instructional Design

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Instructional design is at the same time a process and a discipline, a science and a practice.
As a process, instructional design means systematic development of training specifications, using instruction and learning theory in order to ensure the quality of training process. It starts with analyzing the needs and goals of the learner and uses them to develop a system that meets these goals. Design process includes developing materials and activities for training, testing and evaluating the training activity as well as every other activities of the learner.
As a discipline, instructional design is the branch of knowledge that deals with research and theories on learning strategies and the development processes of those strategies.
As a science, instructional design refers to creating detailed specifications for the development, implementation, evaluation and maintenance of the situations that facilitate the learning, on every level of complexity, in every context.
From the practice point of view, during every step of the design process a new idea may emerge, that has to be developed and implemented, adding all the details needed in order to match the design science.

Main arguments that support the need to rigorously design electronic learning are:

- Learning process design starts with the learner and focuses on him.
- Electronic learning is not like classic learning. Electronic courses may fails if they are taught like classical “in class” courses.
- Building an electronic learning system must start from the principles and theories of the pedagogy, not from the available technological equipment.
- Technology does not have the adaptation abilities of a professor. The professor may modify some aspects of the course “on the fly”, bringing new elements into discussion, based on the students’ reaction. Electronic learning may not do so. This is why the design must foresee every possible situation and prepare accordingly to respond to each and all of them.
- A rigorous design allows for the standardization and consistence of the courses and the exploration of electronic learning materials and ensures a high quality of the courses.

- Instructional design contributes to acceleration of the course development process – long course development time being a frequent problem of electronic learning systems.
- Instructional design offers the possibility to closely monitor the entire process and reuse the experience accumulated.

The ADDIE model

The best known instructional design model is ADDIE ([Strickland, 2006]), which stands for *Analyze*, *Design*, *Development*, *Implementation*, *Evaluation*. This model is widely used in many academic communities. There are many instructional design models (over 100 of them according to [Kruse]), but most of them are based on the ADDIE model ([Kruse]).

The *analyze* phase of the ADDIE model requires a study to determine the characteristics of the learning environment, the goals and purposes of the system to be designed. During this phase the design team must identify between two levels of knowledge and abilities of the learners: the existing level and the desired level. In order to achieve this, the following aspects have to be cleared:

- To who is the system designed for and what are the characteristics of this audience?
- What is the target audience supposed to learn? This means establishing the system goals and for each of them the specific objectives.
- Create a preliminary view on the system to be built, materialized in a general plan to complete the system.
- Establish the means to deliver the courses to the target audience: internet, CD/DVD, videoconferencing, television etc.
- Identify the applicable restrictions: learners' age, available time, technological resources available to learners, available resources to build the system.
- Identify the differences between "in class" teaching and teaching over the internet.
- Define pedagogical considerations.
- Establish the means to evaluate the learners' progress and verify the accomplishment of objectives: written tests, individual homework, online tests etc.
- Creating a detailed plan to build the system, with strict dead-lines.

Fig.1. The ADDIE model

Design phase deals with translating the learning principles in designing learning materials, activities and resources. During this phase learning objects, evaluation instruments, and exercises are finalized. Also, the design team finalizes the content to be taught, plans the courses and chooses the means of delivery. The following steps must be accomplished:

- Establish the training and visual and technical design strategies.
- Apply training strategies according to the type of educational content – structure the training material.
- Create learning scenarios.
- Establish evaluation instruments to determine the knowledge level of the learners and the degree of achieving the objectives.
- Design the interfaces.
- Create a prototype.

During *development* stage all materials must be created (scenarios, programs, graphical interfaces, multimedia elements), according

to the previous design decisions. During this phase all chosen technologies are integrated. Tests are conducted and the project is revised, according to test results. The stage ends with a detailed action plan and procedures to implement the system.

During the *implementation* phase the prototype is tested on a test group. Learners and teachers are trained to work with the system. During these tests, new needs and also design errors may be identified. Teachers' training is about curricula, means to deliver the courses and test the learners. Learners are trained on: using the new instruments (equipment and programs); registering for the courses (if needed); counseling on the best strategies to use the system. Also, this phase identifies the availability of all materials and links to other resources (on the internet).

Evaluation phase determines the quality and efficiency of the entire design process and of the final product. Evaluation is also a full time process during the development of the system, as well as a final stage. As a permanent process (formative evaluation), it takes place during each phase of the design process preceding the implementation. The goal is to determine if the activity follows the plan, if there are unforeseen obstacles or unexpected opportunities. Also, small corrections are made on the project, to ensure its final success. Reactions received during this evaluation are meant to tune up the final product. It involves evaluation of the goals from the point of view of the owners of the final product, preparation of the evaluation personnel and the instruments, collecting data from the test group and from experts, analyzing data with statistical instruments, revising the project through these results and repeating the entire process after correcting the problems that surface.

Final evaluation (summative) takes place after the product is implemented. The goal is to establish the product efficiency and the degree if satisfaction towards the learning objectives. This step determines the knowledge transfer, cost of exploitation of the product and learners attitude towards this product.

Although widely spread, the ADDIE model has been criticized as being too linear and inflexible and even time consuming. Following these criticism, a new approach was devised: the systemic approach. Instead of separated design phases, in systemic approach the entire team works together on modules that are tested right away and, eventually, corrected to respond to the needs.

The Dick & Carey model

The best known systemic model is the one proposed by Walter Dick and Lou Carey ([Dick, 1990], see figure 2).

The model comprises the following segments:

- Identification of the training goals: what is presumed to be achieved through training and analyze of the differences between present and desired situations.
- Analyze the training goals: determine the abilities and skills needed to achieve the goal, steps that have to be followed to achieve the goal and skills needed on each step. This step also analyzes the mental processes used by a person that learns a new complex ability and the learning objectives that require intellectual skills.
- Determine the learners' characteristics: analyze the context in which the new abilities are learned, and the context in which they will be used. This stage determines the prerequisites to participate in the learning process and learners' abilities (intellectual abilities, personality traits etc.).
- Establish the performance goals: transform the needs and goals previously identified in a series of specific objectives. This stage determines the knowledge that must be acquired, the context in which they will be used and criteria to determine success or failure of the learning process.
- Development of reference tests: this stage develops tests for the previously established objectives and criteria. They must

determine the existence of knowledge and abilities required for learning in each student. Also, tests verify that the learning process achieved its goals. Following the testing learners' progress is recorded in order to monitor their evolution. Test results will also be used to evaluate the entire learning system.

- Develop the learning strategies. During this step the best learning strategy to achieve the goals is determined. The main elements that must be clarified are the way to present the information, the way to exercise and to collect reactions from learners.
- Develop the learning materials. If possible, already existing materials are chosen and the need for new materials is established. They will be created during this segment.
- Formative evaluation seeks to collect data for the system revise segment as well as for the summative evaluation. Learning materials are tested on small groups (or even on a single learner) in order to be revised before distribution.
- Revising the training takes place based on data collected by the formative evaluation. They are analyzed in order to identify learners' barriers in achieving the objectives and to find possible weak points in the learning system that raise those barriers. If such deficiencies are found, they are corrected in this segment.
- Summative evaluation is an independent analyze that defines the system efficiency as a whole. It takes place after the formative evaluation.

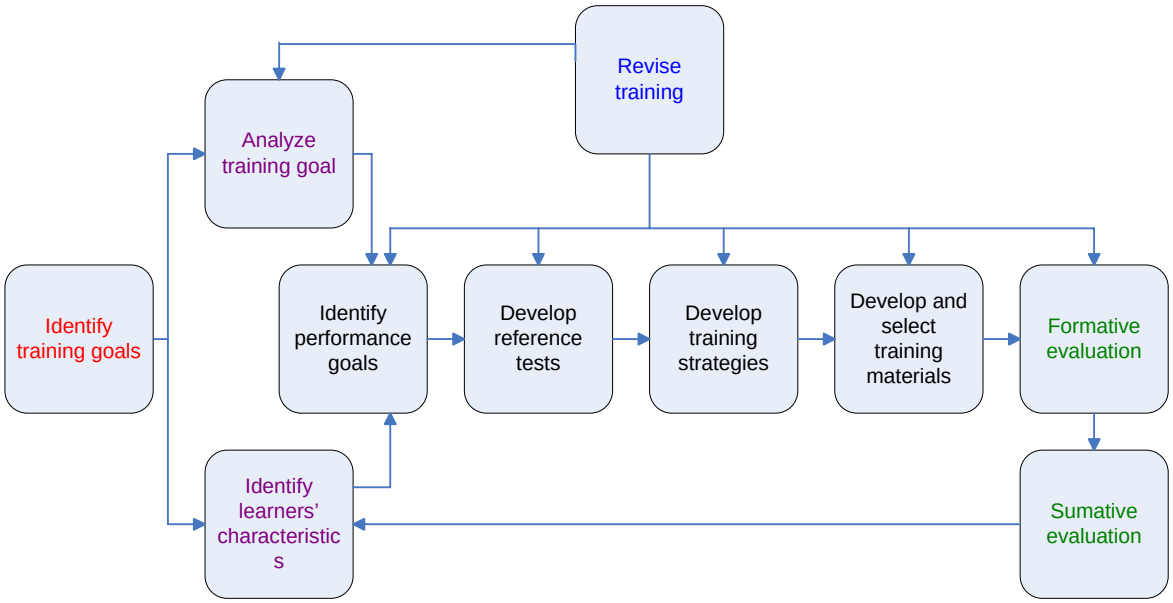

Fig.2. Dick-Carey model

Compared to ADDIE model, systemic approach has both advantages and disadvantages. The team working together has better chances to construct a system that will attract the learners. Also, the time needed to reach a common view on the path to be taken is much shorter. Yet, the ADDIE model is better suited if development is to be conducted on a strict budget and schedule, because it allows for a strict allocation of resources for each stage, while systemic approach does not allow such a planning of the system development, since there are no distinct phases.

Alternative models

Alternative models suggest a new phase of rapid prototyping at the end of the ADDIE model. The advantage of such a prototype is that is can be easily developed and tested on

a small test group. Test results may save a lot of time in the final system development.

There are also models that are entirely based on rapid prototyping ([Thiagi, 1999]). These models reuse existing elements on large scale. Thiagi model proposes using existing and available elements from other models and strategies. They are combined depending on the specific needs of each project, thus saving a lot of time and resources. Thiagi proposes fast development of cheap systems, that may not shine but yield good results on learning efficiency. In the end Thiaggi model is not a real model by itself, but merely a collection of strategies and guides for rapid prototyping of learning systems.

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