TRAINING WHILE WORKING: DESIGN OF A LEARNER-BASED MODEL

Mario Doria & Rafael Santana, Tecnológico de Monterrey, Toluca, México

In order to face corporate challenges where ROI and other measurable effects evaluate training, solutions should make possible to measure the effects of training in the company's processes and results, and not only from acquired knowledge or abilities. To confront the challenges, we need to refocus job training: workloads, geographic dispersion, cost pressures, time and the need to standardize support materials and companywide practices require a revised approach to the training process, from the learner's perspective, their environment and the availability of time and materials, to company's expectations on performance, cost and behaviour.

Training has a different approach than academic learning: in training the emphasis is that at the end the person shall be able to do something, to perform according to standards, to achieve results within established parameters. When the trainees are geographically dispersed, and/or numbers are large, a distance education process is the logical and cost-effective conclusion, if learning materials do not require human direct interaction.

To achieve desired results we require trainees to take control of their learning and to incorporate the learning process into their performance, so that imitation, observation and controlled repetition may result in meaningful learning and successful results, with their intended rewards. When organizations are required to do a perfect job every time, at first try, it is only possible if people that do the actual operations are able and willing to do so, and for this to happen the workers shall be able to learn how to do their work correctly, so that results of training are self-evident to the learner. This "natural" feedback facilitates job enrichment and evaluation.

We are not trying to justify distance education (or knowledge distribution), its viability or possibilities, we are searching for a path to make the learning process more effective and enriching by centring on the person. We reviewed accepted models (Bloom, 1958) and recent favourites (Llano, 1999 and Millán, 1974), the instructional design approach for Internet-based courses (Horton, 2000, Conrad, 2000) and online interaction (Weatherly and Ellis, 2000), to develop a model based on the influence on the person's perception of reality through the senses, where objectives, content and design are the core of the capacity of training to be incorporated into the trainee's intelligence. Our work is based on the work of Carlos Llano, both from his book as from his classroom.

The objectives of our work were to develop a solution to train large groups of workers to perform technical activities according to strict standards, within a short time frame, restricted budget and no loss of quality, measured in terms of actual work performance.

This paper presents the design of the learning model, with results from implemented examples.

Fundamental premises

- Adults are responsible for their own learning, especially in training, but however self-motivated as they might be, the way content is presented to the person and the design of learning and evaluation may define the interest of the person to keep on trying, or to look for other options.
- The core of the learning process is the interrelationship between reality and each individual's perceptions, our responsibility as trainers is to present objectives and content in such a manner that attention keeps focused, and the learner has the perception that he/she is getting something meaningful from the effort.

- Concerning the achievement of specific results, learners shall understand these objectives, and agree to make them become part of their own reality, thus achieving the intended results as part of his "social contract" with the company, in exchange for the expected rewards.

The learning model

The integration of the learning process, centred on the learner, implies that learning is a consequence of the absorption of reality through a person's will and intelligence. This absorption involves using the senses to collect data, making decisions about which data is useful, applicable or good, leading to comparison with other concepts and other people's knowledge, its application and integration into the person's reality, and the acquisition of habits that eventually form character. It is the role of the educator to influence the perception of reality through objectives, content and design, and in evaluation, to assure that learning fulfils the expected objectives.

It is important to note that the learning concept is not only about memorization of actions or data, learning is a deeper process, incorporating and interrelating what is known and has been learned to increase personal growth and satisfaction with self.

We as trainers shall focus to influence the senses through the intended perception of objectives, content and design. Objectives shall be clear and motivating for intelligence to abstract, compare and apply; content shall be accessible, recognizable and easy to understand; media design shall be oriented to the learner's preferences.

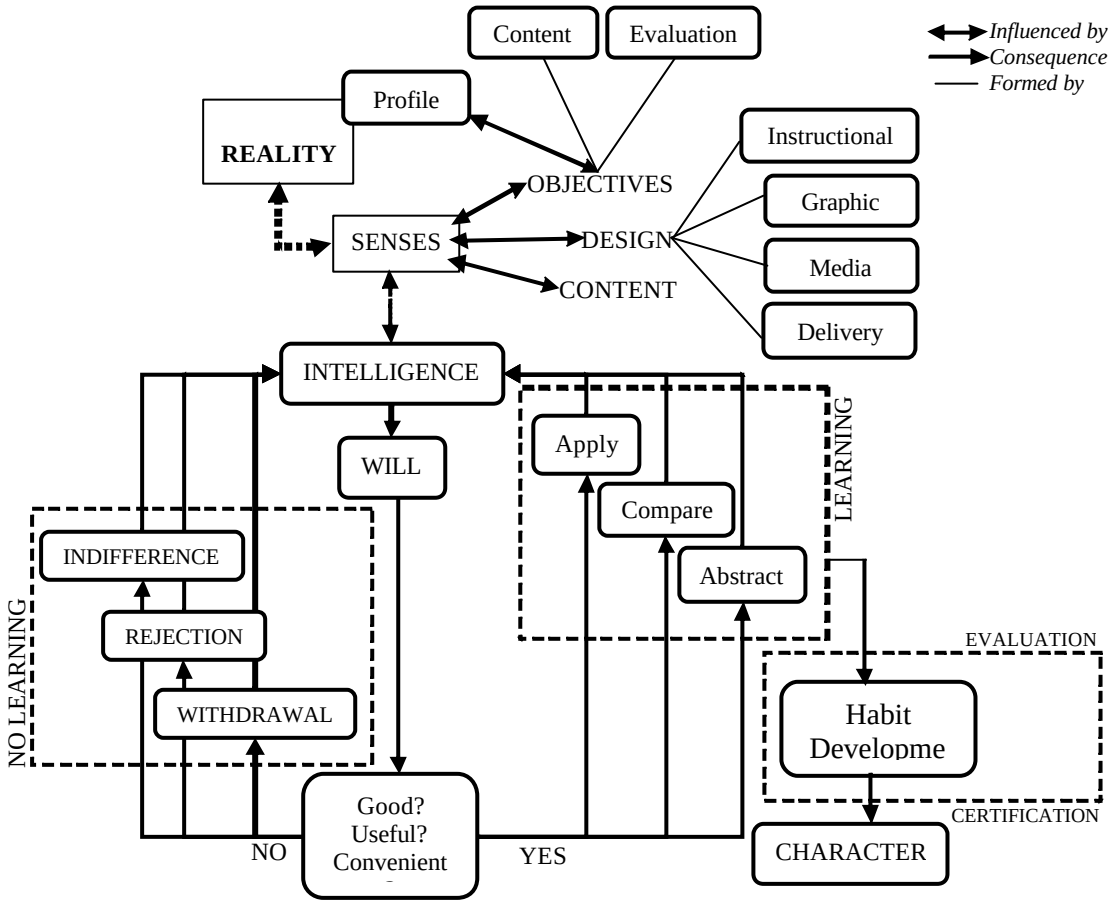

Figure 1: The Model

Learners' profile

The profile we are interested is formed by the characteristics of the learner: culture, education, habits, preferences, familiarity with subject matter, exposure and predisposition towards content or computers, availability and access to distance education media, etc.

Objectives

One expression of the learning process is the modification of the learner's conduct. The determination of the expected behaviour clarifies and defines the path to follow. The fundamental question is: *What should the person know, do, identify, etc. at the end of the course to be considered trained?* In other words, *what are the intended behaviours and habits that the person should have?*

From these needs the educational objectives are derived, based on previous experience and knowledge, and expressed in terms of required knowledge or abilities. Therefore, for each objective the expected outcomes or performances should be determined, from which content and evaluation are easier to design and follow.

Content

Content is determined by training objectives, and shall be structured by traditional didactical principles (Alves, 1963): simple to complex, easy to difficult, concrete to abstract.

Design: instructional

Based on the learner's profile, the design of learning objects must accomplish the following:

- Learners must be shown information in a significant way
- They must have the opportunity to manipulate the information
- They must have the opportunity to acquire more information
- Information shall be easy to apply to the learner's environment
    - Feedback capabilities shall be designed into the management of learning objects

Design: graphics and media

Text-based materials are not easy to master for people with low educational levels, and as Smith and Fisher (2000) affirm "The cultural act of reading has become increasingly less important, or even irrelevant, since new technology has made reading less necessary to the general attainment of knowledge". Especially in our country's workers, reading comprehension is neither practised nor preferred (See OREALC, 1993). A picture, either static or preferably in motion, is easier to repeat, understand and follow.

Slow motion, learner-controlled pace and the capability for endless repetition form the backbone of our graphics-based interface. Colour is used to get and maintain attention, with video clips to illustrate examples or applications of content, but preferably not to explain, as more controllable animations get better results. It is imperative that the objects depicted in animations and video clips resemble closely the actual objects the learner will work with, even actual photographs and video of the real premises, looking for remembrance of known shapes and interactions rather than the application of abstract structures to real situations (the realm of architects and engineers).

Delivery

The process shall be constrained by the learner's willingness to use computers. In this context, connectivity, age and successful exposure to computers are relevant variables to consider in the decision of which media to use. As the keyboard, screen and speakers are the sole interface between the learner and content, available connectivity to the learner's computer dictates the possibility of using video or large pictures that require the transmission of large files. Current mass availability of

bandwidth in our country dictate the preference for compact discs, leaving online transmission for control or dynamic information used by supporting software, not directly by the learner. Embedded programs in the animation files communicate with a server through the Internet to get individualized data for each course and learner. These programs send exams along with the grading program, so that learners get their results right after finishing each exam, along with the right answer to every question done wrong, helping the learning process.

Consequences: examples of the application of the model

From three successful implementations we have developed:

Learners' profile

After interviewing company executives and visiting facilities, it was determined that most employees had 6 to 12 years of formal education; a low preference for reading, had not developed good reading comprehension abilities; were visually oriented or comprehended visual content with ease; and had a low attention span. They were spread out all across the country, available infrastructure restricted reliable bandwidth to that of an old phone line, no more than 33kbps (thousands of bits per second).

Learning objectives

The learning objectives were determined in accordance with our model, in terms of expected behaviour:

- Salespersons shall know the technical characteristics of products, in order to give customers the right information and be able to suggest configurations adapted to the customers' needs.
- Service personnel shall know the service manual procedures and specifications, in order to perform repair procedures according to standards, and assure customer retention.
- Operators shall be able to assemble / disassemble specific engines, with the proper adjustments and procedures, with emphasis in safety and quality.

Content

Content was defined by the company:

- The technical characteristics of the products, configuration procedures and standards.
- Service manuals and standards.
- Engine parts, diagrams, measurement, assembly and adjustment specifications and procedures, safety guidelines, operation manuals.
- Feedback and discussion forums were established to aid in communication among learners, the "Fourth Level of Interactivity" where participants clarify understandings (Weatherly and Ellis, 2000).
- Academic control was established using an evaluation database and support system in an Internet server.

Media and delivery

- Learner's profile and his/her access to computers linked to Internet were assessed, finding that learner's have access to a computer at least at work, and are willing to use it. Content is technical, related to measurable performance

A distance education model is therefore applicable. Preliminary evaluation can be conducted online. However, as there is no current technology to supervise an actual procedure over distance, final field verifications are specified.

Given the geographical dispersion and available connectivity, CD-based delivery was chosen, with Internet academic control and evaluation database. Learners are able to study without a connection, as only evaluations require Internet access.

We are facilitating the learner's process of imitating the course's content with actual workplace practice; so all images and video were taken from real workplace conditions, or supplied by the company. Every time an image of a tool, machine or part is shown, it is a realistic representation of the objects the person will have in the workplace. Visual identification is sought after in every image and video clip.

Results

We developed training programs for three large groups of employees, following the model explained. Informal, unstructured interviews with learners and company executives (formal reviews are not permitted because of company policy) show that:

- Trained employees were able to perform new duties without any other courses.
- The possibility of taking different paths within the course at will, visual identification of course images in the workplace and learner-controlled repetition were repeatedly mentioned as significant aids in understanding interrelationships, causes and consequences.
- Courses were also used for reference; workers returned to the courses to check procedures or adjustments while doing their work.
- Performance of workers trained with our courses was similar to traditional methods, with significantly lower costs (cost per worker was 36 times lower) and in a shorter time frame (6 months vs. 2 years). No errors in actual procedures were detected that could be caused by our courses. Supervisors told us that workers showed a better understanding of why things worked, not only how to make them work.
- Based on the first successful courses, a simulator-based course for production line operators was approved and is scheduled for on-the-job training beginning in January 2004. Operators will use it to learn and assemble automobile components, with no previous training in assembly procedures.
- 3,800 people in one company, and 200 dealers in another, have used the courses.

Problems we faced include adaptations of: the initial graphics design, communications software due to local reliability of connections, and evaluations, due to regional differences in nomenclature.

Implementation was done with intensive feedback from company executives, and a prototype run on a real facility. Feedback resulted in changes in images and examples, graphics-based evaluations and the addition of a section to test product configurations.

We have learned to adapt the software to the course requirements, searching for the right programs for the problem at hand, instead of choosing a specific software piece and then restricting the course to its capabilities. One consequence is that we decided to design and implement an online evaluation control system, instead of relying on commercial learning management software (LMS), other is that we decided to use a combination of two- and three-dimensional animation, internet database and communication software, after the unsuccessful initial trials with only one software.

Conclusions

Given the proper learning model and environment, training can be done at the workplace, during normal work activities, becoming at the same time training and reference. This merging of the learning and working realities facilitates comprehension and the application of new knowledge, increasing the success (and thus motivation) of the employee in getting reliable results from his/her work, and lowering training and operating costs for the employer.

Work continues on the improvement of distance evaluation methods and on the design of animations better suited to help learners comprehend procedures and sequences. Sound is an option we have yet to use, and increasingly available Internet access may change the media design and delivery preferred today.

References

1. BLOOM (1958); *Taxonomía de los objetivos de la educación*; Planeta Editores.
2. LLANO, C. (1999); *La formación de la inteligencia, la voluntad y el carácter*; Editorial Trillas
3. MILLÁN, A. (1974); *La formación de la personalidad humana*; RIALP Editores
4. HORTON, W. (2000); *Designing Web-based Training*; Wiley & Sons
5. CONRAD, K. (2000); *Instructional Design for Web-based Training*; HRD Press
6. WEATHERLEY, R., ELLIS, A. (2000*); Online Learning: What do teachers need to know about communicating online?*; Proceedings of the Sixth International Conference on Web-Based Learning (NAWeb 2000), in http://naweb.unb.ca/2k/papers/weatherley-ellis.htm
7. ALVES, L. (1963); *Compendio de didáctica general*; Kapeluz.
8. SMITH, R.; FISHER, R. (2000*); Pedagogical Issues in Web-Based Learning: The Digital Learning Interactive Approach;* Proceedings of the Sixth International Conference on Web-Based Learning (NAWeb 2000), in http://naweb.unb.ca/2k/papers/smith.htm
9. OREALC (1993); *Comprensión de la lectura de niños de áreas rurales y urbanas marginales;* Boletín 30, 1993, p.p. 3-10 (Oficina Regional de Educación de la UNESCO para América Latina y el Caribe).

Authors

Mario Doria and Rafael Santana
Tecnológico de Monterrey, Toluca Campus
Centre for International Competitiveness
Eduardo Monroy 2000, 50110 Toluca, México
mdoria@itesm.mx and jrsz@itesm.mx