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Systems for Training and Evaluation Assisted by Computer (STEAC) from Tradition to Innovation

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Abstract

In this article it is presented a systemic analysis of the training processes, in order to emphasize the essential features and characteristics of this special class of systems, as for denoting the possible ways and means to increase these systems' performances. This paper presents the training systems' structure and functions, as an overall pattern, which can be applied on several training and performances evaluation forms. There are, also, presented the possibilities and the way to design some systems with superior performances, where the majority of the functions are carried out or assisted by PCs.

Key words: *training, e-knowledge, e-learning, simulation, integrated learning-assessment system*

Preliminary considerations

Human Resources qualification for various activities presents a special interest because the efficiency of the training activity is determined by the performances of the training method adopted. The training efficiency is determined by several factors, including here factors of psychological nature. Therefore, is necessary to highlight these factors and their influence, what means to design these models and to establish those measures which can ensure the optimal deployment of the training program.

Evaluation of the training systems efficiency, as how many of the proposed objectives are achieved, is extremely laborious and complex. This can be made by experts in this field through the adoption of adequate systems for information processing assisted by PC's, systems capable to handle a large range of functions, which previously were carried out exclusively by people.

Training process – target for automatization

The remarkable progresses obtained by the top domains of science and technology make possible a new approach of the training and evaluation processes (TEP), of the efficiency and quality of these, such approach showing the possibility to pass from the stage when these systems where produced exclusively by the instructors to another stage when these systems will be produced by instructors assisted by PC's.

In this approach, the instructor role is not diminished, but is changed, therefore the instructor presence in the knowledge direct delivering process and in the evaluation process of the training

results is not obligatory, these functions being transferred and carried out, at least partially, by PC's and eventually by simulators [3].

During such approach, the instructor main role consists in a rigorous organization and presentation of the discipline content by modules and sub-modules in order to make possible a systemic approach, same like for any other process which can be carried out partially or totally in automation mode. For this purpose, the instructor has to elaborate firstly, "clearly" the training and evaluation program (TEP), which should content:

- Training objectives;
- The quantum (amount) of knowledge and the skills to be assimilated;
- Training and evaluation program (TEP);
- Necessary human and material resources;
- The control (examination) topics (questions);
- The answers to the formulated topics;
- Specific training efficiency indicators;
- The evaluation (examination) procedures for training program completion etc.

Prior to implement any training process it is necessary to establish the functions what such program has to perform, together with the structure of a system capable to accomplish these functions, which means to design a system model.

It is possible that in order to accomplish same functions (objectives) to establish several structures, which will be differentiated between them through the system components functional connections and through their nature. From here is resulting a multitude of solutions which can be given depending on the organizational unit capabilities, depending on the technical and financial resources availability etc. therefore a training system elaboration could became a problem related to optimal selection with or without restrictions [1].

Figure 1 presents a general training and evaluation system (TES) model for several disciplines where are highlighted the functions and the functional connections between the model components, without taking into consideration the nature of these components, due to the fact that those functions could be carried out either by people either by equipments. From figure 1 can be observed that TES is a complex system, a multivariable one, with measurements of different nature, with multiple direct and reverse connections, a system where can take place activities, discrete events which can be unrolled sequentially, but also in parallel, in conformity with the preparation timing schedule in several phases, which can form the training cycle of a graduates series, with the repetition of same sequences for each graduating series.

It could be noticed that the reaction or the "answer" to instructor and trainee interactions are not totally predictable, but most probable, due to the number of influencing factors, including here the factors of psychological nature. Due to this reason, it's almost impossible to establish o mathematical deterministic relation capable to describe the trainees' knowledge and skills assimilation process during the training process, the main indicator measuring the knowledge level achieved being the grade obtained by the trainee.

Such model can be the base for a real structure selection of several training systems. On this base an expert's team can establish a clear training and evaluation program, program which can constitute the fundament of a classic training and evaluation program where the determinant role is assumed by instructors only. But this kind of training form is obsolete because is not taking any advantages what usually are provided by a training assisted by PC's and simulators. To have a benefit from the PC's use the training program will be transposed into a training and evaluation program assisted by computer, TEPAC.

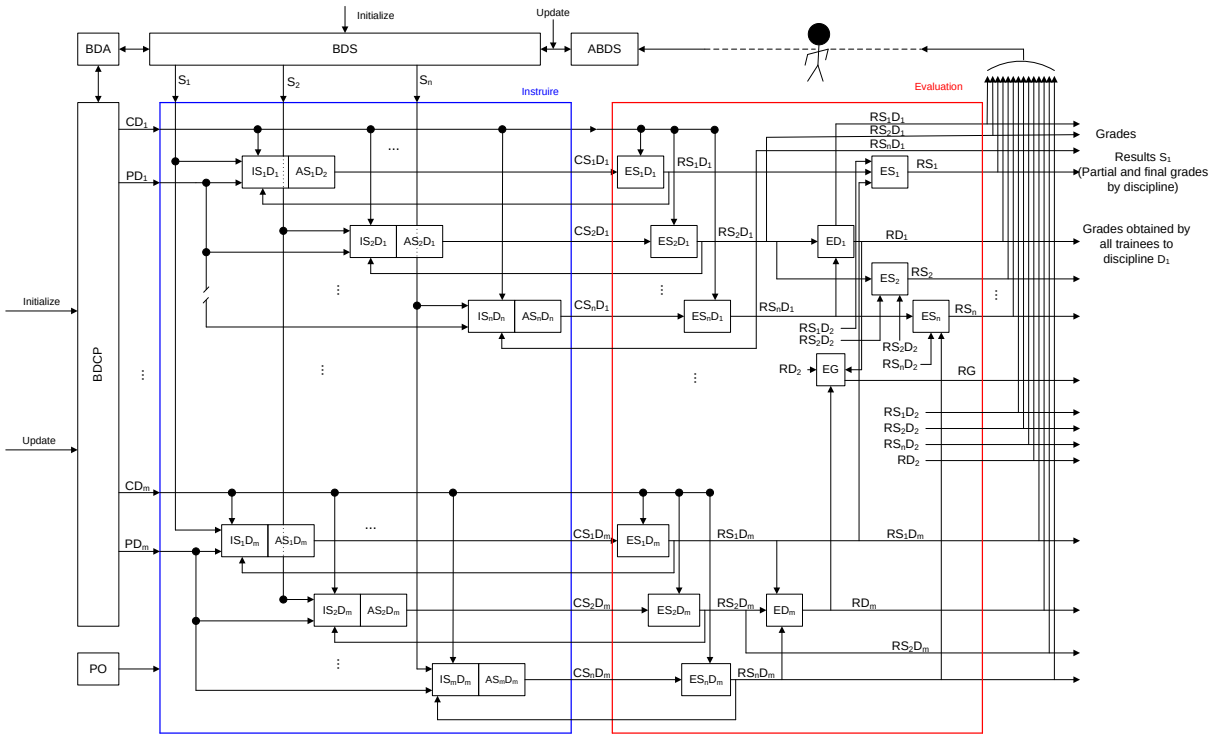

Fig. 1. Training and Evaluation System Model of the training process for a preparation cycle with updates on phases (weeks/months/semesters or study years).

The symbols used in figure 1 are the following:

S_i – trainee *i* (i=1,n);

RS_i – results (grades) obtained by the trainee S_i at all disciplines (i=1,n);

CD_i – the amount of knowledge's/skills to be learned belonging to discipline *i* (i=1,m);

PD_1, PD_2 ... PD_m – the trained discipline *i* and trainers who train the discipline *i* (i=1,m);

CS_iD_j – knowledge accumulated by the trainee S_i at discipline D_j (i=1,n; j=1,m);

RS_iD_j – results (grades) obtained by the trainee S_i at discipline D_j (i=1,n; j=1,m);

RD_i – results distribution for all trainees at discipline D_i (i=1,m);

IS_iD_j – training of trainee *i* at discipline *j* (i=1,n; j=1,m);

ES_iD_j – trainee evaluation *i* at discipline *j* (i=1,n; j=1,m);

RPG – average global result (grade) per full cycle and per sub-cycles;

BDS – data base associated to all trainees;

ABDS – updated data base associated to all trainees;

BDC – data base associated to trainers PD_1, PD_2 ... PD_m and the knowledge quantum to be assimilated at disciplines CD_1, CD_2 ... CD_m;

BDA – archived data base;

PO – hourly activities schedule.

Opportunities offered by computers to training process

Computers offer several opportunities and facilities what can be used in building up a TEP by a better utilization of some specific functions, faster and much more economically comparing with the case when humans carry out such functions. The most important of all of these are the following:

- Secretarial function to keep the students operative evidence, the trainees evolution and to keep under control the results obtained by the trainees from the training cycle starting point up to the end of the cycle;
- Archiving function into an official documents data base referring to all didactical activities closed out;
- The exposing/storage function of the didactical material on electronic support with the possibility to provide access to this to all trainees;
- The function of virtual simulation of some processes difficult to be simulated physically in a laboratory environment (i.e.: flying simulators, driving simulators etc.). In order to offer a proper similarity with the simulated system, these simulators contain apart on one computer, interfacing equipments similar with the original ones;
- The function related to the evaluation of the trainees accomplishment grade without an instructor presence. In this case the computer has installed the necessary software, capable to generate a set of various questions, the trainee having the possibility to select one or more than one correct answers. The software do the analysis of the answers and calculate the assessment result;
- The function of analysis and evaluation of the training process carried out based on the analysis of the results obtained by trainees at the end of each training phase and at the end of the cycle. The computer can generate lists with the obtained grades by the trainees to all disciplines completed, lists with average values and extremes of these grades, their distribution by disciplines etc.;
- The function of elaboration of the optimal hourly schedules used for didactical activities deployment as per training programs;
- Generating the synthetic reports, periodically or upon request, regarding the progress of the entire training process.

Training and evaluation assisted by computer

From the previous sections results that the elaboration and the success of such training method depends mostly on the ability of the institution which organize to establish the training program assisted by computer, TPIEAC, and to establish the rolling program of all other connected activities as well as the method depends also on the ability of trainees to use computers and other components of the system.

The majority of the problems which has to be solved, most of the financial efforts and the major part of the working efforts what instructors and administration have to do are involved by the implementation phase of the training system, this phase being the one when the trainers and organizers professional “intelligence” is transferred to computers can be capitalized in the training process.

For all trainers and trainees with insufficient experience in computers domain, the promotion of such training concepts can produce an impact which can be translated as retention or mistrust. In time, as soon as these systems show their efficiency they became accepted at a larger and larger

scale. Also, it is true that some domains can't be included on the list being quite difficult or even impossible to build up such training programs like art, music, fashion etc.

In fact, not all trainers have to elaborate or implement their own TPIE, because some professional associations or specialized companies have already designed and released on the market such programs for several disciplines or groups of similar disciplines. In these conditions, the senior trainer of each discipline could use such programs in order to implement their own TPIE. To achieve such objective the trainers need to know the principles and the concepts what form the fundament of the purchased programs, in order to use those correctly [6].

To have a recognized and build up by a computer a TPIE elaborated "in clear" has to be transposed in acceptable terms by this. For this purpose, has to be selected a codification (programming) language and the training program is build up for computers, this program being stored on an adequate support.

The program for computer will be elaborated base on some data sampling, organization and processing procedures, these data being collected from the training process in order to determinate the training results as follows:

- procedures for planning and carry out of various training sequences;
- procedures for trainees assessment or self assessment at the end of some training sequences for each discipline [5];
- procedures for replaying of some sequences already done but with unsatisfactory results;
- procedures for the evaluation of level reached by trainees to all disciplines;
- procedures for communication of training results by the trainees and trainers;
- procedures to determinate some statistical indicators, statistics, histograms etc.

The main *attributes and advantages of STEAC's* are the following:

- STEAC's are addressed mainly to the online and at distance educational process, a process which don't require the presence in the same location of the trainers and trainees, but these systems can be used also for the classic educational system;
- STEAC's are infallible when they are used for trainees evaluation, because this is done by the computer, which is incorruptible and do not accept favouritisms. However, needs some restrictive identification measures for trainees identification when they are evaluated in order to avoid the person substitution;
- STEAC's are programmable systems which can be developed and improved gradually through the enrichment and improvement of the software's;
- The results of the evaluation performed by computer showed through lists, graphs etc. can be used for the management and for the effective correction of the training process either by discipline either globally, as well as could be used for a re-structure of the training system;
- Using such systems, the trainers can dedicate and involve themselves more and more to the research and improvement activity of the addressed discipline content, because they are relieved from the task to teach through classical methods of a discipline and from the face-to-face evaluation of the trainees;
- On long and medium term, such system is more economical comparing with the classic one, mainly when is addressing to a large number of trainees, because make possible the reduction of the trainers number as well as the number of persons involved in secretarial and archive activities;

- After implementation and functional test, these systems works relative automatically, without direct participation of the trainers and only with the involvement of the support staff who is maintaining the servers and the terminals [4]. These systems can do also secretarial and documents archive activities, these being addressed to the trainees' management.

Conclusions

Today requirements in higher education teaching involve re-ordering the leap magnitude in the instructors' ability to create, acquire, assimilate and share the knowledge to their students. The available information and communication technologies re-shape on daily basis the educational environment. In the next decade the knowledge sharing methods and techniques will be re-invented significantly. Clearly, at present all these transformation are underway and in the authors opinion there is no other option than to follow this mega-trend and to try to contribute as much as possible to the future changes in the benefit of all parties involved in the educational process. Across the globe, we see examples of the e-knowledge revolution [2].

The problem proposed by the authors in this article don't end here, being possible to be commented further in another article where will be presented several details regarding the implementation of such systems for training and evaluation assisted by computer.

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Sisteme de instruire şi evaluare asistate de calculator (SIEAC) de la tradiţie la inovaţie

Rezumat

În acest articol se prezintă o analiză sistemică a proceselor de instruire pentru a pune în evidenţă trăsăturile şi caracteristicile esenţiale ale acestei clase speciale de sisteme şi pentru a semnala căile şi mijloacele posibile de mărire a performanţelor acestor sisteme.
În lucrare se prezintă structura şi funcţiile sistemelor de instruire sub forma unui model general valabil pentru numeroase forme de instruire şi evaluare a performanţelor acestora. Sunt prezentate, de asemenea, posibilităţile de realizare a unor sisteme cu performanţe superioare în care majoritatea funcţiilor sunt dirijate sau executate de calculatoare.