Constructing Learning Corporate Virtual Communities

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ABSTRACT

In the current global economy, the capacity to build knowledge is a reliable source of success because many different corporations favor its creation, trying to incorporate new technologies and to improve processes. Virtual corporate communities are Web based learning environments that offer resources for construction of knowledge in companies. This paper presents a solution for the qualification of networked corporate communities, considering aspects such as: the importance of learning in the organizations and of implementation of a learning culture; the lack of alternatives for the institutions to solve their problems related to professional education; the use of information and communication technologies for the construction of organizational knowledge.

1 INTRODUCTION

Analyzing human resources qualification programs in business corporations shows that little or almost nothing has been done for the development of new methodologies to help their employees become better prepared for new productive and global scenario. Even with new technologies, current methods are similar to those ones that have been practiced for several years (Bassi, Cheney & Buren, 1997). Besides, as Drucker (1993) states, the challenge is not on technology, but it is on how we could apply it. The implementation of a learning culture is never associated to a qualification program because it ignores environment, people and reality, which lead to a total lack of context and meaning to employees.

On the other hand, suitable use of technologies and computer, relying on an approach that promotes the construction and, consequently, knowledge creation, together with an efficient qualification and evaluation methodology, can contribute for construction of an organization that learns and generates knowledge, educating an employee that understands what he does, allows other groups reflect, expose, test and improve mental models they use when face problems or make decisions in factories.

Favoring this kind of approach, it can be observed an increasing number of technology applications to develop distance learning process in every economic sector. Many examples of learning network mediated by technology can be found in Harrison, Hiltz, Teles & Turoff (1997). At enterprise scope, a research done by the institute *Masie Center*, a distance teaching specialized entity, checked that 92% of big organizations in the United States would implement some training activities using Internet or Intranets (Aisenberg, 1999). At the end of 1998, 41% already had some distance qualification. Research conducted by *Social and Economic Sciences Research Center* at *Washington State University* (Meister, 1999) revealed that 29% of interviewed professionals already prefer distance education as a means of job related qualification.

The importance given to distance education is justified, mainly, by the easiness provided to join groups of people without moving them, offering reduced expenses to the company, minimizing costs by saving money associated with human resources qualification. With the advances in technology we are enjoying through Internet, Intranets and in communication systems, possibilities for distance education are being favored. For example, using chats, forums, discussion lists, and e-mails is a common practice in many organizations.

However, the implementation of a presencial qualification program, held in Schlünzen (2000), lead to conclude that distance teaching in companies must be evaluated carefully and it must have as a requirement the creation of presencial learning culture. Because, as practical issue, employees must look for learning consciously. They must act without thinking of that as a task, but they must be conscious of its importance (Schlünzen, 2002).

When such a culture is established, learning is looked for by employees spontaneously, systematicly and naturally, so distance qualification becomes possible. Hence, the chances of implementing distance teaching successfully are higher and the results are more significant.

Thus, an important research should be done to develop tools for distance qualification of learning agents in corporations, so that it is possible to create, as we name it, learning corporate virtual communities.

At present, we are creating virtual corporate communities at *Delphi Automotive Systems*, considered the world biggest group in sector of car parts, where we have already performed a wide task of presencial professional qualification (Schlünzen, 2000). We used an application software named "Target Game" ("Jogo do Alvo"), based on the idea of computer games using the metaphor of a target shot (Torrejon & Schlünzen, 2002). This game is being applied to qualify workers at assembly line and it allows learning to be promoted by distance interactions between expert/supervisor and workers/apprentices. With this possibility, a expert/supervisor can accompany at distance every workers/apprentices and game interactions, propose problems, present suggestions and be asked by apprentices.

This dynamics seems to be interesting to companies considering that expert/supervisor does not need to move to geographically spread units and it is possible to constitute teams with experts from several company branches.

The results obtained from these first virtual applications of "Target Game" show significant advantages and opportunities for learning of several concepts, implanting a new teaching paradigm – training in service – because workers can be qualified in an on-line or off-line manner at work places, since nowadays machines in assembly lines have coupled networked computers.

In this paper, we intend to describe the current and global corporate environment and to present the construction of communities aimed at workers qualification, presencial or virtual, in organizations.

2 THE CORPORATE ENVIRONMENT

The job environment that leads to worker intellectual development can be well defined by Paulo Freire (1970, pp. 80) who wrote in his book "Pedagogy of the Opressed":

> *"There is no, on the other hand, dialogue, if there is not humility. The pronunciation of the world, with what men recreate it permanently, cannot be an arrogant act. Dialogue, as a meeting of men for a common task of knowing how to act, is broken, if its poles (or one of them) lose humility. How can I dialogue, if I alienate ignorance, that is, if I always see it in others, never in me? How can I dialogue, if I admire myself as different, virtuous man by heritage, in front of others, mere "this", in whom I do not recognize other me? How can I dialogue, if I feel a participant of pure men, owner of wisdom and truth, to whom all*

others from outside are "those people", or they are "inferior natives"? How can I dialogue, if close myself to others' contributions, never recognizing them, and even feeling offended by them? ... Men who do not have or have lost humility, cannot be close to people. They cannot be their fellow in pronunciation of the world."

The most important feature in this environment is humility, which allows creation of an environment for exchange, where each one must teach what he knows to others, without a teacher/pupil perspective, instead, a partnership relation with mutual learning. A place where a rich source of experiences can be obtained, an environment where intense interactions among workers occur, favoring creation and construction of knowledge, spreading it, expanding it and making it accessible to all.

Such an environment means an administration that invests in material, cultural and epistemological overcoming of obstacles, creating a collective qualification project (Fazenda, 1995), establishing learning practices as a key element to corporation objective and success. It does not occur in isolation, but when a corporation begins an effective exchanging with other corporations, for example, as it happened to our group's paper.

Thus, it is necessary to create a culture involving all participants to get comprehension about importance of learning to organization and willingness to change. Supplying all workers with opportunities to integrate working and learning activities in the same environment makes people learn in their professional context, with real world problems, since learning does not happen in separate phases and places, but integrated to the working process (Fischer, 1999).

Administrators and managers must ensure that all organization members can contribute to solve problems and to define policies and strategies. It is also required that information is accessible to all so that a conscious and competent participation in decision making process is possible.

Another important aspect in this environment is effective communication that must exist among departments, units and workers, which will make possible exchanges of information, experiences and results. Besides, errors and problems must be shared and not hidden or disguised. In this scenario, everybody fills free to express their thoughts and doing so they contribute to solve problems. It is created an organizational culture that promotes a learning culture, allowing a new paradigm change, in other words, transformation from an qualified organization to an organization that qualifies (Fleury & Fleury, 1997).

Besides, it arises a strong interaction and communication factor among workers that, made possible by technology, usually becomes more intense than in presencial activities about what it will be detailed below.

3 INTERACTION IN LEARNING CORPORATE VIRTUAL COMMUNITIES

In these communities, if learning agents face any difficulty in his qualification task, a expert support can be asked for through computer network. Inquires or problems that learning agents can not solve are then sent to a expert who, in turn, reflects on these questions and sends back his opinions or materials to help agents in problem resolution. Thus, expert analyses and reflects about how he could intervene, recommending new questions that could help employees in their qualification process, so that a virtual learning cycle is created, as illustrated by Figure 1.

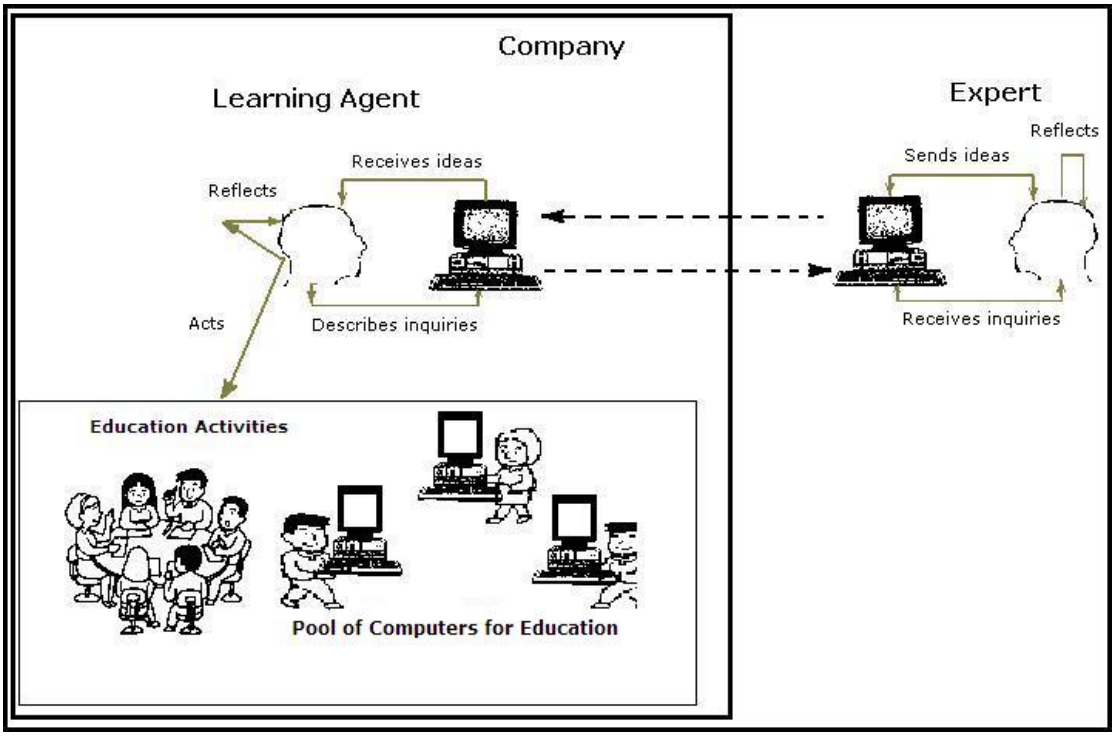

Figure 1 – Virtual Learning Cycle

Many advantages can follow these activities, such as quick access to external experts to help learning agents; access to other information sources; constitution of discussion groups; development of collaborative projects where employee groups can discuss and implement shared projects using resources available at different units in the organization; learning as a requirement for a new teaching-and-learning way.

Finally, this same methodology can be used by the community to qualify other colleagues in the corporation, from branches geographically spread or even suppliers and clients, establishing global alliances and creating new means of creating and sharing knowledge, as Figure 2 illustrates. It makes possible a new dynamics in virtual learning process, constitution of learning virtual teams (Cunha, 2000), geographically spread, that could represent an important contribution to employees and companies.

Based on this current context, we began developing tools for worker qualification having not only technological resources for an individual qualification, but favoring interaction and development of a group of workers engaged in learning, knowledge construction and, consequently, stimulating the development of continuous improvement in organizations.

One of these tools is being used at present is an application software named “Target Game” (Torrejon & Schlünzen, 2002), which main focus is to qualify workers on Statistical Process Control concepts and techniques, but it also offers resources for virtual interactions among apprentices, learning agents and experts.

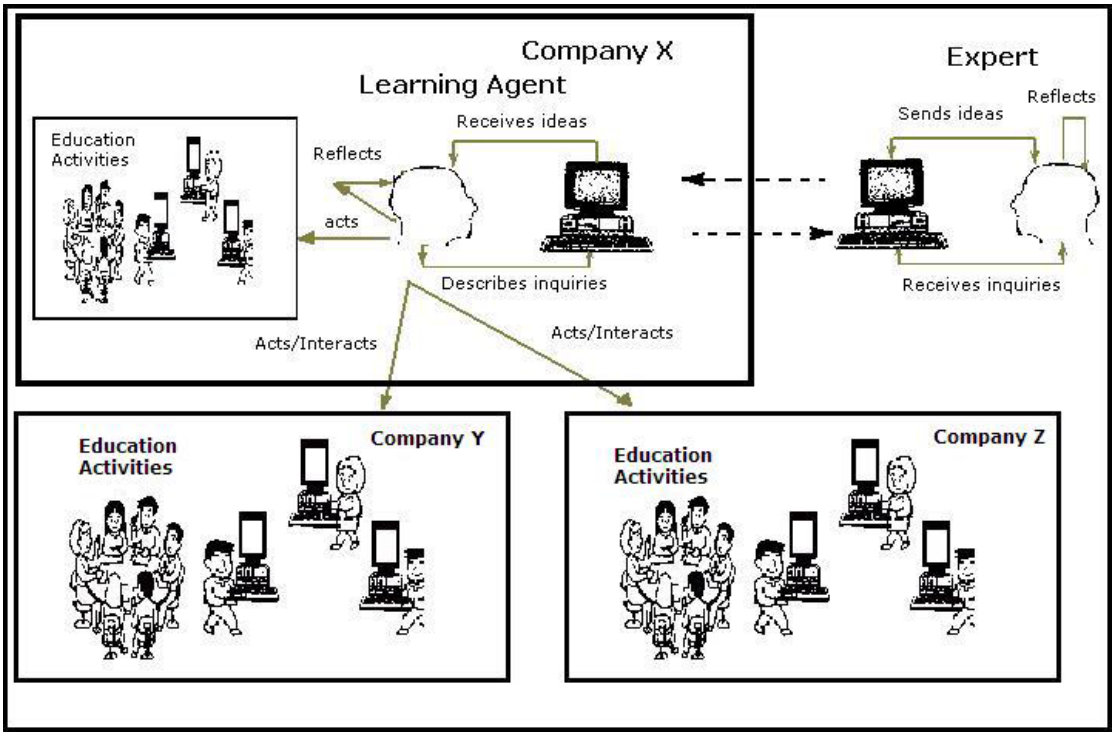

Figure 2 – Organizational Learning Network Simplified Model
Adapted from Valente (1999) and Schlünzen (2000)

4 THE TARGET GAME: FROM PRESENCIAL TO THE VIRTUAL

The Target Game (Baranauskas, 1998; Schlünzen, 2000) it is a software that explores concepts about Statistical Process Control (SPC) using a shooting at the target metaphor to define values to generate the graphs (Control Charts). These values simulate the process of collection of samples accomplished in the workplace.

Initially it was implemented for interactions between expert and apprentice (Schlünzen, 2000). Now, there is a new version that allows a teacher/expert, at the distance, to interact with the apprentice. Therefore, we have two interfaces in the game: one for the expert and the other for the worker, considering that the apprentice can also be a worker in a factory.

The Worker interface is practically the same as the first version of the Target Game, strictly defined and used directly. Through it, the user registers marks on the target by using the computer mouse. The distance from the hit to the center of the target defines the value of the sample, considering the center as the average (nominal) between the inferior and superior limits of tolerance in the productive process (LIE and LSE, respectively) indicated in the target (values 50 and 100, respectively, of the Figure 3). Thus, a set of values can be generated that represents possible samples that are obtained in the factory and the quality concept is understood as the uniformity of the shots around the target center, that characterizes a stable and capable process, as Figure 3 illustrates.

Being an easy procedure, it is possible to create several situations where the results can be observed. These results are defined through a group of shots and expressed with the graphs of the average, amplitude, histogram and the calculation of the two statistical indexes CP and CPK[1] as well, as they are also shown in Figure 3.

[1] The CP and CPK indexes compare the natural variation of the process with the variation allowed by the specification. The natural variation is defined as 6 times the sample standard deviation.

Figure 3 – "Target Game" and a distribution of shots corresponding to a stable and capable process

With these information, the user is invited to classify the process regarding its stability and capacity, as the "Avaliação do Processo" window shows Figure 4. Soon after, the game indicates if the answer is correct or not, remaining in the same exercise until the user answers correctly.

However, in this new version of the Game, an area of chat was included between the expert and the apprentice, as it is observed in the Figure 3, in the space "Conversando com o Especialista".

At the end of each session, a registration of all the interaction of the user with the game is stored in a file. This can be an important way of analysis of the mental models, aiding in the evaluation and future observations.

In the new version, there is the expert that uses his/her interface denominated "Especialista " to interact with the apprentice. The interface allows the expert follow at the distance up to four apprentices working with the Target Game simultaneouly, as Figure 5 illustrates. In this situation, for a more detailed monitoring, the expert can choose one of the users clicking in his respective area in the screen. Therefore, everything that the apprentice is doing with the game can be observed and commented by the expert, through net, allowing a full interaction among them.

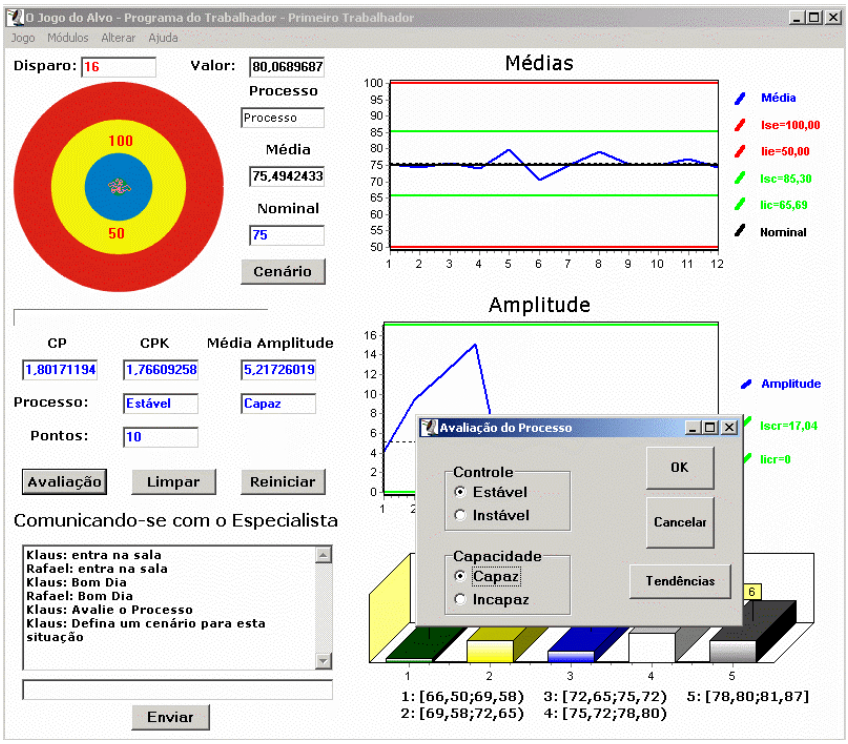

Figure 4 –Process evaluation dialogue window

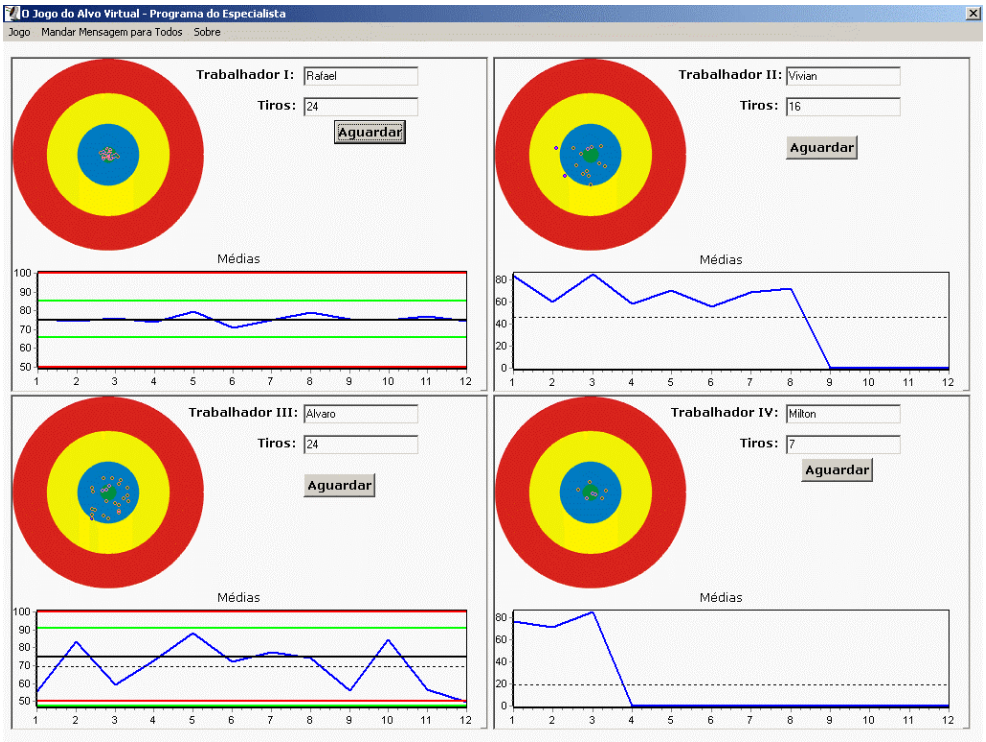

Figure 5 – View of four users simultaneously interacting with "Target Game"

It is also possible that the expert at the distance recommends exercises to the apprentice or that he/she alters some configuration in the game to observe your performance, as shown in the Figure 6.

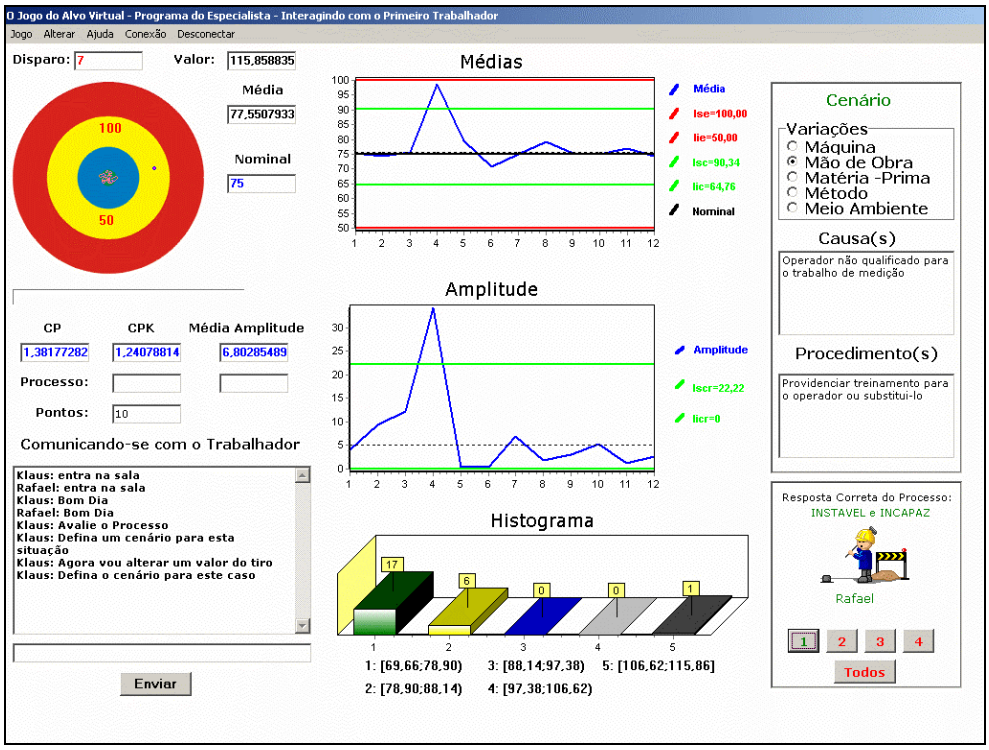

Figure 6 – Apprentice exercise viewed by an expert

In the same way that in the Worker interface, the expert can store in a file all the interaction, including the messages of the chat, for subsequent analysis or evaluation, where he/she could suggest new exercises for other users. These registrations are important instruments to create a group of factory situations that we called scenarios.

4.1 The Scenarios

The scenarios are situations in the productive processes defined for the apprentices, and are related with a configuration of shots in the game. The Figure 7 illustrates an example of a scenario defined for the apprentices for a specific configuration of shots. In this situation, the process is capable, however, unstable. It is possible to observe a pick in the graph of the averages so that it exceeds the superior limit of control. In this case, the situations and solutions were indicated by the apprentice, as it can be observed in the Figure 7.

The scenarios add a new resource to the software, being an interesting way for the apprentice to express the relationship among a disposition of shots in the Target Game and a real factory situation. Besides defining a real context caused by a problem, the apprentice is stimulated to present a solution. Thus, the scenarios allow him/her to think of giving meaning to the Target Game and with an immediate application in real problems, generating an effective communication base and storaging cases that are planning tools for solution of unexpected problems.

This collection of cases can allow the construction of an organizational memory, important for the mapping of mental models that not just determine the way we understood, but also as we acted and solved the problems. In this case, it is the explicitation of the apprentice's knowledge, in other words, the transformation from tacit knowledge to explicit.

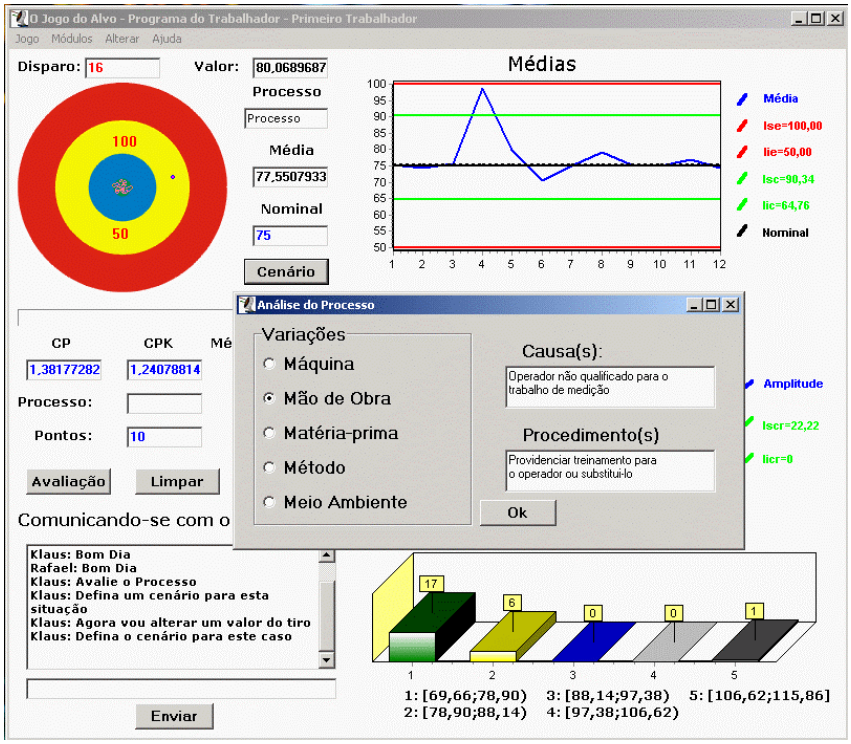

Figure 7 – Scenario definition resource of "Target Game"

Besides, the scenarios can be a rich instrument for diagnosis and evaluation of how the aprentices understand the problems, how they act and also which the solutions are. This will allow the expert to interfere to help them reflect better.

Another important aspect for the learning process is to observe diferent solutions. With the scenarios, it is possible to explore the multiplicity of the users' perspectives that work with them, where their understanding about the subject or the problem solution is expressed using the computer as a tool. The description-execution-reflection-debugging-description cycle, defined for Valente (1999) and expanded in Schlünzen (2000), allows the explicitation and the formalization of this knowledge that defines the apprentice's mental model (scenarios) and the learning cycle. Besides, it allows to try new situations, to learn from old experiences, to build new knowledge quickly and efficiently, to collaborate for the creation of an organizational memory.

In this sense, considering the importance of working with real data, with the technological progress the machines in the workplace it is already possible to collect the information of the process directly and send it to a database. Therefore, with this opportunity, a new module to the Target Game was implemented: the Factory Module.

4.2 The Factory Module

This module is derived from the Virtual Target Game which main difference among them is the source of the data. In the initial version, the source of the data are the shots to the target accomplished by the apprentices with the mouse. In the Factory Module, the data is directly obtained from the machines in the production lines, generating a database.

That is an interesting possibility for the companies that acquire modern machines to obtain information of the productive processes directly, in real time. These information is then stored, offer a constant source of real situations of the factory to the workers.

Thus, this database can serve as an important resource for the workers' training as well as to guarantee for the company a storage of the report of the processes. Besides, with

these new machines, the function of the operator is, basically, to position the piece and the passive supervision, since the remaining work is due to the equipment. Therefore, most part of the worker's time is to await the end of the machine's operations. His free time can better used for his training in concepts and techniques of SPC.

With this purpose, we implant a new and innovative modality of professional training in the workplace, what is called "Training in Service ", since the operator can take advantage of this time interacting with the Virtual Target Game, communicating with other workers, evaluating the processes and being monitored by an expert/teacher at the distance.

Another important contribution is that, when accomplishing this interaction with the Virtual Target Game, we would be qualifying this worker to act as a multiplier agent, who is known as partner-multiplier[2], Schlünzen (2000). This approach also allows to implement what Drucker (1989) defines as *knowledge worker*, where the worker is not just involved in producing, but also involved in learning, in teaching, in exchanging and creating knowledge. Through this, the company would win the training of the multiplier agent that could guarantee the continuity of the implantation of a learning culture in the company, turning it self-maintainable.

Now, we are implanting a database system in the Delphi Automotive Systems company, that is fed by the data generated by the modern machines of measurements defined as Discovery CMM, as shown in Figure 8. These machines measure the pieces positioned by the workers and they execute a series of operations that generate a significant amount of data that need to be analyzed by the operators and engineers of the factory. Through that, the database is not just an important resource to store data, but mainly to approach concepts and techniques of SPC in real time, as well as, the storage of the report of the processes.

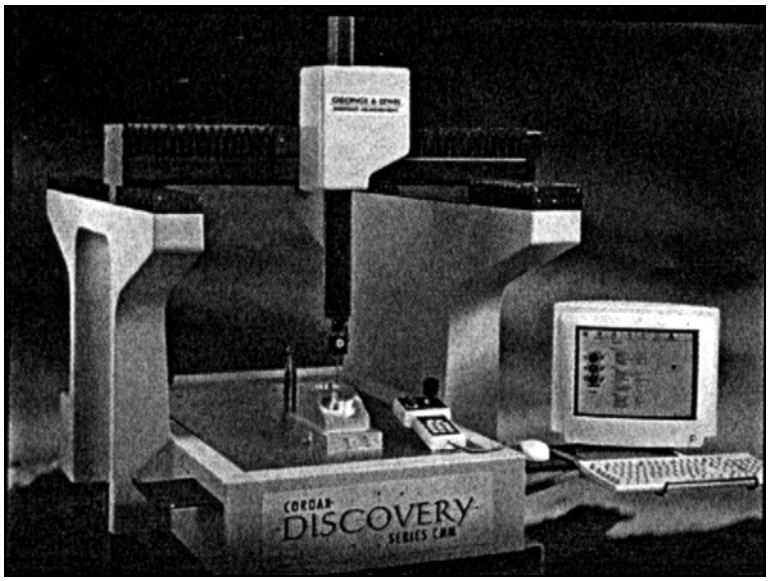

Figure 8 – The *Discovery CMM* measurement machine
Source: RFM Resources for Manufacturing, Inc.

Thus, the shots positioned in the target are coming from real information. Each machine is connected to a computer in the intranet, after the end of the measurement process, the equipment generates a report of the piece containing all its characteristics, sub-characteristics, specifications and measures.

[2] The partner-multiplier is a facilitator of the learning that belongs to the context, in other words, he/she is part of the company work force and lives with the work place problems.

In this conception for the Target Game, all the workers are connected to the same database. The worker chooses the piece in the area "Selecionando Dados" as presented in the Figure 9.

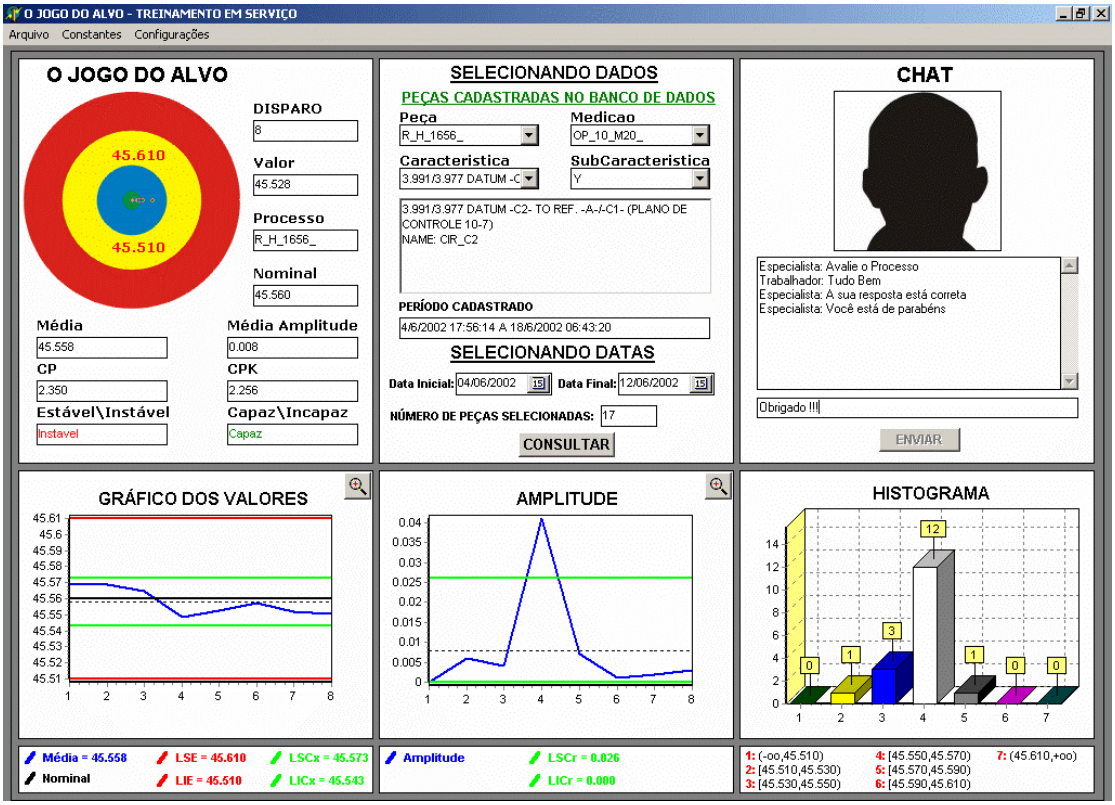

Figure 9 – Factory Module

Data is selected in the database and the program generates the control charts in the apprentice's screen and the expert's simultaneously. With these data, expert and apprentice can be interacting while the machine is performing the operations in the piece. This dynamics is innovative, because the training is accomplished in service, during a period that, until then, the worker used to passively await the end of the operations of the machine.

All the acquired experience with this methodology allow us to identify important contributions for the involved companies, as well as, a new form of workers' training, presencial or virtual, with expressive operational results for the organizations.

5 CONCLUSIONS

This research investigated how a contextualized and significant workers education takes place through the use of communication tools at distance, associated to education and methodology and of ruled evaluation in learning agents. The development of the work was accomplished in workplace, totally done inside of factory context, from the implantation of the virtual learning environment until the definition and validation of the methodology. This solution, could also contribute to the formation, promoting the learning inside of the organization. It allows the creation of learning corporate virtual communities.

The experience of educating at the distance the learning agents, for an effective use of the information and communication technologies in the formation of human resources, makes

possible to engage this professional in a just-in-time learning, because he/she will seek for solutions for day-to-day training problems and with need of immediate solution.

Besides, it will help the worker to answer suitably to the changes that can often happen his environment, since it offers resources that can be consulted, used and tested and this will still contribute to the organization and to a significant improvement in the results, contributing to the understanding of the importance of the investment in education and learning in the organization, presencial or virtual.

The operational results collaborate for this understanding since the registrations of the own SPC controll charts allowed us to evaluate us the benefits of the training work with the Target Game, arriving at 100% of efficiency in the completion of the charts in the last months. With all the workers' participation, including the factory coordinators, it was also possible to look at the workers' involvement in the solution of problems and in continuous improvements.

Regarding the aspect of financial performance, the measurable parameters of tangible profits also showed significant progress. For instance, one of the analyzed indexes had an increase of 5.2%. The improvement in this aspect has direct consequences on the company's billing, practically in the same proportion.

As for the education learning agents at the distance, it allowed workers to learn how to do and the development of communication abilities related to knowing how to help and to the knowledge to teach, that can contribute to turn the education process completely self-maintainable.

As institutional earnings and organizacional, the developed work could provide an interorganizational learning. This work defines the characteristics that should exist among the organizations:

· to develop and to disseminate new tools and learning methods;
· to test tools and methods in practice;
· to supply interorganizational learning;
· to use an interdisciplinary approach;
· to offer opportunities of cooperative education, presencial or at the distance, to the worker;
· to create workers' groups that interact seeking to find benefits for the organization to each other.

It was aimed to begin a process of self-maintainable learning, favoring the development of competences that allow to create flexible organizations, with employees that are self-sufficient for them to look for and acquire new qualifications. Among these competences, we can point out: to learn to learn, communication, collaboration, reasoning, creativity and hability to solve problems.

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