W3E - A WEB-BASED INSTRUCTION SYSTEM FOR LEVERAGING CORPORATE INTELLIGENCE

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SUMMARY

We are already living in a knowledge economy. First there was the agrarian economy, then came the industrial economy, and while we are still immersed in the information economy, the dawn of the knowledge economy has finally arrived. What makes the book value and the market value of knowledge-intensive companies so different in stock markets worldwide? - The innovation capacity of such companies as perceived by traders.

In this article, the concept of Corporate Intelligence is analyzed, mainly based on the Intellectual Capital of a firm. Training today is a strategic weapon to leverage the Human Capital of any company. Hence, this article analyzes what corporate intelligence means, and presents a reengineering project to rethink training in the work environment through the use of Web-Based Instruction Systems.

The main concepts and modules of Web-Based Instruction systems are presented, as well as the communication, coordination and cooperation tools needed to develop a computer-aided learning environment.

A recently developed Web-Based Instruction system called W3E is presented. The architectural logic of the system is depicted and a new modus operandi offered to companies in order to transform learning into an ongoing process within them.

Some conclusions are drawn from this proposed model, the benefits are outlined and the latest challenges this new paradigm has posed to us all are also presented.
THE CURRENT SCENARIO

The current fierce global competition among companies worldwide has obliged them to rethink all their productive processes, in order to guarantee greater competitiveness, effectiveness and quality, while keeping overall costs in check. Besides, due to lack of time and the present speed of innovation, executives are obliged to re-qualify themselves constantly in order not to be outdated, obsolete and forced out of a job due to state-of-the-art management and technological innovations. In a market as dynamic as that which exists today, it is easy to be replaced in a job when it is not possible to keep studying while working.

One can say that we are going through “Just-in-Time Education” or an “Education Anytime, Anywhere” reality.

More and more companies take into account the importance of their human capital - the knowledge their workers have. This awareness is felt in the importance training has received in firms. But a very important dilemma is how to reconcile the operational duties with which executives are concerned with the time required to attend either an internal or external course.

First of all, it is important to understand fully what knowledge means to most companies nowadays.

Data, Information and Knowledge

There is great misunderstanding and confusion about the differences between data, information and knowledge.

Data means a set of discrete and objective facts concerning events. Therefore, it can be understood within an organization as a structured record of transactions.

Information is data that makes a difference and is relevant, or as Peter Drucker says: “information is data with attributes of relevance and purpose”. Normally, information is understood as a message, usually having the format of a document or visual and/or audible messages. Information is, above all, context-based.

Knowledge is linked to the capacity for action. It is intuitive, therefore hard to define. It is linked to the user’s values and experience, being strongly connected to pattern recognition, analogies and implicit rules. Most of the time knowledge is located within an organization both inside the employee’s head (tacit knowledge) and in documents (explicit knowledge). This explains why so much confusion has arisen between Document Management and Knowledge Management.

Despite the fact that it is a generally accepted distinction, doubts have been cast recently over the tacit-explicit dichotomy. According to the autopoietic epistemology school, knowledge is a private, personal thing, therefore an organization cannot possess it. Hence, knowledge cannot be explicit, but tacit: explicit knowledge is actually data and/or information which help other people to create their own knowledge through what is known as “structural coupling”. However, this article will accept the tacit-explicit distinction, which will permit us to reach more interesting conclusions.

Thus, assuming the tacit-explicit dichotomy, the following mathematical formulas depict what has been said above:

\[
\text{INFORMATION} = \text{DATA} + \sum (\text{Attributes, Relevance, Context})
\]

\[
\text{KNOWLEDGE} = \text{INFORMATION} + \sum (\text{Experience, Values, Patterns, Implicit Rules})
\]
TRAINING AS AN OUTDATED PROCESS

Companies need to store data and information, in such a way that employees can change them into knowledge. This knowledge must be shared so as to create corporate collective intelligence. Then, several training programs are developed by the companies, not only to leverage the operational skills of their employees (such as courses to present a new product line to the sales team), but also to develop the strategic expertise of the leading team (such as an Executive Management Program). These training programs follow a standardized methodology that must overcome a plethora of obstacles to be successful:

- Most of the time, massive expenses are involved in gathering all the people involved, normally geographically spread, i.e. trips, hotels, man-hours and so forth;
- There is a natural lack of motivation from the employees, as the traditional methodology has proven itself ineffective;
- Some operational activities must be interrupted or transferred to other employees during training, resulting in loss of productivity and quality when done by others;
- Training is a specific event that lasts a given time. There is no continuity after training, leading the pupils to forget most of the content they have learnt during the meeting, as is shown in Exhibit 1, where the Retention Curve is depicted.

![Employees' Retention Curve](bottom-line)

Exhibit 1 - Current Training Processes x Employee Retention Curve

This scenario calls for a new modus operandi to get a ROT (Return on Training) higher than that achieved today. The advent of the Internet, intranet, video multicasting, videoconferencing, video-on-demand etc. makes this possible and enables companies to remain in an ongoing learning-state, as well as attempt to provide customized training for each of their employees, anytime and anywhere.

CORPORATE INTELLIGENCE

Today, everyone is living in a world where change is the only constant, and this applies to knowledge which is being discarded and made obsolete in a frenetic way, shortening its useful life-
span. The CPM operational system can be cited, as well as some previously very important programming languages, such as PL1, ALGOL etc. Many professionals were trained to use these technologies that are now useless to our society, and this has made them migrate into other knowledge areas. It has not been an option, rather a question of survival.

Corporate Intelligence can be evaluated through the enterprise’s capacity to achieve connectivity (internal link and link with its partners), sharing (data and information shared among its personnel, and its partners) and structuring (ability to extract knowledge from information and raw data). The following exhibit depicts this concept.

Exhibit 2 - Corporate Intelligence

Concerning the structuring issue, as might be expected, most corporations have a very low score, since their employees have great difficulty (or inadequate skills) to extract the necessary knowledge from the available information and data. Hence, the ability to learn new things or learn to learn is paramount today. Rather, the ability to “de-learn” what has been learnt is necessary most of the time, which is not a very simple task, unless well coordinated.

Among others, the major challenges facing workers today include the ability to learn to learn, to solve problems with which they have never been faced before, to be creative and to use inductive thinking, instead of the deductive method which still prevails in the current educational process.

Intellectual Capital

Another way of evaluating Corporate Intelligence is to analyze the organization’s Intellectual Capital, i.e., the roots of a company’s values and the measurement of the hidden dynamic factors that underlie the visible buildings and products of a company.

Typically Intellectual Capital is compounded of two different types of factors:

1. Human Capital: The combined knowledge, skill, innovative talent, and ability of the company’s individual employees to meet the task at hand. It also includes the company’s values, culture, and philosophy. Human Capital cannot be owned by the company, as it lies inside the employees’ head.

2. Structural Capital: The hardware, software, databases, organizational structure, patents, trademarks, and everything else of organizational capability that supports those employees’ productivity - in a word, everything left at the office after the employees go home. Structural Capital also includes customer capital, the relationships developed with key customers. Unlike Human Capital, Structural Capital can be owned and therefore traded.
So, it is true to say that:

\[
\text{INTELLECTUAL CAPITAL} = \text{HUMAN CAPITAL} + \text{STRUCTURAL CAPITAL}
\]

Human Capital depends heavily on the companies' training strategy for their employees, such as:
- Training expenses/employee ($)
- Employee time in training (days/year)

Exhibit 3 summarizes the concepts presented in a structured taxonomy:

\[
\begin{align*}
\text{INTELLECTUAL CAPITAL} \\
\text{HUMAN CAPITAL} & \quad \text{STRUCTURAL CAPITAL} \\
\text{Training Expenses / Employee ($)} & \quad \text{Employee’s Time in Training (days/year)}
\end{align*}
\]

**Exhibit 3 - Intellectual Capital Taxonomy**

Thus, as we have seen, training is a very important feature in order to leverage corporate intelligence. The main issue is how to use Information Technology to reengineer the outdated training process still prevalent in most companies, in order to use training as a strategic weapon to build a continuous learning-oriented organization.

**WEB-BASED INSTRUCTION SYSTEMS**

Web-Based Instruction (WBI) systems are engines developed so that anyone using both a corporate intranet infrastructure and the Internet can, on a distance learning basis, attend courses that are deployed on the Web, in an interactive and hypertextual way. The user needs only an Internet browser on his/her desktop. The system and its content is stored either in the corporate intranet server or in a general Internet server.

WBI systems normally comprise three different modules:
- Authoring Module: Used to create automatically a course either by the author of the material or a third party. Usually, no advanced computer skills are needed to undertake this task.
- Learning Module: Used by pupils to accomplish training; also called Productive Module.
- Tracking Module: Used by the teacher to manage performance of both the pupils and the class as a whole, through the evaluation of grades, FAQs, problems etc. that are stored in the log of the system.

Another module can be projected so as to customize the course according to its pedagogical background. Most of the off-the-shelf systems already available on the market take it for granted that the authoring module is able to encompass all the pedagogical peculiarities of training. This technocentric view can hinder the success of WBI systems. All training should have a pedagogical
design in order to accomplish its targets effectively. The anthropocentric view holds that it is almost impossible to create an Authoring module so comprehensive as to incorporate all the features of any course. Hence, the Customization module is necessary for doing just that.

WBI systems can encompass a large range of courses, from self-learning tutorials - also called courseware - to collaborative-based courses - also called learningware. The former does not explore all the potential the Internet has on offer, working almost as a self-instruction system that most of the time can also be stored on CD-ROM media. The latter tries to explore the workgroup environment that can be created by Internet, and is the major focus of this article. It is based on three axes of interaction as detailed and depicted below:

- Communication Axis - This axis deals with the following Internet tools:
  - E-Mail between pupils and teacher, and among pupils;
  - Interest Groups (newsgroup);
  - List servers (as majordomo, for instance);
  - Chat rooms;
  - Videoconferencing system.
- Coordination Axis - This axis deals with the following Internet tools:
  - Course Agenda;
  - Course News;
  - Assessments;
  - Exercises.
- Cooperation Axis - This axis deals with the following Internet tools:
  - Texts, spreadsheets and presentations;
All these tools can be integrated and deployed via the Web. Besides, other technologies, such as video multicasting and on-demand can also be used.

Most of these events are synchronous, and only a few are asynchronous, such as chats and videoconferences.

W3E AND A NEW TRAINING PROCESS

Based on the concepts already presented, a WBI system called W3E (World Wide Web for Education) was developed in order to set up a new training process complying with the demands of the new Knowledge Economy in which we live.

W3E is not an off-the-shelf system. A core system was developed and is expanded according to the pedagogical needs of the client, according to an adopted anthropocentrical approach. W3E was developed using HTML, Cold Fusion (to access the data base), JavaScript (to provide real time consistency tests), a relational data base, and external tools such as a majordomo server (discussion lists), a newsgroup server, an IRC server, a CuSeeMe Server, just to name the most important ones. A CGI (Common Gateway Interface) is developed according to the demands of the project. The course content can be either stored in HTML files or inside the data base, as memo fields. A FTP server is also used so as to allow the upload of the digitally-developed content of the course (texts, spreadsheets, presentations, videos, sounds etc.). A very important insight was to link W3E with an e-commerce environment. A mall was developed in order to allow the pupils to purchase the course material. This material can be either sent by post or downloaded by the user once permission has been granted.

The following exhibit depicts W3E’s architectural logic:
Exhibit 6 - W3E’s Architecture

Some exhibits depicting W3E’s graphical interface may also be seen below.

Exhibit 7 - The W3E Opening Screen
Welcome to TrendNet IRC Server

To join the chat, make any changes you want below and then press here.

Or go direct to Kid’s Corner, a sample embedded chat page.

conferenceRoom: the style for the chat client

guest: the "nickname" you will be known by

your email address (optional)

#arena: the room to chat in - or select one below

<table>
<thead>
<tr>
<th>Room</th>
<th>Topic</th>
<th>Users</th>
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<tbody>
<tr>
<td>Alfabetização</td>
<td>Alfabetização e Cidadania</td>
<td>0</td>
</tr>
<tr>
<td>Arena</td>
<td>Cheque com alunos do CA - Mallet Stores</td>
<td>0</td>
</tr>
<tr>
<td>BrasilDDIAS</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Exhibit 8 - The W3E Chat Room

Marketing Tools

Uma simples e poderosa ferramenta de Marketing Direto para Windows. Crie a ficha do cadastro que você quiser, faça etiquetas para venda direta, cartas personalizadas e selecione as fichas segundo o critério mais conveniente.

Adicionar ao carrinho de compras

Qtd: 1
Preço: 99.00

Exhibit 9 - W3E and the Mall (E-Commerce)
The use of W3E (a WBI system) allows a new *modus operandi* to be developed, reengineering the current outdated training process. This new process is based on the following tasks:
- Definition and generation of programmatic content;
- Hypertextual modularization of the content to be deployed in the Web;
- Definition of the required Communication, Coordination and Cooperation Tools to be used;
- Deployment of the course content in W3E through the Authoring module;
- Use of W3E by the pupils through the Learning Module;
- Tracking and Evaluation of the course by the teacher through the Tracking Module.

Usually W3E is located in the corporate Intranet server. As the corporation is spread geographically, and the personnel to be trained in a specific course stays in different corporate branches, an extranet link must be provided. A satellite channel can be used, such as fiber optics or other technology.

Exhibit 10 - Topology for a WBI training program

The course’s virtual mentor can be located anywhere and must be in charge of the development of training. Chats and videoconferences are assigned for the course and recorded in the course agenda as well as news that can happen during the course duration.

A corporate collaborative learning environment is set up and the training can last an official period. However, the learning environment spurs on employees to share their knowledge and to create new knowledge from their knowledge, which is the main characteristic of the knowledge economy.
CONCLUSIONS

Distance Learning is more than 100 years old. It began in 1881 when William Rainey Harper, the first President and founder of the University of Chicago, successfully offered a Hebrew course by post. In 1889, Queen’s College in Canada launched a set of distance learning courses, which were a great success, mainly due to their low cost and the large distances separating the urban centers in that country. We are now in the fourth generation of Distance Learning. The first was called the “Textual Generation” (until the 60’s) being based on self-learning supported merely by issued texts. The second or “Analogic Generation” (from the 60’s to the 80’s), was based on self-learning supported by texts and multimedia resources (sounds, videos etc.). The third phase, starting in the 80’s and lasting until today called “Digital Generation”, used many technological resources to develop computer-based tutorials. The fourth model, beginning with the advent of the Internet, is called “Computer-Supported Collaborative Learning Generation” and is mainly based on the use of the Web plus other new technologies such as videoconferencing, video multicasting and so forth.

Benefits

This last generation has progressed to Web-based Instruction Systems, such as W3E. This new approach has led to very important benefits for companies such as:
- Elimination of expenses with trips, hotels and man-hours related to the old training process;
- Training of a large number of persons concurrently;
- Continuous education through the use of Discussion Lists, Forums, retrieval of explicit knowledge from the WEB and the Data Base;
- Development of employee computational skills and their involvement with technological innovations, as a ripple effect;
- Corporate strategic knowledge management and leverage of the company’s intellectual capital.

New Challenges

As a new paradigm has been implemented in world-class companies, new challenges must be overcome in order to accomplish the forecast targets. Some of these new challenges are under research, but must be highlighted to show the main hurdles for which companies and the academic community must develop solutions, in the near future.

We can pinpoint three main issues to be addressed and the respective questions that need to be answered:

1. Aligning Training with Business Objectives:
How can training and learning departments and functions more closely align themselves, effectively, with the stated goals and objectives of the overall business?

2. Developing a Corporate-Wide Learning Technology Strategy:
How can learning and training decision-makers create and implement an organization-wide strategy for making appropriate use (or non-use) of learning technology? How do we map a sane course through this maze of real and hyped capabilities?

3. Economic and Business Models for Learning:
What are the new economic and business models we can use to structure and predict the investment in learning within an organization? How can organizations plan for appropriate investments in workforce learning? How much should be spent on learning with what levels of expectation for ROI? How should organizations approach staffing issues for training management and delivery (in-house vs. out-source)? How should cost recovery be structured as learning moves towards informal and digital delivery?
These are the new questions to be answered to turn training today into a strategic weapon of a company. Hence, training reengineering must be made according to the global strategy of knowledge-intensive firms in order to leverage their intellectual capital, and not as a simple technical issue. To create new knowledge from existing knowledge is what makes the difference today in a globalized business arena. The companies that succeed in harnessing this power will be the leaders in their industries.

Notes