Management Methodology Applied to Web Courses Production

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Abstract – *The goal of this work is to offer a methodology to produce on-line courses on the Web, allowing an improvement on the creation process.*

This proposal is based on practical experiences conducted at NMI and theoretically on three main aspects: the chosen method on content creation, the way how will this production be structured – shall be defined as the product lifecycle, and how to manage it, employing in this case the concepts of project management.

To understand this proposal, the associated subject are: e-learning, instructional models for course construction, project management and creation of digital content.

Finally a methodology of this proposal is showed in order to create Web courses, in addition to a case of study illustrating its utility.

Index Terms : e-Lerning, Digital content, web, Project management .

1. Introduction

The goal of this article is to recommend a methodology to support the production of courses available through the web. It is based on new methodologies projected to the e-learning, the instructional design and the project management.

This proposal was based on the first experience in the construction and application of a course web for the attendants of the post offices of the Brazilian Company of Mail and Telegraphs. During this experience, problems were identified in the planning, execution and application of the course. The main problems were: absence of a systematic process which guided the project, aim of the project not well documented, lack of control, flaws in the communication and the project measurement.

From this paper analysis, it was proposed a new concept for the course applying to project management through the eye of the e-learning, presupposing that the simulations usage based on multimedia resources.

This study developed a methodology to produce web courses that will be presented in this article. Also, it will present an application, which resulted in improvements in the construction and effectiveness of the training.

The methodology is structured in four stages, divided in two parts that interrelate, still they are simultaneous and interdependent: the project management and the process of the course development, which we referred in this article as being product lifecycle.

For each one of the stages of the project management, which are: definition of the project, planning, control and revision, there is a process corresponding to product lifecycle: rising of requirements, production of the project plan, execution of the project and evaluation. For each one of the stages it will generate products that will support the subsequent stages, thus supporting the whole methodology, Figure 1.
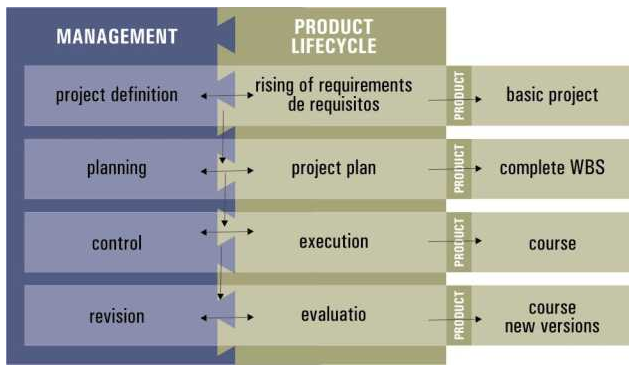
FIGURE 1
Structures of the Methodology

2. Methodology Description

2.1 Stage 1 - Project definition – Requirements rising

The definition is the process of formal recognition of the beginning of a new project. In some organizations a project is formally initiate after the conclusion of an evaluation of requirements, of a study of the viability, of a preliminary plan or in any equivalent way of analysis that has been initiated.

During the stage of definition of the project, the rising of requirements is executed through instruments, which are questionnaires, forms, maps and graphics. These instruments are: definition of the objectives of the organization, identification of the profile of the target public and definition of the learning objectives, resulting as final product of this stage the document: basic project.

This document authorizes and guides the project formally. It should include, directly or for reference, other documents such as:

- Definition of the objectives for the organization; these objectives are gathering the description of the needs connected to the project.

- Analysis of the audience identifying the profile of the target public and also the methodology to be used to develop the training program.

- Learning objectives described.

- A complete description of the product to be developed, including the by-products.

- Estimate deadline to develop the project.

- Estimate number of people in the developing team of the project.

- Estimate of costs.

In table 2.1 it is related to the most important matters to be considered in this stage of the project, as well as the instruments to be used to support in this process.

It is important to reflect on that the definition of the objectives of the organization, and the identification of the profile of the target public can be collected in parallel, for complete analysis. It will contain the information necessary to definition of the learning objectives.

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Goals	Main Information To Be Collected	Instruments to basic project production	Results
Definition of the organization goals	1- An executive summary must be produced. It should offer a general sight of the organization about the project as a whole. 2- We should reach a detailed description of the need or problem that the organization or institution must solve, this must include a commercial problem description and performance which is expected after the training, as well as the information about the company parts involved direct or indirectly with the project. The document must include enough information to structure a basic plan project. (Initial proposal). 3- It must be included in the definition of the objectives of the organization, which are the technical requirements about the project execution. 4- Interview the organization management team who will be part of the project.	**Attached A1.** Instrument 1 Objective description	-The general goals and objectives of the project. -The duration of the project. -The evaluation criteria, success that the organization expects with the project development. -Technical specification about the project development; -Team; -Project costs.
Identification of the target public profile	1- The profile of who will use the solution of the e learning. (Target public). 2- Search for the need of auxiliary training to develop some abilities in the target public. 3- Participants degree 4- Level of experience in technology. 5- Check the forms of training that the users have attended before. 6- Interview the students	**AttachedA2.** **Instrument 2** Audience Analysis	-The kind of event of learning and some characteristics that it should have and are defined from these results. -It will be defined if there is a need of complementary training.
Definition of the learning objectives	While developing the objectives of learning we should always specify the audience and the behavior expected after the course closing or any e learning event. **Audience:** - To whom the learning objectives be formulated for? **Behavior:** - What student will be able to do after training? And how? - How will the guider know about the achievement during the course? - How will the organization know? **Condition:** In what conditions will learning be required? 1. Definition of the main subjects to be developed in the training. 2. Check the existence of content to this event of learning that have been formulated previously by the organization.	**Attached A3** **Instrument 3** Definition of learning objectives	-Methodology proposal to be used; - Learning objectives of presentation; - It is defined the methodology to development and application of the course.

TABELA 1
Definition of the project and requirements rising

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The gathering of information collected and analyzed in this stage of rising requirements creates a document: the basic project plan. This document should be analyzed, among the developing team of the project and customers, so that the closing of a proposal for the learning event can be accomplished.

2.2 Stage 2 - Planning – Project Plan

It is developed in this stage the structuring of the course and also the activities that will take place during its construction. The functions are identified and described and the tasks of the executive team, as well as the management activities, the abilities, knowledge and attitudes requested to its duties and established the patterns to work performance.

The planning stage has the largest number of involved processes. It is the stage of larger importance, in the construction of a project of this nature, when they organized all information and described all the auxiliaries' plans to the administration, minimizing the problems in the execution stage.

The result of the planning stage is the "project plan document", which includes information necessary for its execution. This document has as primary information the "basic project", developed in the definition stage, besides other essential management plans for the following stage, the one of execution of the project.

The project plan is formed by a collection of documents used to control and to manage the project execution. The project plan development uses the definition stage exits, the basic project, creating a solid document that can be used to guide the execution as well as the project control.

For courses' development, the project plan can include:
- The declaration the project scope
- The course defined structure
- WBS - Work Breakdown Structure
- The estimated dates to begin and end of activities and attributions of responsibilities of each WBS sub product
- The description of the team and its costs/efforts expectation
- The estimate of costs
- Auxiliary management plans, such as communication, risks and restrictions, control, etc.

We will detail each item of the project plan, as well as the instruments produced to assist its development in Table 2.

Product	Description	Instruments/ Documents
Project Scope Document	Specification about the project, and it is document that you can find the following definitions: · product description; · project objectives; · project reasons; · expectations; · facts to project success; · · restrictions; · project marks.	Attached A.4 Instrument 4 Project scope declaration
Course Structure	Develop a structure to the course to be produced and its subdivisions. As for each course we can have subdivisions; this should be done from a methodology defined in the basic project and the subject must be dealt with during the course.	Attached A.5 Instrument 5 Subdivisions model of
WBS	Subdivide the project in tasks. We propose to develop courses in some types of subdivision that can be used in situation in the course	Attached A.6 Instrument 6 Structure Model
Estimated dates to the beginning and ending of activities and attributions of responsibilities to each subproduct of WBS.	The calendar definition and the estimated dates to the activities will depend on the project of the course to be developed. We present here an estimated time to develop the key activities in the project of the course. These activities can be broaden depending on the kind of project.	Attached A.7 Instrument 7 Table of estimated time/activity
Team description and its expectations of cost/effort.	Describe the teamwork, the function and cost of each component to the project development.	Attached A.8 Instrument 8 Table of Resources/cost/effort
Cost Estimation	Based on the items mentioned above: scope, WBS, dates, teamwork; it is possible to have at this moment an estimative of costs close to reality	Attached A.9 Instrument 9 Project plan of costs
Communication Plan	We identified here all the people involved in the project, each team member, the stakeholders, the suppliers, finally any person who direct or indirectly take part in the project. We connect these people to see how communication will take place among them.	Attached A.10 Instrument 10 Communication Plan
Risk and restrictions plan	Based on the risks identified during the identification phase and project planning. It's a document, which describes the possible problem, which can occur during the project.	Attached A.11 Instrument 11 Risk/restriction document
Control Plan	Definitions of points, which must be controlled during the course.	Attached A.12 Instrument 12 Control Document

TABLE 2
Project Plan Details

The main document to be used during the stage of execution of the project is WBS. WBS - Work Breakdown Structure or analytical structure of work division, it is a grouping of elements generated in the planning stage. This structure organizes and defines the global mark of the project and it supports the execution and control. It is represented by the levels of activities and tasks. It could be of two types (product or service), being the inferior levels a detailed representation of a superior level to them.
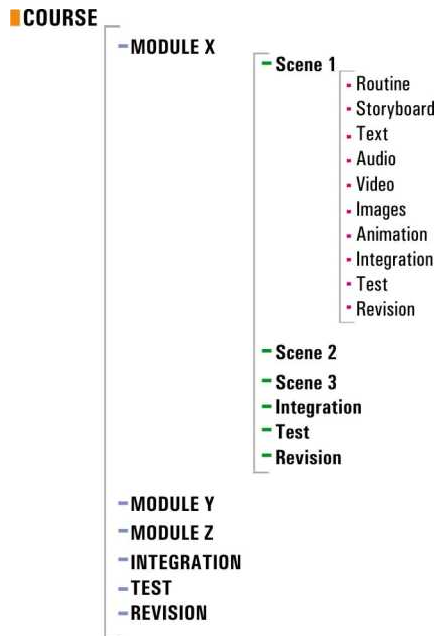
FIGURA 2
Division Structure for the course construction

We began the set up for the smallest tasks. We built the objects (text, images, videos, audio, animations) separately; these objects are integrated to generate a scene. After the conclusion of the integration stage, the scene is tested and revised. This sequence is applied in all of the scenes that are integrated in the end of its execution, testing, revision and generation of a module. That sequence repeats to the set up of all of the modules, concluding then with the integration, test and revision of the complete course.

Below we present the sequence of the set up of WBS, as well as of the objects to be used in the set up of the course (FIGURE 3).
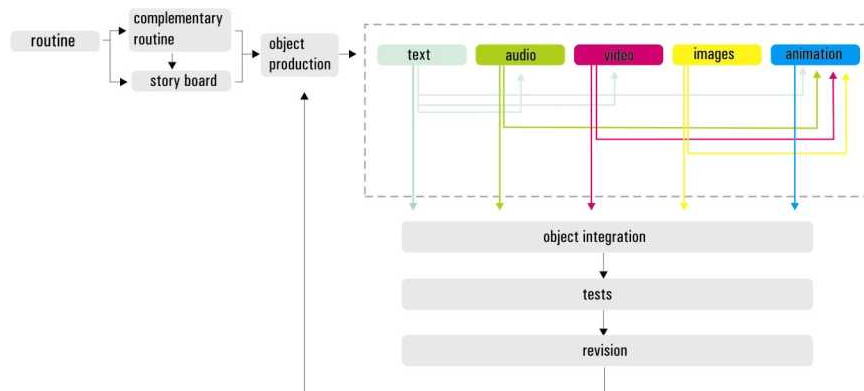

FIGURE 3
Sequencing of the activities proposed for the scene

To smooth the progress and the activities execution, the WBS proposal was to built taking into consideration the course structure adopted for this model: a mixed structure, in which part of the structure is hierarchical and part is in the net.

We presented then, a course structure subdivided in modules, these modules, in scenes and these in objects (schedule, story-boards, texts, audio, videos, animations and images), Figure 3. We still have the repetition of some tasks during all of the phases of the project, which are: integration, test and revision.

The module of the course represents the largest unit of information to be built. The scene acts as the smallest unit of information of the course, it is structured as a content sequence, evaluations and interactive activities or not.

With the plan concluded the execution of the project is accomplished. This part is controlled from a metric defined in the planning, creating the final product of this stage: the course.

2.3 Stage 3 - Control - Execution

The control in a project assures that the objectives are being reached, through the regular monitoring of their progress. It is important also to identify the variations of the project plan, creating corrective actions to be taken when necessary.

The work accomplishment during the execution of the project should be monitored and measured regularly to identify the variations in the project plan and in all plans auxiliaries. When there are deviations, these plans are analyzed during the development of the project. As significant deviations are identified (those that can put it endangered the project objectives). Adjustments will take place through the repetition of the appropriate planning processes to that case. For instance: to not accomplish a deadline activity, it may requires adjustments in the human resources, the need or not of extra time, or the balance between the budget and the deadline in goal of the project. To control also means taking preventive actions, getting ahead problems.

- Change control of the mark - it controls the changes in the mark of the project.
- Chronogram control - it controls the changes in the chronogram of the project.
- Cost control - it controls the changes in the budget of the project.
- Performance control of the acting - it collects and publishes performance information. This includes status reports, progress evaluation, and new estimates for the project.
- Risk control and monitoring - it accompany the identified risks, it monitors the existent ones and it identifies new critical points, guaranteeing the execution of the risk plans. Finally it evaluates his/her effectiveness in reducing risks.

The process execution of a course brings the planning to evidence, creating as final product the complete set up of the course. The project execution should constantly be followed by the manager, along with the customers. Therefore it is fundamental that managers are updated and tuned with the requirements and definitions of the project, so that the execution result - the concluded course – reaches the appropriate expectations.
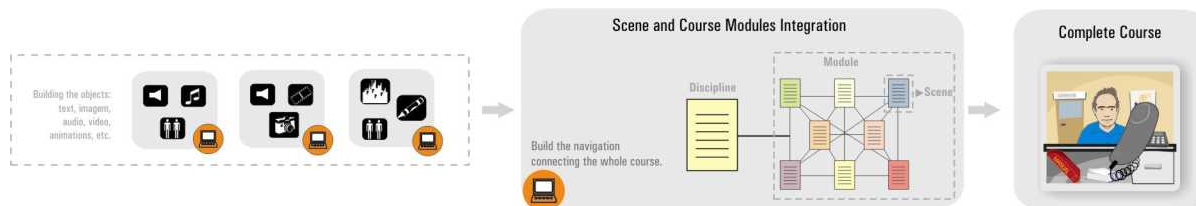

FIGURE 4
The set up of the course.

After the execution stage, we go ahead to the course and revision evaluation.

2.4 Stage 4 - Revision - Evaluation

The course development is not just a process with beginning, middle and end but a continuous development cycle.

It is a constant in course projects, analyzing, projecting, construction, evaluation and redesign. These aspects always seek for the largest effectiveness. In general, the more we use cycles in the construction of a course, the better will the final results be.

We adopted as a solution for the course improvement, the approach of fast prototyping, therefore, it will build a single scene or a smaller module and test it immediately.

After, starting from the identified and solved problems, we applied the solutions in the remaining course components and if it is appropriate for whole course.

As earlier we test the smaller components as fast we will have the solution for the problems during the course development.

As evaluation takes place, we assume that there isn't any perfect in its first version, and that all courses can be improved. Therefore, after the construction of a course, we evaluated its effectiveness. Such evaluation will guide us to advancements that can be implemented for the continuous course's improvement.

The evaluation of a course can be made through the application of a pilot course, where we will evaluate its effectiveness. The results should consist in a concise and effective report, presenting the success points, of tension points and the possible solutions for the identified problems during the application. The product of this stage is the implementation of improvements, creating new versions for this course.

A well structured project of e-learning requests a constant evaluation, not just of the final product, the course, but also of the results obtained by the organization. For, the first applications of the course should be followed and the revision necessary until the product stability is reached and the organization obtains the expected results; the ones described in the basic project.

For the application of an effective evaluation, we suggested a pilot course application, as many times as necessary. A pilot's planning should be done in advance, and it should be offered before time to avoid mistakes and the corrections can be done before the course is presented for a larger public.

The pilot course doesn't need to enclose the whole content, but it has to include a sample, which will allow us to test all the possibilities that will be offered during the complete course.

The steps to offer a pilot of the course and to evaluate the results are the following ones:

- Select the students: to choose people who belong to the largest group that will be trained. It is important that we set up a large group enough so that the results will be considerable, however of the number of people that makes possible the observation of the reactions and results.

- Prepare the students: we should always explain in the pilot course, the purpose of the test and provide the students all the important information to which they should be attempted.

- Monitor the performance: the practice, the knowledge in technology and the attitudes of the test group should be measured. For, it should be established points which we can measure the problems and fulfill the improvements.

- Administer the training: we should apply the pilot in the same conditions that the concluded course will be applied, in the same place type, using the definitions stipulated for the training.

- Measure the results: by the end of the pilot's application, we should compare the performing, attitudes, and knowledge of the group to those measured defined before the beginning of the training.

- Analyze the results: in this stage we compared the results obtained with the pilot to the learning objectives that were developed for this course.

Another important aspect during the pilot's application is to evaluate if the presented material is enough for students' understanding. Also, evaluate if there were unexpected costs in this test and if the duration applied was appropriate to the training.

In the end, we summarize the evaluation in a concise and effective report, presenting the successful points, the tension points and the possible solutions for the identified problems during the pilot. This report is meant to the presentation improvements; therefore, this should be the focus in its elaboration.

After the offering, evaluation and revision of a course, new versions are distributed, in other words, continuous improvements in the development process. A great advantage in offering a web course is that we can share out the course after its conclusion, with practically no extra time or additional expense. The new versions look for continuous improvements in the development process, Figure 5.

FIGURE 5

Phases of revision of a course.

The revisions are made whenever necessary to update or to improve the offered course.

3. Study Case – Developing prototype

To exemplify the application of the described processes, it was chosen the first scene of the module: Account opening course of the Postal Bank, because it is a quite representative cell of the training. The intention was not to demonstrate all of the necessary stages to be reached as the final product, the total course but some procedures that we judged important, once we start from a product, which is already defined and partially drifted.

We defined as starting point a new approach for the content using the methodologies approached in the learning using simulations. During this process, we inserted learning concept starting from the mistakes, specialists' models and histories and, still, the reusing of the material after the learning. Besides the methodological change of the point of view about learning, we reformulated some processes of the planning: the reconstruction of WBS was made, as well as the activities' sequencing, based in the model presented in this article, and, also, the estimates of the time period of the main activities. In the Table 3 and 4, we can verify the restructuring accomplished in WBS.

Task Name	Duration
Postal bank	8 days?
Planning	5 days?
Producing	8 days?
First Stage	8 days?
Sequencing definition for the student interaction	1day?
Elaborate the routine completely	3 days?
Send a valid routine to Profº Sérgio team	2 days?
Image production	6 days?
Animations production	6 days?
Content production	6 days?
Reference guide	1 days?

TABELA 3
WBS used in the first course

```
- Module
      - Scene
      + Routine
      + Storyboard
- Object production
- Text
      + Course content
      + Audio speaking
      + Video speaking
- Áudio
      +Speaking
      +Soundtrack and sound effects
- Video
- Images
      + Vetorial images
      + Bitmap images
- Animation
      + Interactive animated objects
      +Animated object
- Integration
- Test – phase 1
- Revision
- Test – phase 2
```

TABELA 4

Rebuilt WBS, based on the presented methodology

For the activities time calculation we used the instrument 7, proposed during the plan of the project. We presented a picture summary, Figure 3.3 of the main activities and their respective durations here, with base in the experience that we already possessed to begin such estimates.

TASK/LENGHT

Scene routine = 8h

Storyboard scene = 10h

Vetorial image - medium complexity = 4h

Bitmap image - medium complexity = 4h

Small audio speaking (record+editing) = 1h

Small video speaking (record+editing) = 4h

Animaiton -medium complexity = 4h

These information are estimated e take into consideration
the work executed by an experienced person.

FIGURA 6

Task Duration

With the material of the previous version in hands to begin the work execution, it was not necessary a complete team to develop the tasks foreseen in WBS.

After the division of work, we defined, together, the tools that would be used for the project execution.

From these definitions, we restructured the routine. Previously, the general routine was divided in disciplines and it already has the final content text. This way, we took a long time to start to the execution of the objects that made up each screen.

We decided to choose for a routine which separates module by scenes, describing, this way, it forms the navigation to be proceeded, the objects (Figure 7, 8, 9, 10) they will built and their functions.

The course was restructured so that the student lived real situations of a bank service, learning from his mistakes and achievements. It is important to stand out that an experience that uses simulations, doesn't exclude the need of the attendance of a tutor during the whole training process.

FIGURE 7

Interactive objects where the student chooses starting from the click in a "customer", which situation he will live.

FIGURE 8

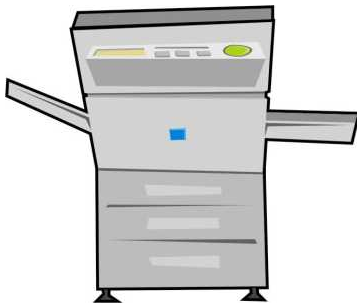Interactive objects and you reused.

FIGURE 9

Interactive objects that are part of the student's routine

FIGURE 10

Aid Video to help the student during the task accomplishment

At the end, all the objects were mounted separately and in parallel, reducing the execution time of the Figures and scenes Figures and pictures integration, Figures and the interaction objects. We presented a scene of the new module below (Figure 11) built and of the old module (Figure 12), where the differences can already be noticed starting from the applied graphic project.

FIGURE 11

Module opening of bills - new version

FIGURE 12

Module opening of bills - new version

4. Obtained Results

The results obtained through this partial application were the following ones:

- Through the systematic execution, we got to accomplish the tasks as they were proposed in WBS, including its sequencing.

- We verified that the tasks duration were very close to the estimated ones. For this course scene, we observed that the team got to accomplish what was proposed in the planning. However, for the complete course accomplishment, we would need to reformulate the team size and the project execution time.

- From the routine and storyboard elaboration, we got to identify all the necessary objects to the course construction.

- We could support the needs of simulations' construction of simulations in which the student could interact with the course.

- We observed that for some animations there was a need of intermediate pictures, doing that movements which were not so rigid.

- From built objects, as the manual, specialists' videos, audio clues, we could reuse these objects for later reference. This will build a net of knowledge that is as a summarized course.

- We observed, starting from a proposed method exercise that is exposed in this paper, which the use of organized methods, concentrated on the course production, it becomes a viable alternative to the service for the growing competition for organizations with well-structured projects. Therefore, it sort things out; habitual problems as delay, increase of the cost or no service of the mark are easily solved.

We emphasized the relevance of the applications of interactive multimedia resources; it allows the creation of net concepts. Also, it will take the student to choose for the learning in the order that he decides to be more appropriate. Besides, the multimedia applications make possible the simulations built. It is a powerful mean of trying ideas and concepts under conditions that would be beyond the test possibilities in practice, due to the cost, length or risk involved.

They were built for this work tools for the structuring and control of the course project. Documents models make possible the set up of the routine and storyboard. Besides the tools, it is important to emphasize the use of fast prototyping for the course construction. This application is made to collaborate with the project execution time reduction. Also, it makes possible the identification and correction of mistakes since the project beginning. This methodology was applied to the course reconstruction for the Brazilian Company of Mail and Telegraphs becoming a doable alternative, minimizing organization problems such as, delay, increase of the cost, service of the scope; smoothing the progress for the construction of other web courses which also use multimedia resources.

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