IDMatrix: A Tool for Distance Education Planning

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ABSTRACT

In this paper we present a management system for the Instructional Design Matrix (IDMatrix). The management activities consist in designing, planning, and monitoring the contents offered in semi presence-based courses of the IFCE (Federal Institute for Technological Education of Ceará - Brazil). Before the implementation of this tool, the IDMatrix were conceived just as a restricted document to certain people, and consequently unable to improve efficiency in the whole process. With the growing number of courses and professionals involved in their conception, the IDMatrix began to be constructed by a specialized professional- the instructional or educational designer - with the help of the main instructor of each course. By this way, this tool allows the standardization of the planning activities, and also the fast information localizing that contributes to increase the team integration and prevents possible loss of data. Although this strategy and the developed software tools were aimed for distance learning systems, its use should also improve the organization of regular courses in IFCE and other institutions that follows the ordinance number 4.059/2004 from the Brazilian Ministry of Education (MEC).

Category Descriptor

K.3.1 [Computers and Education]: Computer uses education – Distance learning

General Terms

Experimentation. Management. Theory.

Keywords

Distance Education. Planning in Distance Education. Instructional Design Matrix.

1. INTRODUCTION

Distance education systems are increasing their popularity in Brazil. In the Census of Distance Education [7], the number of enrollments of students using distance learning exceeded 5.5 million.In order to meet this growing demand the Ministry of Education (MEC) has augmented the number of distance education accredited institutions mainly colleges and universities. The IFCE(Federal Institute for Technological Education of Ceará - Brazil) is one of these institutions.

The IFCE as a partner of the Open University of Brazil (UAB in Portuguese) offers three distance undergraduate courses (Mathematics, Professional Education, and Technology in Hospitality), nine courses in the program e-Tec (Open Technical School of Brazil) which five of them have technical contents (Safety at Work, Informatics, Electrotechnics, Computer Network and Edifications) and the other are suited for the high school students. It also has graduate courses *in Vocational Education*and a *Specialization in Tourism and Hospitality* as a partnership with MEC. With all of these initiatives, the IFCE is somehow forced to search for particular solutions to inherent problems that affect its work. One of these solutions is the subject of this article.

One of the main activities carried out in the context of distance education is the production of teaching materials. This production is performed by a multidisciplinary team composed by the domain expert (DE), the educational designer (ED), the reviewer, the printed materials designer, and the web designer among others.

The didactic production models, although particularized in each institution, usually follow the quality guidelines established by the MEC [2]. In the IFCE it could not be different. Its distance education department conducts the process of production by creating and developing their own models and documents for preparation and delivery of materials through the digital learning resources on the Internet.

Among these documents, there is the Instructional Design Matrix (IDMatrix). The IDMatrix was conceived in 2009 in order to organize, plan and systematize a course held by main instructor. This means that the information contained in that matrix will drive the team of visual designers in their creative process for setting up a course in a Virtual Learning Environment (VLE).

IDMatrix is basically a shared setof documents. Before its inception, the team interacted by exchanging text files in a slow, tedious job with serious scalability limitations.Furthermore, with a large influx of courses and professionals involved in the

tedious job with serious scalability limitations.Furthermore, with a large influx of courses and professionals involved in the production and in the offer of the courses, the creation and elaboration of the documents were just made by each educational designer, along with the instructor of each course, which implied in the lack of standardization.

In this context, it was proposed the development of software tools for building and managing the IDMatrix. The main goals were to share documentswith all users in order to optimize time, to accelerate the development of activities and assessments, to enable version control, and finally having standard documents generated at the end of each schedule.

2. THEORETICAL BASIS

2.1 Distance Education in Brazil

It is evident that education cannot be on the sidelines of technological development. In this sense, the government continually invests in projects of technological nature, i.e., makes use of information and communication Technologies (ICT) in support of the teaching and learning process as well as the initial and continuing training of teachers and related professionals.

The Brazilian government invests massively in the creation of undergraduate distance courses for teachers training in several knowledge areas. It realized that it could meet a large number of professionals through the use of distance education and regulated this type of education by the means of the decree No. 5,622 of December 19, 2005.According to this act, Distance Education is characterized as an educational modality in which the didactic-pedagogical mediation occurs between students and teachers developing educational activities in distinct places at different time[3].

To consolidate distance education in the nation, the Open University of Brazil (UAB) was created in June 8, 2006, whose main objective is to promote the expansion of undergraduate courses and programs into the interior of the country [3].Supported by intensive use of ICTs, this action has trying to offer training for professionals spread up in several geographical regions of the country and providing access to a totally free public education.

Regarding the expansion of the graduation programs, the Federal Government (FG) has structured the offer of distance courses in this field by the ordinance number 1 on June 8, 2007. It is important to note that according to the 6thrule of this act, these courses may only be offered by institutions accredited by the Federative Union.

Continuing the distance education expansion project, on December 12, 2007, through the decree 6301, the FG established a UAB similar system for the high school students. This is called Open Technical School of Brazil and has more or less the same goals of the UAB, i.e., promote the distance education for specific people.

From the growing offering of the distance courses it arises several demands, which must be explicitly described in their pedagogical project. The quality reference guidelines [2] are the starting point to meet these demands.

The main elements of these guidelines refer to: (i) education and curriculum design, (ii) communication systems, (iii) teaching materials, (iv) assessment, (v) multidisciplinary team, (vi) support infrastructure, (vii) academic and administrative management, (viii) financial sustainability [2].

Note that the management of a distance course depends on the proper functioning of the elements meeting each one of the items above. This should be elucidated in the pedagogical model of the education institution as it is done in the planning of presence-based programs.

In the construction of a distance education based system, the education institution must consider the effectiveness of the use of Information and communication technologies in the different threads of the development process of their courses. Furthermore, one must consider all aspects involving the planning action. In this sense, Behar [1] highlights the essential aspects concerning the structure of a pedagogical model such as the organizational aspects, the subjects, the methodologies, and technological aspects.

It is important to note the central role of the course contents in the construction of the materials to be made available. It has an impact on both the planning and the implementation of the course over the various elements that compose the model. For example, in the preparation of the teaching materials, the content is produced by a multidisciplinary team that, in its turn, depends on the experts who work collaboratively for the development and creation of materials for different media types [10].

In another moment, in the stage of offering courses, the content ever produced serves as a basis for the construction of other elements such as activities, reviews, audios, videos, etc. All of these items lead instructors to structure their teaching schedules, as well as their choice of the most appropriate pedagogical strategies for the better understanding by learners.

2.2 Planning in Distance Education

Planning is an activity that deserves a closer look and a constant process of reflection that must be carried out by its executor. A plan is not final, instead of it, it is necessary to analyze it by checking its suitability for the general context and (re) structure it when necessary [1].

Educational planning deals with the existences of different levels within the systems and learning networks, within the school unit, and also in the context of educational activities [14]. So, to planning is also to reflect about its construction and execution inside several sectors of society, and, off course, this task should not be dissociated from education goals.

In Brazil, the execution of actions in the educational field, as well as in other sectors, is guided in advance by the official documentation that are decrees and related laws. As an example, we have the National Education Plan (NEP), effective for 10 years, which searches to promote, by a set of guidelines, actions for the organization and operation of both public and private educational entities throughout national territory.

The NEP emphasizes that education mediated by Information and Communication Technologies (ICT) is a valuable tool in promoting the teaching and learning process, however, these technologies are just auxiliary elements, serving as instruments by which teachers and students can keep their interaction.

With this in mind while creating the pedagogical project of a distance-learning course, it is necessary to consider the use of technology as a means by which it is done all interactions

between people, including the development of the related educational activities.

Junges, Povaluk and Santos [9] highlight that the development of a plan requires a careful look over all the actions involved in the conception and implementation of courses and programs. These authors divide the complexity of planning in four "dimensions": the "conceptual dimension," the "didactic-pedagogic dimension", "administrative dimension" and "dimension of self-regulation". The success of the distance education programs would rely on the prior preparation of these dimensions and the necessary integration [9].

From this discussion, we can perceive the importance of each dimension in the coordination of the planned actions and relate them to the structure that makes up a project in distance education. Specifically about the provision of a course itself, the didactic-pedagogical dimension plays a major role by having the core elements related to the teaching and learning process.

It is imperative that the actors, especially the teacher who acts in distance education courses, not just take advantage of digital technologies, but also try to understand the relationships between the course contents and the type of media that will be used to make it available in a better way.

In this sense, the teacher needs to consider the following aspects in the planning process: what content will be used; how will occur the relationship among students, content and the teacher; how will be made the evaluation process; and what teaching strategies should be used to promote interactions [13].

The following list shows other levels of planning that must be made before offering courses in distance education:

- tutor's level that is responsible for the selection of the faculties who will manage the courses in VLE,
- level of the multidisciplinary team that is responsible for the composition of digital and printed educational materials;
- level of technical team that is responsible for the selection and preparation of media content to be made available to students;
- and finally, the level of students that is responsible for organizing schedules and the follow-up of the courses and the subjects in the VLE.

In distance education, all this articulation starts up much before the course execution and continues to occur systemically.

3. INSTRUCTIONAL DESIGN MATRIX

In the current context of provision of distance learning courses, the determinants of the teaching and learning process must be clearly defined.This stems from a previous activity, ie, construction of a planning process. As in presence-based, distance education requires the construction of reference documents and guidelines that make clear its full development.

By the fact that is a new, growing education modality in Brazil, many didactic-pedagogic models are in preparation.Each educational institution that offers distance courses has autonomy in its creative process of preparing documents, and that process allows the possibility of creating its visual identity.

From this context, emerges the Instructional Design Matrix (IDMatrix). The planning and development of the IDMatrix

follow the precepts of the Pedagogical Engineering (PE), which is a term created by Paquette [11] to explain the processes of the learning systems engineering.

Paquette [11] defines EP as a method to support the analysis, design, implementation and diffusion of learning systems that incorporates conceptions, processes and principles from the educational design, software engineering and cognitive sciences.

In that author's point of view, the Pedagogical Engineering is divided in the following phases: analysis of learning needs; identification and structuring of knowledge and skills; design of activities and learning spaces; choice of media, or resources to reuse; choice of a diffusion model of activities and resources; integration into a platform in order to begin the education event. [12].

Corroborating Paquette's statements, Filatro [8] points out that it is possible, by using a matrix, define objectives, contents, activity tools, and also describe the evaluation process, determine the duration of each activity, and define how these activities will be better distributed over the Virtual Learning Environments (VLE).

So, based on that previous work [8], we have made some adjustments to the proposed models in order to attend the IFCe's specificities. Note that the IDMatrix goes beyond the Filatro proposals because it considers the dynamics of the pedagogical process and the offer of courses. Figure 1 shows the empty form of the Filatro matrix.

Classes	Units	Goals	Roles	Activities	Duration	Tools	Contents	Evaluation
1								
2								
3								
4								

Figure 1. Components of the Filatro Matrix. Source: [8]

In our proposed model, the details of all the elements inherent in planning a course are specified. This follows the IFCE pedagogical model. The IFCE Educational Design Matrix, and so the IDMatrix is bigger document composed by the following items:

1. **General data:** This item presents data related to the main menu, the objectives (general and specific), the target audience and academic information. The latter includes the time involved in completing the technical course load, approximate dates of the beginning and the end of the course and the teaching staff.

2. **Interactive Instructors**: In this item, we have the names, location, emails, and phone numbers of the distance instructors that follow the students in VLE and the presence-based tutors that will eventually give support to students in special, specific locations.

3. **Curriculum Activities:** It describes all the detailed activities of a distance class, as well as the duration of each activity, type of assessment, and each activity weight (in percentage).

4. **Presence-based Meetings**: This item describes the activities that will occur at the training center, with their schedule defined by the course coordinator.

5. **Calendar**: It establishes the timetable for implementation of the course.

6. **References**: It presents the bibliographical information related to course that will aid students in developing their activities.

In the topics listed above one can see that they search to address all the guiding principles in setting a course in a LVE. However, the main concern of the teachers in fulfilling it should be related to didactic-pedagogical organization of activities in order to promote a meaningful learning process.

The Matrix is built every semester after the allocation of the instructors to their respective courses by the coordinator. So, the list of allocated instructors is passed to the educational design team, which in its turn starts the guiding process to the preparation of the course plans. Each Educational Designer (ED) is responsible for contacting the course instructor that will be guided in the process of creating the IDMatrix.The building steps of the IDMatrix are shown in Figure 2.
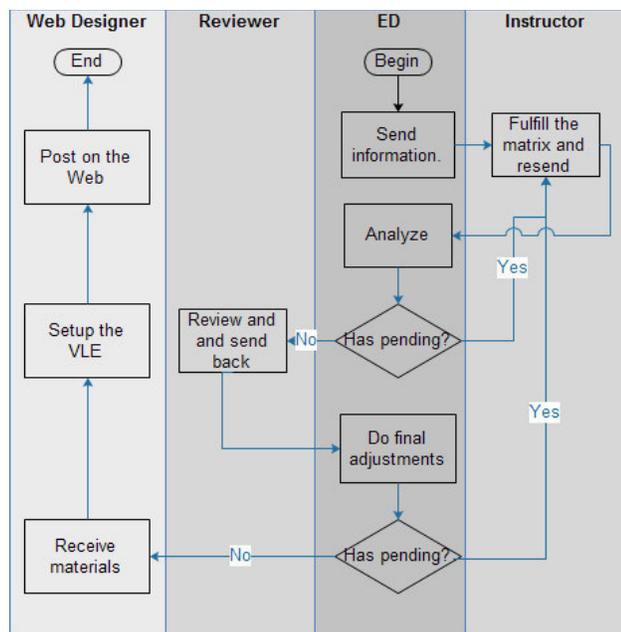

Figure 2. Building the IDMatrix

In Figure 2, we observe the flowchart of matrix building process that contains the steps and professionals responsible for their execution. The workflow depends on the submission of a list of courses to be offered by the coordination with their respective list of instructors.

At a first moment, the educational designer (ED) contacts the instructor sending some materials including books, articles, programs, course schedules, and the IDMatrix forms.

Secondly, the instructor performs all necessary corrections and adjustments to the course documents, fill the matrix, and return it to the educational designer.

So, the flow can follow two paths. In the first one, after of the educational designer analysis, the Matrix is resent to the instructor for adjustments and then it is returned to educational designer to validate the adjustments that were made.

In the second one, the analyzed matrix with some adjustments is forwarded to the reviewer who will return it to educational designer. This last professional examines again the matrix, which can be returned to the instructor or sent directly to the web designer. This depends on the reviewer report.

If the first of two situations occur, the instructor corrects it again and resends it to the ED, which performs a final analysis and adjusts all pending matters. After this, the matrix is forwarded to the web designer for posting on the Virtual Learning Environment.

If the last situation occurs after the final adjustments, the matrix is sent directly to the web designer to post it on the VLE.

4. THE SOFTWARE SUPPORT

The construction of the software system followed the traditional model of software engineering, which comprehends design and implementation of the system itself, tests, users training, and finally it was put in production.The challenge of the requirements analysis was to accommodate all needs and contrast the views on a fully heterogeneous group.

Different technologies were used in the implementation of the software system. We can cite Java script, HTML (Hyper Text Markup Language) with Postgresql as the management database system among others. Although observing that the use of these tools is not the central point, it is important to understand that the development of a software system to be used in a context of distance education also has a technological bias.

As we can see in Figure 2, the information structure of the matrix documents permeates several stages of the collaborative work of the instructor, ED, reviewer, and web designer. The role of these and other system users are show in table 1.

Table 1.Role of The System Users

User	Role
Administrator	- Manage the system - Manage users - Set permissions - Create and manage all matrices
Educational Designer (ED)	- Monitor and manage the documents of his/her responsibility
Reviewer	- Review the documents of his/her responsibility
Web Designer	- Create and post content on the web
Instructor	- Change the contents of his/her course - Review the contents of his/her

		interest
	-	Download/Upload documents produced by him/her
Course Coordinator	-	Visualize contents of his/her interest
Tutor Coordinator	-	Visualize the contents of the course under his/her responsibility
Tutor (teacher)	-	Visualize contents from his/her curse and other from his/her interest

All users must have a login and password to access the system. The system sends confirmation mail and usage information to authorized users. Figure 3 shows the login screen.

The instructor, the educational designer (ED) and the reviewer are the actors directly responsible for editing a matrix. In this edition, the ED is responsible for the management and completion of the document. Matrices of all subjects are created by the system administrator, which links it with the professionals responsible for their production.

The navigation menus of a specific matrix in the system have beenbuilt using the one in text documents as basis. In addition, it was added a "finish" step for the software version of the IDMatrix. This step is under the responsibility of the ED. In Figure 4 we can view the menus that make up the IDMatrix within the software system. The menus are shown according to the role of each user.
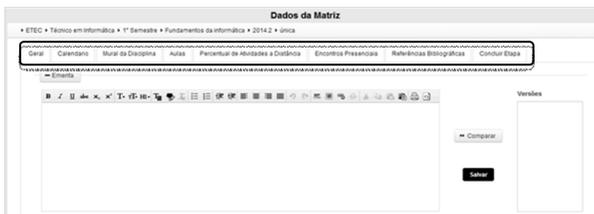

Figure 4. Navigation Menus of the Matrix

In Figure 5, we can see the edition of a "Ementa", which is the description of a course. This case refers to Basic Mathematics 2. After inserting text, the author clicks on "Save" to keep his version recorded. As users perform changes and save jobs, new

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¹ MADE is IDMatrix in Portuguese.

versions are generated. The menus "Calendar", "Wall of Course," and "References" use the same edition format as the edition of the "General" menu.

Figure 5. "Ementa" Field

The "Classes" menu and "Presence-based meetings" menus have another form of insertion and deletion of information. The amount of classes entered the "Classes" field changes according to the duration of the course, where the proportion is set to 10h for one lesson. In Figure 6 below, you can see the list of classes configured for the course example, and the user can add more classes by clicking the "+ Aula" button.

Figure 6. Menu "Aulas" e "Encontros presencias"

The amount of presence-based meetings also varies in accordance to the hours of the course, the current legislation, and the proposal described in the political project of course. In this case, the IFCE establishes a minimum 20% of regular classes [15].

In Figure 7, the user can verify if the percentages assigned in each lesson activities sums to 100%.

Figure 7. Menu "Percentual de Atividades a distância"

The educational designer is the actor responsible for the finalization and submission of the matrix to the web designer. This step occurs through the menu "Concluiretapa" (Figure 8) and is only available when the tutor and author of the course validate its stages within the production flow chart of the matrix.

The software system is in the testing phase. After this phase, it will be available for use by professionals working in IFCE that contribute to the management of the planning processes of the courses offered in distance learning courses.

Figure 8. Menu "Concluir etapa"

5. FINAL REMARKS

Understanding the complexity that is inherent to the processes of information management, planning, and activity development for the modality of distance education, the adoption of this tool allows users to quickly and easily locates the desired information helping to resolve potential communication barriers and loss of data.

Another important point is the possibility of having access to a large database of documents that were created by the professionals of the institution in previous semesters. Tutors have access to the content easily, which can be a great aiding tool for the preparation of quality classroom lessons.

In addition, the management system of the matrix meets the needs of professionals working in distance education at IFCE, and after the necessary approvals, this solution may be shared with the totality of the institution courses. Off course, these tools can also be shared with other institutions that also make use of distance learning based on the Decree 4059/2004 of December 10, 2004.

As future work, we intend to perform the integration of this system with the Virtual Learning Environment enabling the exchange of information between both the VLE and the IDMatrix.

6. ACKNOWLEDGMENTS

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