Collaborative Development of Learning Objects Via Education Portal

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Abstract:

This study emphasizes the collaborative development of Learning Objects that support the teaching-learning process towards the educational contents of a fifth grade Mathematics class of elementary school. The collaborative process is developed on an Education Portal that has specific communication tools for the development of those activities. The development is carried out based on two teams which have technical and didactic features and those staff are divided into work groups. The development stages take into consideration the former ones for the implementation of the educational applications. The whole process is carried out via Portal. The Learning Objects generated are also available on the Portal.

KEY WORDS: Collaborative, Learning Objects, Education Portal.

1 Introduction

The use of the information technology in the Education allied to the process of the knowledge construction depends on the education vision and the pedagogic condition where the computer is used so that it may produce positive results [9].

Amidst so many projects and programs developed in the area in the last three decades, the information technology has become more and more present in the schools, so it should be mediated by qualified professionals and along with specific goals.

With the use of the information and communication technologies (ICT) in the learning process one needs to understand that the teacher must be involved in that process so that he/she can continue disseminating for long years, assuring, this way, a strategically richer class.

This document reports a research that has as the main objective accomplishing mediation along with teachers of public schools to introduce the use of the information technology in the curricular activities.

The use of such resources occurs with the Learning Objects (LO), once it is known that an LO is a digital resource for the support of the learning of educational contents and it may be reused in several situations [10].
To get the teachers effectively involved in the context of the LOs use in curricular activities of the elementary school, a Portal was developed to provide support to the Los collaborative development. That Portal makes it possible for the teachers, in contact with the developer staff, to express their opinions, directions as well as specifying the target public's needs so that the LOs can be implemented. It is also via Portal that the access to the concluded LOs is accomplished, this way they can be applied in the classroom.

This article presents the relevance of the use of the Collaborative Educational Portals for involving the teachers of the elementary school in the development of the Learning Objects, so that such resources may be another ally to the teaching process. The document is divided into eight sections. The second section explains about teachers' training and specialization via Web.

In the third section there is the description on the use of Learning Objects for educational contents. The fourth section presents the developed Educational Portal, on the other hand the subsection 4.1 describes the portal Conceptual Map. The fifth section explains the collaborative development in the educational context, and section six offers the results accomplished. The seventh section presents the final considerations and then the references.

2 Teachers’ Training and Specialization via Web

More and more often the teacher has become the mediator between the student and the technological resources available. ICT has supporting the teaching-learning process, providing opportunity for the teacher to work better with the students. Moreover, with the increase of the distance education, the teachers will need support to understand and to adapt themselves to play those new roles [4].

In this context the distance education (DE) has been increasingly considered a quite good element of the educational systems, taking on functions of increasing significant importance towards the teachers' specialization and training.

The teachers training can be illustrated through some initiatives that are performed in Brazil. It may works as initiative models the Teachers Distance Qualification National Program. It is a national extent program, broadcast on television via satellite and also addressed to the teachers' qualification who work from the first to fourth grades of elementary school although extensible to the preschool ones.

The program is a result of a partnership between the Ministério da Educação (MEC), via Secretaria Nacional de Educação Básica (Seneb). The program was considered "the most viable way of obtaining, at short and long term, a renewal of the education system". The field research was carried out in a sample that included eight states, spread over several areas of the country: Acre, Mato Grosso, Ceará, Paraíba, Bahia, Espírito Santo, São Paulo and Santa Catarina [1].

Currently the State of Paraná has some important initiatives set off by the State Government towards presenting an apparatus for the use of media in education. Among those apparatus there is the Portal Dia-a-Dia Educação [13] and the Teacher's Portal.

Portal Dia-a-dia Educação has as the main goal to promote a deep and wide knowledge change, installing a collaborative learning model on the hypermedia, recognizing and valuing the accumulated knowledge in the State Public Education Net, becoming as well an information means as the educators' cultural and academic expression means, attending the whole school community, in an open interactive constant and dynamic process.
On the other hand, the Teacher's Portal (Mec) presents a collection of materials related to several issues as well as Learning Objects, videos, images which have the intention of supporting the teaching-learning process. This scenario highlights the relevance of the Education Portals so that they may promote the teachers' interaction with the many forms of ICT application. The current research is based on such characteristics to develop an Education Portal that provides the spread of the information technology use in the education together with collaborative Learning Objects as well as materials that support the application: brochures and manuals.

3 Learning Objects Use for Instructional contents

Through the many available ICTs, the teacher presently has access to a great amount of technological resources that can be used in education. The technology of Learning Objects (LOs) have become a very interesting alternative for its broad applications, allowing us to create small "fractions" of educational material and to organize them making this way possible to reuse them, saving time and costs in the production of more materials [6].

Learning Objects are education materials which have pedagogic goals and work as support in the teaching-learning process. According to [15] they are supplemental resources to the learning process which has the reuse as a feature for supporting learning and behave as blocks that are used to build the learning context.

In agreement with [17], Learning Objects can be considered starting from images and graphs, videos, sounds, tools until any other digital education resource that should be used for education purposes. Based on those concepts of LOs, this research focused on the collaborative development of its own Learning Objects in order to provide support to the teaching activities of the educational contents of a fifth grade Mathematics class of elementary school. As a start some educational contents were delimited according to the education needs. The theoretical contents were elaborated following the considerations raised by the teachers involved who, via Collaborative Education Portal, chose the issue that would be approached and they also made the bibliographical references available, following the State of Paraná basic guidelines. The contents firstly approached were: Addition, Subtraction, Multiplication, Division, Polygons, Polyhedron, Measurement Unit, Fractions and Fractionary Calculation.

4 Education Portal

The virtual environments have already being used extensively for the support of learning. In agreement with [7], there is the need to cause the education to be a communication process between students, teachers and the community, making every one take part of it in an interactive way.

The Education Portals are present in that technological context and they may be pedagogic tools inserted in the teaching stages. It is possible to organize on the Portal the developed contents or the ones that will be developed in the classroom, allowing teachers to meet support in this technology.

In the Portal development, the main purpose is to reach gradually a higher number of users, and in relation to an Education Portal there is a specific concern towards the support for the teachers during the teaching / learning process.

Thus, in order to disseminate the concept of the collaborative Learning Objects development, an Education Portal was developed so that the teachers could take part of the process of the
collaborative development and they may also access, as they wish, the Learning Objects that have been developed as well as some other contents.

Figure 1 shows the initial screen of the Education Portal developed by Gied (Grupo de Informática Educativa of UENP).

On this Portal, it is available the Learning Objects, user manuals and also the support documentation, as well as brochures which characteristics are very similar to the class plans because both aims at supporting the teacher towards the application of those Los in the classes. It is also available some communication tools which give support to the collaborative development of those cited contents, thus allowing that the teachers and the development team can communicate in a synchronous and asynchronous way, creating a collaborative process related to the construction of educational contents.

![Figure 1: GIED Education Portal Initial Screen (www.gied.falm.br)](image)

### 4.1 Conceptual map of the Education Portal

In order to make the development of the Education Portal possible, it was developed the Conceptual Map of that Portal. As [8], Conceptual Maps are hierarchical diagrams that points out concepts and the relationships between them, what is quite relevant for structuring a Portal that intends to work as a communication mechanism for the collaborative development of the Learning Objects.

The planning and implementation of a Portal Conceptual Map in its creation or in its restructuring has additional relevance, because it allows delineating connections and terminological associations between information. These graphic organizations can represent the activities of a portal, where it is possible to realize clearly the connection between the system fundamental concepts and their basic requirements.

On the Conceptual Map of the Figure number 2 the items of the area number 1 represent the educational resources, LOs, documentations, manuals and brochures which were generated via collaborative process on the portal and the items of the area number 2 represent the communication tools that give support to the cooperation process.

It can be observed in the area number 2 the the Chat, the Forum and the Fale Conosco Channel (Contact us Channel) which are specific tools of an Education Portal and they have resources related to the communication, coordination and cooperation between the participants. Actually, they are quite common in Education Portals to provide participants' integration, because they are physically separated one from another.
Figure 2: GIED Education Portal Conceptual Map

Systems which present collaborative functionalities show specific requirements while non-collaborative applications do not [2]. Some of the main requirements are: a) access to the shared objects and to the cooperation tools, where the system must provide easy access to the objects and the cooperation tools; b) support towards the appropriate tools selection, one should know which tool is appropriate to accomplish a specific towards one type of object; c) synchronous and asynchronous cooperation; d) access to the independent environment of the workstation; d) environment dynamic extension, which is the capacity of the environment to incorporate and make it available to the users new tools with no need of being reinitializing; f) performance, that is related to the system low latency and automatic notification of modification in the artifacts of the work environment.

The developed Education Portal allows easy access as much to the communication tools as to the contents which are the focus of the collaborative development through the items from the Teachers Guide and the Communication Channel. In the item LOs Gallery it possible for students and teachers to use the LOs developed collaboratively.

It is worth mentioning that the Portal provides, in the item Communication Channel, synchronous (chat) and asynchronous (forum and contact us) communication tools that supply ways for the participants to collaborate with the instructional process. Concerning the participants who are already involved in the collaborative development there are instructions for them to know which tools are more suitable for the different types of communication.

It is secure to state that the Portal was developed and tested to be accessed by several navigators and different Operating systems [3], remaining no restriction regarding platform. Those tests also highlighted that the portal performance, in relation to the answer time and versions updating in the collaborative activities, is also good. The operation of the Education Portal is illustrated in Figure 3.
Figure 3: GIED Education Portal Operation. Source: Adapted from (Pimentel 2006)

Figure 3 shows the collaborative development process. The technical/didactic staff determines and attributes the tasks that have to be accomplished in a collaborative approach. The participants contribute to the contents, however in order to make that cooperation to happen there is the need for communication means between the participants and this communication can be accomplished through a chat or forum, for instance.

So the generated materials are managed by the technical/didactic staff, giving a new start to that process which is intermediated all the time through the Education Portal, a tool that stimulates each stage of that cycle of the collaborative development. The activities related to the technical/didactic staff are described in the next section.

5 Desenvolvimento Colaborativo no Contexto Educacional

It is not enough to insert computers into school to guarantee the students and teachers digital inclusion, the computer may become a possible extra resource through which students and teachers can create, think and negotiate information [16].

Still in that context, another term that is more and more common in the education environment is the collaborative development of new technological resources that makes it easier the interaction between people.

However, it is common to find in the literature the terms collaboration and cooperation as synonyms, but the difference between them lies in the type of participation of the people involved in a specific project or work [12].

A collaborative construction allows the confrontation of ideas and arguments, stimulates the reasoning process and allows that to happen in a worldwide dimension, which means, the things that one day were restricted to small communities, today are exposed and discussed all over the world [12].

The collaboration focus on the work process allowing autonomy among their participants while the cooperation focuses on the result produced together, with a central vision [4].

Based on the premise of disseminating products and materials that provide support to the use of the technologies of the Learning Objects types in the teaching-learning process, it was considered relevant to involve the participants of the development process in a collaborative work. For this reason the Education Portal was developed, and that was discussed in the section 4 of this document.

The development of the Portal do Grupo de Informática Educativa (GIED) was based on the collaborative process towards the execution of the activities that generate the LOs and the materials that follow its development and their application in the computer science classes. The next section presents the organization of the staff and the stages involved in this process.
5.1 Collaborative Development Organization

The Development of Learning Objects supposes a support and an organization so that the work is objective and shows positive results. For this research the application of a staff structure was determined based on the purposes for free software development communities, such as Linux, Joomla and Moodle [5].

Figure 4 shows the structure adopted by the staff involved in the collaborative development Learning Objects. It was defined some groups so that the work could be more organized.

Each staff has some tasks and responsibilities related to the Los development. The technical staff is formed by professionals and academics of the Computer science field. The members of the didactic staff are teachers from elementary school and high school, who provide the pedagogic subsidies for the LOs development. The groups that intermediate the relationship between the technical and didactic staff are: Quality and Tests, Design and Accessibility, Documentation, Communication, Applications and Manuals.

The tasks related to Quality and Tests involve, usually, activities related to the validation of the LOs. The staff Design and Accessibility works together with the Quality and Tests one. The tests accomplished make space to improve the design of the LOs and to establish the development focusing on the accessibility requirements.

There are participants from both technical and didactic staff.

The Documentation is accomplished with the participation of the two staff, however it is important to notice that the contributions of the didactic staff are decisive. Every LOs is recorded and for each one of them a Conceptual Map and a Storyboard are created. Those two documents are also developed in a collaborative way, via Education Portal.

The group responsible for the Communication controls the support tools for the interaction, and also the versions of the documents generated by the staff and stored on the Education Portal. It is important to notice that the communication tools are the base that makes it possible the whole the collaborative procedures to occur. Therefore, the users' access controls and the different versions of the documents are under the responsibility of this specific group which involves the participants of the technical staff.

The Applications and Manuals created to support the LOs application are also controlled by a specific group. Here, the responsibility is to develop the LOs and to create manuals to facilitate their use by public school teachers. The didactic staff works directly in the development of these manuals, however that task is accomplished right after the conclusion of the LOs development by the technical staff.

Picture 1 show the relationship between the groups, activities and the staffs.
The purpose of the collaborative process organization of the technical and didactic staff highlights the "coherence in relation to the educational objectives" criterion. However, it is still important to define in which way the LOs planning, development and evaluation could be divided. Hereby, the whole team of the collaborative LOs development, both technical and didactic staff is based on the stages defined by [3]. The Picture 2 shows the stages of the collaborative LOs development [3] and the respective responsible staff.

From the Learning Objects collaborative development conception, it was implemented, via Education Portal, seven Learning Objects. So, twelve issues were assisted for the support of the curricular teaching of Mathematics at a fifth grade elementary school. Nowadays, there are five schools involved in the collaborative development of the Learning Objects. Each school has three teachers participating actively in the process. The teachers of the elementary school perform, via Education Portal, in the staff defined as didactic and they are present in

### Picture 1: Relationship between Groups and Staff for the development of the Collaborative Activities

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<table>
<thead>
<tr>
<th>Group</th>
<th>Staff</th>
<th>Activity</th>
</tr>
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<tbody>
<tr>
<td>Quality and Tests</td>
<td>Technical</td>
<td>Determination validation and metrics forms.</td>
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<tr>
<td></td>
<td>Didactic</td>
<td>Application of tools made for validation.</td>
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<tr>
<td>Design e Accessibility</td>
<td>Technical</td>
<td>Development of Storyboards.</td>
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<td></td>
<td>Didactic</td>
<td>Interface Creating Models.</td>
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<td>Accessibility requirements application.</td>
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<tr>
<td>Documentation</td>
<td>Technical</td>
<td>Development of Conceptual Map.</td>
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<td></td>
<td>Didactic</td>
<td>Development of Didactics Booklets.</td>
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<tr>
<td>Communication</td>
<td>Technical</td>
<td>Maintenance of Communication Channels</td>
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<td></td>
<td>Didactic</td>
<td>Use of Communication Channels</td>
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<tr>
<td>Applications and Manuals</td>
<td>Technical</td>
<td>Development of Learning Objects</td>
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<td></td>
<td>Didactic</td>
<td>Development of Manuals</td>
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<td></td>
<td>Didactic</td>
<td>Correction of Learning Objects.</td>
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<td></td>
<td>Didactic</td>
<td>Correction of manuals.</td>
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### Picture 2: Adopted stages for the development of the Collaborative LOs and the responsible groups.

So, the didactic and technical staff works via Education Portal following the specified stages. Taking into consideration the collaborative characteristic of the development it can be clearly realized that there is a large-scale interaction between the teams, however it is possible to observe, in the delimited stages, the difference between the performances of each staff. The Communication staff works in no stages, however it provides support so that the activities of each stage are accomplished.

### 6 Results

From the Learning Objects collaborative development conception, it was implemented, via Education Portal, seven Learning Objects. So, twelve issues were assisted for the support of the curricular teaching of Mathematics at a fifth grade elementary school. Nowadays, there are five schools involved in the collaborative development of the Learning Objects. Each school has three teachers participating actively in the process. The teachers of the elementary school perform, via Education Portal, in the staff defined as didactic and they are present in
most of the stages of the LOs collaborative development. From the seven LOs created it has being possible to attend, so far, 150 students divided into 6 groups.

It is worth to emphasize the vantages in productivity obtained from the implantation of the collaborative development models. As the division of the staff into technical and didactic as well into Quality and Tests, Design and Accessibility, Documentation, Communication, Applications and Manuals groups, provided greater agility to the implementation. The use of the Education Portal also reduced the time spent on moving and face-to-face meetings.

7 Final considerations

The use of the Information and Communication Technologies to support the teaching-learning process is viable only with the participation and the effective teacher's commitment. This research developed an Education Portal to give support to this educational commitment in the regular teaching ICTs implantation.

In order to make the collaborative activities accomplished and culminating in the creation of the Learning Objects and their documentations and manuals, it was necessary to organize the staff in groups. The groups created involve participants of the technical and didactic in sections that were adapted from the development reality of the communities' collaborative development of free software, which were the propellers of this web process.

There was also the need to specify stages for the collaborative development of the Learning Objects. Those stages involve: Content Choice; Previous knowledge analysis which is fundamental for the user to manage the software; Identification of the structured content concepts; Development of the flow diagram, depicted by the software screens and their connections/interconnections; Development of the screens, involving layout and orientations for implementation; Implementation of the screens; Development of the documentation, including instructions on installation, hardware characteristics and the user's manual; Use, Evaluation and maintenance of the Learning Object.

As much the stages as the organization of the staff help in the organization and in the maintenance of the collaborative activities that were accomplished via Education Portal. It is important to highlight that the Portal was designed from its Conceptual Map to meet the characteristics that are considered requirements for collaborative systems, such as: tools availability for cooperation / communication (synchronous - chat and asynchronous- forum) in any work platform; easy access to those tools and easy incorporation of the new versions of the documents and to the Learning Objects generated.

This way, it was possible to involve the teachers (didactic staff) and the developers (technical staff) in the collaborative process of the implementation of the Learning Objects and their documents and also to propitiate ICTs to be used in a daily basis classroom, working as support to the teaching-learning process.

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