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Abstract:

Bologna's process and the opening of university teaching to new educational scenarios provide an opportunity for the implementation of innovative and active methodologies.
This paper describes a practice implemented by the share and reuse of learning contents using streaming technology. Streaming technology was used since it promotes the support of pedagogical activity as a dynamic resource and oriented to a model of shared learning.
The motivation beyond this idea was the share of teacher's efforts in the development of didactic resources that can be reused on identical curriculum classes on a later moment. Also, within different learning units, some concepts are considered well-known, but they must be remembered specially if they are not used for some time. Didactical resources where developed and made available allowing and facilitating the student's revise needed. In these cases, only activities are changed.
In this model, it is underlying the constructivist theory of learning: students are motivated to construct knowledge for themselves.
It demonstrated to be an enhanced experience not only concerning the sharing of knowledge but also because it promotes a desired partnership inter-department.
The possibility to make available these contents in an open access repository is a new challenge that it is being tested (e-Learning Repository, UMinho/TecMinho).

1   Introduction

Technology's potential and its continuous renovation cycle bring to the education field a set of opportunities to expand knowledge nets. The growing on the quest of education models focused on flexibility and autonomy becomes an important issue in nowadays. These models, at the same time, must respond to two challenges: creativity and innovation in the process conception that teachers use in the transmission and dissemination of knowledge. These challenges bring teachers and students to the table as stakeholders but they aren't alone. University's governance needs to be active in order to support the execution of this politic.
Jurow (2006), alert for a scenario of transition in the higher education. This phenomenon is inherent to its own evolution and for which Universities should be sensible to. This fact results from "technological advances, heightened student expectations, shifting student demographics, stakeholders demands for accountability, and new vehicles for educational delivery are all current challenges driving the need for innovation in higher education" [1]. The proclaimed challenge is not itself lacking from difficulties, just like Bauer and Furst-Bowe (2007) state that must be understandable the "structure for educational institutions to align their mission, vision, values, goals, and strategic challenges with the resources essential

for long-term improvement" [2]. Only through a holistic vision oriented to a sustained change process will be possible to take the academia to an action characterized by innovation and creativity in the learning and education field.

Innovation represents "the implementation of a new or significantly improved idea, good, service, process or practice that is to be useful" [3]. Following this concept and answering interests demonstrated by a group of teachers in 'drawing' attractive and dynamic learning contexts through the exploration of new technologies several modules were created and presented by streaming [4]. These thematic modules were implemented in different courses of Engineering and Education, being some of them reused in different curricular unit of different learning level.

In an era where learning environments mediate by the Internet assume an important role, the initial motivation to this work was taking the challenge to create 'just in time' contents to the consolidation of students' knowledge. Building pedagogical materials that can be stored and categorized by thematic areas on a contents repository, allowing its reuse in different scenarios and learning levels will mark the second phase of the work.

In the different parts of this paper, the objectives, a systematic description of all developed experiments emphasising the students' feedback; the teachers' perspective face to the possibility of reutilization of their contents by different people on different contexts and learning scenarios, and at the end, the conclusions inherent to the ongoing work are discussed.

2   Goals

One of the objectives defined for this work was to comprehend, in the teacher's point of view, the motivation level to create streaming contents. Equally important, was to understand and to know their mindset concerning the availability of these materials on an educational contents repository. One of the objectives of this educational repository is to make possible the storing of the e-contents that can be reused by different people on different contexts and learning scenarios.

3   *Streaming* Contents Experiences Description

With the finality of understanding the field of application of the streaming contents, several thematic modules were developed and presented to different learning units of distinct graduation university courses.

The learning units considered in this project were: Methods and Techniques of Education Administration of the Education Courses, Computer System of the Integrated Master in Computation and Applied Mathematics of the Integrated Master in Industrial Electronic Engineering and Computers. The corresponding streaming contents as the learning levels are identified in Figure 1.

The streaming contents "Differential Equations" were used into two distinct course learning units. Considered as a nuclear subject in the students learning process, the Applied Mathematics was available in the platform Moodle. Later on was reused by a different teacher and in a different level. In this case this leaning unit was used as a revision unit to the learning unit "Digital Control". A different platform as a virtual scope virtual classroom was used, Blackboard.
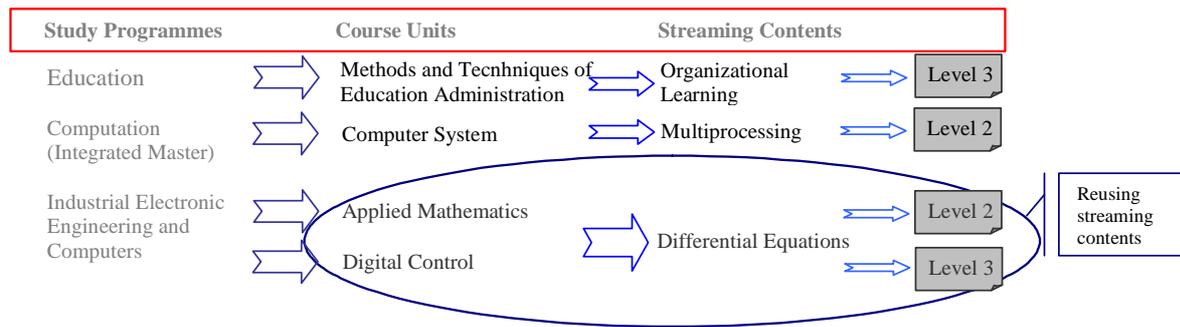
Figure 1. Course Units using Streaming Contents.

The entire three modules integrate the theoretical aspects, for considered fundamental to the students learning process. The possibility to see all the available materials, as many times as they like and anywhere with an Internet access, is one of the advantages related to this kind of materials. It also permits students to find their own learning balance point. The student can repeat the contents message as many times as they think necessary through the distinct stages that constitutes their learning concerning to a specific topic, as stated by Adão and Santos: "streaming technologies are one of the most promising technologies for learning purposes in this changing domain. It seems to be very flexible and capable of keeping students motivated, mainly because students may view and 'use' lectures wherever they want and need them"[5].
The students have not only different routine of study and behaviour/reaction to stimulus but also different needs of learning. Knowing this, and in order to follow all student's activities and to give to the teacher an idea of the study hours that students prefer, an access counter was associated with the streaming contents. Figure 2 describes the daily/hours access to the content for the Applied Mathematical module that the students prefer. In February students have the last period of assessment, coincident to the end of the first semester.
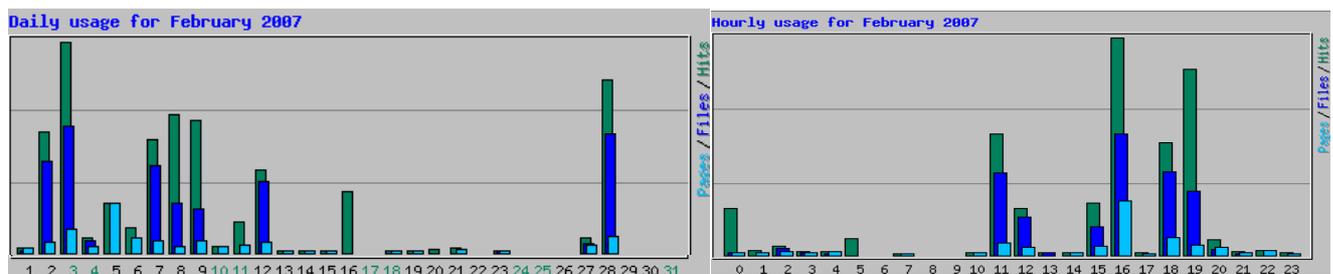

Figure 2: Daily/Hours Access to the Content for the Applied Mathematical Module in February 2007.

All learning units were kept online during the entire correspondent course units.
To encourage and stimulate students to use this type of contents, the teacher must have the capacity to innovate and create attractive materials and enriched them with appropriate and applied exercises. It is important, in an educational point of view, to foment interactivity between teacher, student(s) and contents. It is expected that the teacher develop a learning strategy to enable students to explore, practice and test their competencies. They can be associated to the streaming class presentation, for example, challenges with activities and practical exercises, podcasts with relevant news, related small videos, links to relevant sites, among others solutions.
Shared spaces, like forums and discussions, are scenarios that can promote expected results since they can promote a space for debate. From this harmonious combination, traditional

face-to-face classes and web spaces, new holistic learning scenarios are establish filled of stimulus and new challenges not only in the point of view of the students but also in the point of view of the teachers.

3.1   Involved Technologies in the Design and Implementation of the Contents

The technology involved in these experiences to compile the streaming contents was Microsoft Producer, a free Power Point 2003 complementary tool. Of great simplicity and easy to use, this tool allows to import different types and formats of files. Different types of files can produce the streaming contents, depending of the final use: video, power points, audio and HTML documents. After the synchronization of all the involved different files, the content must be published and stored in a streaming server. Following, the building pedagogical materials can then be turn available through the addition of links to the reserved space in Moodle and Blackboard platforms.

Figure 3 shows the interface layout used for the three streaming learning units developed: Computer System of the Integrated Master in Computation, Applied Mathematics of the Integrated Master in Industrial Electronic Engineering and Computers, and Methods and Techniques of Education Administration of the Education Courses.

Figure 3: Structures of the Streaming Learning Units Developed.

This type of contents formats allows the teacher to, anytime he feels its needed, change de HTML document without the need to synchronize the remaining content. Depending on the public target, the teacher can reformulate the associated complementary activities to a particular subject, only associating the new document of activities inside the establish temporization and proceed to a new publication. Doing this, the teacher doesn't need to start the procedure from the beginning.

3.2   Students Perspectives

At the end of each pedagogical experience, the students answered a questionnaire in order to evaluate the use of virtual classes as a complementary tool to the face-to-face classes.

From a group of 123 students (44 from Education, 24 of Computation and 55 from Industrial Electronic Engineering and Computers[1]) we can observe that the level of satisfaction with the realized experience was very good, as illustrated in Figure 4. Almost 60% of the involved students were very satisfied in opposition to 3% of students little satisfied.

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[1] At this moment the learning course of Digital Control is still running, so the students had not answered to these questionnaires.

Figure 4: Level of Satisfaction with Experience.

Faced to these results, we can conclude that the level of satisfaction in the use of pedagogical contents in streaming is high, nevertheless a lower band of students manifest little satisfaction with its use. From an open question, the students mentioned that the fact of not having Internet at home is a limitation making it difficult to access the materials. Other common observations marked by students were the lack of privacy and appropriate resources to attend the pedagogical contents.

3.3 Teachers Perspectives

To obtain and to apprehend better the teacher's perspectives about the use of streaming contents, four open interviews were carried through. One for each involved teacher. As mentioned by Patton "the interview guide simply serves as a basic checklist during the interview to make sure that all relevant topics are covered" [6]. This kind of interviews permits the interviewed "to adapt both the wording and the sequence of questions to specific respondents in the context of the actual interview" [6].

Two of the four involved teachers mentioned they didn't have difficulties in developing the streaming contents. One in particular mentioned "that was not a difficulty but more an adaptation"[2] to the new reality. Some of the used pedagogical materials were elaborated for the face-to-face classes (power points, some activities and bibliography of support). Only small adjustments were needed. In a general way, all the teachers mentioned the fact that differentiates the preparation of the contents for streaming to the ones they present in normal classes is the "question of being filmed"[3]. This was the most difficult part of the work, as mentioned by two teachers.

All were unanimous when considering that developing streaming contents is initially more time consuming comparing to the time needed in the preparation of normal classes. Despite this, all agreed that this additional time consumption "is rapidly amortized"[4] all over the years. One of the teachers, in a certain way, summarizes the general teacher's perspective: "the streaming obliges us to a setup time considerable (…) but that is later recovered"[5].

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[2] Transcription based on Portuguese language: "que não foi tanto uma dificuldade mas sim uma adaptação".

[3] Transcription based on Portuguese language: "questão da filmagem".

[4] Transcription based on Portuguese language: "é amortizado".

[5] Transcription based on Portuguese language: "o streaming obriga-nos a um tempo de setup considerável (…) mas que é depois recuperado ao longo dos anos".

3.3.1   Advantages Gained in the Point of View of the Teachers

Table 1 summarizes the advantages that the four teachers had found for carried through the preparation of the contents in streaming format.

Table 1. Advantages gained from the work associated to the preparation of contents in streaming.

Described Main Reasons	Related Citations [6]
Time	**Professor 1:** "Time is saved, in truth, the module is prepared and, only some adjustments or some update in terms of materials to be available and new exercises will be needed to make". **Professor 3**: "I do not see that it exists any lost of time, in the contrary, I find that, with this type of contents, we can save time."
Higher use of face-to-face classes	**Professor 3:** "(…) with the advantage that the contact time can be used more efficiently."
Reuse perspective of the streaming contents	**Professor 2:** "at this moment we are studying the possibility to use the same contents in streaming in the scope of another curricular unit. It is the call reusing the contents, and that will save us time". **Professor 4:** "the perspective of reusing the contents is one of the great advantages for teachers and students. For us teachers, because it saves us time and spend time for different dynamics of the actual classes and for the students who can learn or review subjects in a more autonomous form".
Income of the effective class time	**Professor 3:** "(…) in a normal class there are immense interruptions caused by disturbance. When we have 120 students in a class in a room, the *useful time of antenna* is very short, right? When I am speaking for a camera, to make the stream, I do not have interruptions, in this way, the speech is more fluid, does not exist replications, as it happens in a normal class where frequently I have to come back behind and to repeat. (...) I would say that my module would take me two hours of normal class is condensed in 20 minutes, more or less, of streaming". "There's a huge reuse… with a minor effort for the teacher and a higher benefit for the student".

As it can be seen from the presented reasons (Table 1), the profit in time in a medium and long term, appears, implicitly or explicitly, as an advantage for all the presented comments. As an associated advantage, the management improvement of the face-to-face classes and the perspective of the streaming contents reutilization.

3.3.2   Advantages in the Students Learning Process

Another aspect that seems important to point out is the advantages found by the teachers concerning to the use of this type of e-contents in the students learning process. In Table 2, some of the interviewed opinions are summarized.

The perspective of creation of the pedagogical contents structured to be use *just in time* in turn of *just in case* [7], is reverted in one of challenges for the development and consolidation in the learning process. Their flexibility allows the adjustment to different profiles and needs of each student appears as the most cited advantage for the concretization of more effective learning's.

3.3.3   Perspective to the Conception of Repositories of Contents "Open Access"

Questioned about how they would face the conception of repositories of contents opens access in streaming, under the institutional point of view, teachers gave interesting opinions. These are registered in Table 3.

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[6] Adapted to English

Table 2. Advantages in the Students Learning Process – Teachers point of view.

Advantages for the Learning Process	Related Citations[6]
More structure contents	Professor 1: "we must find a more structured and organized contents, with a logic sequence in a way to help student to construct the idea on the subject in study."
Possibility to assist to classes only when motivated	Professor 1: "I find that this is very useful being an advantage since it permits, from a previous work, the teacher can make available to the students consult in any time he wants, managing its time". Professor 3: "The great advantage is that the students be able to hear when they decide and not when I want that they hear".
Possibility to replace a missing class and to repeat when necessary.	Professor 2: "(...) when a lesson is given, who is in the class is in the class, and who is not is not... and also being in the class, the attention is changeable, and small details can not be understandable, and with this system of streaming, the contents are 24 hours available, and they can always go back and stop as many times they need, while in a class, the teacher says its once and its done". Professor 4: "Is to give the student possibility to learn in his own rhythm".
A more efficient learning	Professor 3: "Today, it is very boring to present these same contents in a theoretical class: boring for the student since most of them are not synchronized to hear theoretical classes, it is boring for the teachers who have to deal with great groups of students (I have group of 120 students). The use of the theoretical classes in this context is extremely reduced, it's the experience that I currently have and I am sure that with streaming contents the obtained message could be more effective".

Table 3. Perspective to the Conception of Repositories of Contents "Open Access

Presented Reasons	Related Citations[6]
Revealed Interests for Specific themes/modules/units	Professor 1: "I would accept it well. I do not see any problem in turning all the streaming contents in free access. I find that much people will be able to have interest in these themes/modules/units and therefore they must be of free access to anyone who wants them. It is clear that someone can think that is violating copyrights, then the strategy must and could be negotiated".
Opening to new challenges	Professor 3: "I find that is interesting, and it opens great chances and perspectives (...). It is truth that we have immense searches, the social and economic activity of a country is extremely diverse, there are people that work at night and studies during the day, there are people that work during the day and studies at day, there are people that doesn't work and that only studies, but they needed to study… if we increase the type of offer, we open new opportunities".
Support Structure to the reutilization perspective	Professor 2: "Hell, I find this experience to be continued… the development of these repositories seems to me an important issue as a structure of support to the reutilization perspective. But, must have a dialogue between all the involved parts in the process".
Copyrights guaranties	Professor 4: "It is a delicate question... we have the copyrights problem. If it will be in a restricted environment, inside the university community perhaps… being total opened for the exterior,, sincerely I do not know, I have some reserves".

In general, the idea is well accepted for the majority of the interviewed teachers. The main point out advantage is the perspective the university opening to the public, capturing new public and new opportunities. Outstanding the fact that these repositories are able to function as support structures to the storage and reutilization of pedagogical contents developed in streaming. They can also be reused in different contexts and learning scenarios. However, despite the optimistic perspective, some concerns related to copyrights must to be taken into account.

4   E-Learning Repository (UMinho/TecMinho)

Minho University has created in 2005 its Institutional RepositoriUM (an open access structure of resources based on scientific documents, thesis, articles, etc). This infrastructure is based on DPSPACE open source platform) and contains at the moment more then 5000 documents. This Repository is available at the Minho University Library.

Based on Minho University experience and following the international movements of open availability of educational content, TecMinho (Minho University Interface) created in 2006 a project to develop an Open Educational Resources Repository, the so called e-Learning

Repository, where teachers and trainers can upload educational content to be use within their face to face or e-learning courses, avoiding the use of the LMSs to that end.

In figure 5, the e-learning Repository is shown in its context (e-learning framework). In this schema, the life cycle of "educational content" is represented.

The "content" is created by the teachers (authors or learning designers) and is used by the students or by other teachers or trainers in a new learning context.
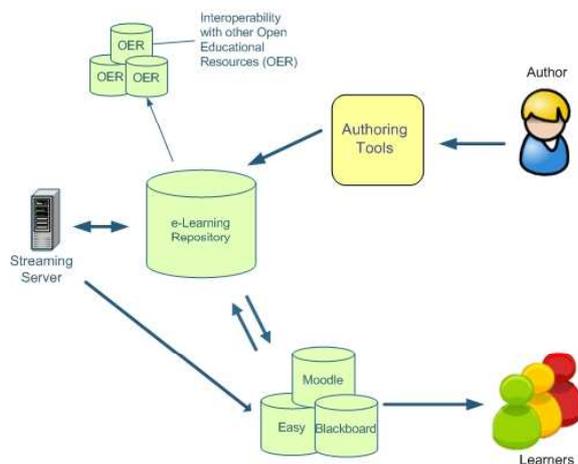

Figure 5: Life Cycle of Educational Contents.

The life cycle of the content is initiated by the design of the "learning contents" by an author/teacher who can use different tools to create content, for instance he/she can create "streaming content" as in the example shown above.

The content can then be uploaded in the e-Learning Repository and at that moment the author can register the content "metadata" (DSPACE uses Dublin Core as the Metadata schema).

The Repository accepts different formats, for instance a simple file (word file, pdf file, etc.), or a set of files for the same content, and he as no format restriction.

Due to the specific needs of the streaming format, we will always have the content in the streaming server. In this way, streaming content is not physically in the repository, but rather only a link to the content and the description of this content will be in the repository.

After the deposit, the content will be available throughout the e-Learning Repository at any time, anywhere, with the simple reference to the repository website, or via the use of the "Handle" address, a unique address that allows referring the content from any other Internet based system.

The use of these "handles" will allow an easy link between the e-Learning Repository and any e-Learning Platform (LMSs in use, for instance with Blackboard at Minho University or with Moodle at TecMinho).

This way the author or teacher will not need to transport the content inside the LMS, he/she just needs to indicate the unique address "handle" in the LMS and the content will be automatically available.

All the content available in the repository is indexed by search engines and is interoperable with other content repositories that support OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting).

The e-Learning Repository adopts two types of licences. One is referring to ownership of the content (intellectual property) and is defined by the author, the other licence to the service of the repository. The licence defined for the content is a Creative Commons Licence[7] [8]. At the

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[7] http://creativecommons.org/

upload workflow, the user can mark their content with one of the creative commons licences through the licensing process.

In this way, the author defines in which condition the content can be used. The licensing process allows authors to choose if they allow commercial uses of the work and if they allow modification of the work.

The other licence type is a statement that authorise the e-Learning Repository to distribute the uploaded content. If the author doesn't accept this licence, the content will not be available until he accepts this licence.

The reuse of streaming content in engineering and education courses can then be integrated in the e-Learning Repository without any problem.

5   Conclusions

The principles that oriented an inclusive university and, at same time, open to the spread and promotion of their *know how*, launched the university to the challenge defined by the "next-generation tools" [9]. Using new technologies to develop, store and make available more and more appealing and flexible learning materials induce to scenarios of change, with new challenges for teachers, students and universities.

This paper describes the positive reaction of students and teachers, with the advantages that the streaming contents have in answering to specific students needs in their learning process. The obtained results follow the studies developed by Gradt-Johnson and Price, and Hickson, Land and Aikman [10-11]. They state "research that examined the relationship between learning styles and the learning environment has suggested that teachers should adjust and structure the learning environment and their expectations of students around the students' individual learning styles". To develop these contents the teachers must bet in the design of the learning units. Following Ary, the design is "an activity whose objective is to establish and find multifaceted qualities in the objects and involved systems"[8] [12]. In this perspective, this element represents "a crucial factor for the innovation, the human-technology relation"[9] [12] and for the established exchanges, being the teacher the one to define the design that better adjust to each scenario or educative context.

In the point of view of the students, the principle advantage is that the contents are permanently online given them the possibility *to be in class* whenever they need or when they feel motivated. At the same time, a greater autonomy and flexibility associated to the self-management in their learning process.

The use of the described methodology must be regarded as a complementary tool to the traditional face-to-face environment, transforming students to be more responsible and more active in their *learning how to doing* process.

On the other side, and in the point of view of the institutions, the greater challenge is much behind the design of the structure of support that permits to keep or to look for, in an organized way, the developed didactical resources materials in order to be reused on a later moment. Several advantages and apprehensions must be taken into account.

The existence of strong oriented politics of the institutional point of view that stimulate an educational for the sharing is essential for the growth of open educational resources repository. The strategies definition of teachers negotiation, who develop questions related with the development support, copyrights and professional assessment, are others basic

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[8] Transcription based on Portuguese language: "uma actividade criativa cujo objectivo é estabelecer e encontrar qualidades multifacetadas nos objectos e nos sistemas implicados em cada um deles".

[9] Transcription based on Portuguese language: "um factor crucial para a inovação, para a relação humano-tecnologia".

aspects to promote the development of these contents. These contents are a type of *raw materials* unseparated from the knowledge.

In a generalist point of view, we can say that to innovate in education and in learning subsist in premises of the "knowledge valuation" [13] by all parts involved in the project, being them teachers, students or educational institutions.

Although this experience is still in a development phase, there are already several learning units using streaming media contents, anticipating enlarging the design and the use in different contexts in the university institutions. It is in study the possibility of the available in an open access structure, the so called e-Learning Repository, where teachers and trainers can upload educational content to be used within their face to face or e-learning courses, avoiding the use of the LMSs to that end.

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