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THE FLIPPED-BROADCAST LEARNING SYSTEM, APPLICATION ON AZORES

João Cabral, PhD
CIMA-UÉ – Research Centre for Mathematics and Applications of the University of Évora
Department of Mathematics of the University of Azores, Portugal
Jerónimo Nunes, PhD
CMATI- Centro de Matemática Aplicada e Tecnologias de Informação da Universidade dos Açores
Department of Mathematics of the University of Azores, Portugal

Abstract

On this work we suggest a teaching solution that can be implemented in Azores, an archipelago of nine islands of Portugal, based in already known system of e-learning, with a twist based on the flipped method. Structured in a cooperative way, the organization of the system allows to isolated groups of people to have access to a certain level of teaching, if they cannot have the possibility to have physical presence in school due to problems emerging from territory discontinuity. Our suggestion can be elaborate in a model that can be adapted to any level of education, and can be adapted also in cases that a cut of budget exists. We suggest the name of fb-learning: Flipped Broadcast Learning.

Keywords: E-learning, b-learning, long distance teaching, flipped learning methods

Introduction

The University of Azores consists of three poles located on the islands of São Miguel, Terceira and Faial, and integrates university and polytechnic organizational units. Their teaching, research, service and cultural extension covers the most diverse areas of Exact Sciences and Technology, Natural Science and the Environment, Medical Sciences and Health, Agricultural Sciences, Social Sciences and Humanities.

Fruit of their framework and of regional, national and international priorities, the University of Azores explore these distinctive areas of training and research, as the sea, including fisheries and aquaculture, and natural hazards, notably volcanology and seismology, climatology and meteorology.

Also worth mentioning other areas, in particular, the level of biodiversity, biotechnology and biomedicine, agriculture and livestock, geological and energy resources, economics and marketing, sociology and geography, pedagogy and psychology, language and communication, history and philosophy, archaeology, political science and new technologies, in particular the information and communication technologies and the material technologies.

The University of Azores is a young institution in the framework of higher education institutions and their growth potential is proportional to the motivation and commitment of its teachers, researchers, technicians and students, who are striving to ensure a close link of the institution to society and the business sector as a contribution to the economic development of the region, the country and the world.

Nowadays, the University of Azores is trying to explore the e-learning and b-learning systems, due to the dispersion of Azores Islands, its most common provider of students. More than 90% of students come from all islands of Azores, and almost half of them are dislocated students from another island. The Azores islands are indeed a natural laboratory where researchers can develop some new ideas and techniques about long distance teaching. The proof of that is the continuous interest of the Open University in maintaining a pole in one of Azores islands with the main centre in Lisbon, and the cooperation protocols that this specialized long distance teaching university has with the University of Azores. This way they can improve the quality of their own courses, receiving the proper feedback from long distance students that live in Azores Islands.

Our work intends to be a contribution, the first step, to improve the actual method of e-learning used by Azores University, based in the old but efficient method of "Telescola" and the modern method of Flipped Classroom, mixing them both in a method that we call the Flipped-Broadcast Method, fb-learning. So, to support our idea, we describe the main characteristics of *Telescola*, we also provide a theoretical framework for long distance teaching, exploring the Learning Process and its foundations, and present the main aspects of our fb-learning model. Due to its own properties we believe it can be an excellent improvement to the already classical e-learning and b-learning methods.

The Telescola

Taking the information provided in [1], the "Telescola", education via television system, started in Portugal on 6 January 1965, with programming produced in the studios of the Portuguese Radio Television of Mount Virgin in the city of Porto, in Portuguese mainland. The students were accompanied in reception centres by monitors. The intention was to allow

the fulfilment of compulsory education students at the time made up of four years of primary school and the two "Preparatory Cycles". Geographically *Telescola* intended to serve remote rural areas and suburban areas with overcrowded schools. At that time, there were about a thousand students enrolled, but the entire population had access through television emissions occupying part of the RTP afternoon programming. RTP was the main and only TV channel in Portugal until the beginning of the last decade of the 20th century. The Portuguese *Telescola* was one of the most successful in Europe.

In the early 70s, education reform dictated the extension of compulsory education to eight years. Where it was not possible to provide in presence teaching to students this could be replaced by *Telescola*. This system was also applied to the High School level in Portugal, on the year known as "Ano Propedêutico", that was intended to be a preparation year to students that wished to apply to the University. In the 80s, with the arrival and extension of VCRs, *Telescola* no longer was televised, thus freeing those hours for other programs. The contents of the videotapes had further clarification provided by a tutor. In the 90s, the use of new communication and multimedia technologies led to distance learning passing to function simultaneously as a complementary form of regular education and as an alternative mode of education. At this point, it was addressed mainly to those who do not have the possibility to attend school in the normal age.

Over the years, the Telescola was changed from its initial designation Telescola Unified Course, to TV Preparatory Cycle and to Mediated Basic Education (MBE). In July 2003, it was announced that from the 2003/2004 school year the MBE schools would begin to be extinct, at that time about 320, dedicated to teaching the 5th and 6th years. In 2001/2002 there were about 5200 students enrolled in MBE, with a success rate of around 90 percent.

Fig.1. 1968, *Telescola* class – from RTP Archive

Models of learning

Models help us to make sense of our world. They provide a framework or structure to help us understand a large or complex concept, and break it down into discrete, manageable units. Learning models provide teachers with an organized system for creating an appropriate learning environment, and for planning instructional activities. Learning models affect what the teacher does, what the student does, the organization of the classroom, the nature of the procedures, materials, and the instructional tasks.

Adapting some ideas from Brain Compatible Learning for the Block, by Williams and Dunn, [3] and taking the summary elaborate in [2], we have that: 1- Learning becomes relevant through personal context. Students need to understand how this new information relates to their "real life"; 2 - Learning is dependent upon motivation. Students need to be motivated in order to commit the new information to memory; 3 - Learning is reinforced through hands-on experience. This experience enables the student to put a concept or theory in context and examine the parts that make up the whole; 4 - Learning requires linking new information to prior knowledge. The brain has a much greater capacity to take in and store new information that it can relate to something already learned. Teachers need to help students make these connections; 5 - Learning is achieved more efficiently when information is chunked. By grouping together related information, the brain forms a schema, or concept, and assigns meaning; 6 - Learning is enhanced with time for reflection. Reflection, or thinking about what was just learned, helps put the new information in long-term memory. Activities such as group discussions, questioning, and writing in a journal all aid in this process; 7 - Learning is retained longer when associated with senses and emotions. The more senses that are involved in the learning experience, the more stimuli have a chance of reaching long-term memory; 8 - Learning occurs in an environment that fosters and accommodates various ways of being smart. We all have multiple intelligences that need to be accommodated and strengthened. We will discuss this in depth in the next lesson; 9 - Learning is a high-energy activity. If not rehearsed, new information will begin to fade after 30 seconds. It is essential that instructors cover new information several times and in a variety of ways.

In models of learning we can identify some variables that are connected to environment, to emotions, to physical characteristics, to sociological behaviour or to psychological aspects.

When building a model of learning each one of this group of variables have their own importance and must be study separately or together when interacting in order to improve the accuracy of the learning model. When collecting information about the environment we can analyse if the

student likes to study with music or silent, if he prefers dim or bright light, if the room temperature must be cool or warn, or even if the furniture arrangement must be in a certain order. Regarding to the emotional state, motivation is an important factor, as persistence, responsibility and task structure demands. Sociologically, we must see if the student prefers working alone, in pairs, with a team, and if he likes to work with the teacher and work with the same activities using repetitive processes, creating routines, patterns, or if he likes to have a variety of procedures to engage activities. Related with the physical, the mobility aspect is important since the student can love to move during a task, or can prefer to stand still in some place. The time of the day when the task is completed can also disturbs the learning process, since studying at night or during the day is completely different, since can affect the biological rhythm. Finally, the variables that have psychological nature, like the student being impulsive/reflective, making quick decisions or taking some time in order to consider all options, or a detailed student that likes to observe every aspect of a mathematical algorithm in confrontation to a more global point of view finding generic conclusions. All these variables can generate their own contribution to dynamics of the learning process.

Flipped Classroom Model

As described in [5], the Flipped Learning model of instruction, although virtually unknown a few years ago, is gaining attention and adherents among teachers and administrators in American K-12 and in postsecondary classrooms. In this model, some or most of direct instruction is delivered outside the group learning space using video or other modes of delivery. Class time, then, is available for students to engage in hands-on learning, collaborate with their peers, and evaluate their progress and for teachers to provide one-on-one assistance, guidance and inspiration. The shift is from a teacher-centred classroom to a student-centred learning environment.

The flipped classroom inverts traditional teaching methods, delivering instructions online outside of class and moving “homework” into the classroom. Mainly, replaces old style live lectures by new fresh live activities. The students watch lectures at home at their own pace, communicating with peers and teachers via online discussions and the comprehension of the concept takes place in the classroom with the help of the instructor.

Educational technology and activity learning are two key components of the flipped classroom model. They both influence student learning environments in fundamental ways.

Usually the structure of this learning model has three main support ideas: 1 – Teachers create videos, or another similar multimedia material; 2 – Students watch the videos at home, or at School; 3 – Class time are spent doing labs or interactive activities to illustrate concepts. With this simple structure the method allows students to receive instant feedback, since teachers have more time to help students and explain difficult concepts. Students don't get so frustrated, since the difficulties that arise in solving some problems are solved in class room. Teachers revisit concepts students don't understand. After students watch lessons, they write down any questions they have. Teachers review those questions with students individually. And finally, teachers can support students in class helping them to use properly the technological tools. This method is proving to be so effective that can change a rate of 44% tax rate of failing in math to a 13%, results obtained in surveys done by the Khan Academy, see [4].

The student at home

When student is participating on the learning process at home, all the variables that can contribute to a learning model style, like the Dunn & Dunn model explains in [2], can be controlled by the student.

The environmental preferences like sound, light, temperature and design, can be adjusted by student to converge to as maximum comfort as possible. Student can choose if he likes to study with background music, or be in silence, having a quiet studying. He also can adjust the light to a bright one or dim, in order to improve his own power of concentration. The room temperature also can be adjusted by student, in order to adapt to the climate of each place on the islands, as the arrangement of furniture can be adapted to cause more comfort to student. He can sit at a desk, or use a couch or bed to study, or even on the floor, lying down and spread all the sheets of study support around him. This last image is the most common one that the student has as reference, when he sees movies that have some "genius" working.

The emotional preferences like motivation, persistence or responsibility can be controlled by the student, but the one related with structure needs extra support, by a teacher, so it is not so controlled by student. The student can be self-motivate and not need a adult feedback to motivate him, or any kind of reinforcements, but we all know that after a while, the student needs to knows if he is going on the right track or no. But persistence is a factor that is related to the ability to stay on task and this characteristic can be only controlled by student, since to do one task or multiple tasks at the same time is more a personal choice than induced by teachers. Of course, when the student works alone at home, the supervision of the work is not so demanding, cultivating the degree of responsibility that student must carry. When studying alone, at his home, the way to organize

the study is far the most week aspect that we can find in students. If the student doesn't have a plan in order to structure the study then he can skip some important objectives and disregard valuable items that could help to improve their own way of reasoning.

The sociological preferences like working alone or in group, or creating routines, patterns of study, when the student is working at home are converging mostly to the "alone" case, using a personal routine and very own pattern of work. But this handicap can be easily trespassed if the student as some way of connection to the internet or any kind of mobile communication. Of course, these kinds of variables are the ones that are reinforced through the use of e-learning methods. Using the new technologies the student have the opportunity to work with his pairs, participating in working groups, and also have the guidance of teachers, since the materials are available at a repository that can be accessed by the student. The advantage of being at home is that study can have more time to understand other ways of working in some subject, adapting other patterns of behaviour from other students, without being afraid of criticism from others. He can do a progressive study at his own pace and rhythm. The student has the tendency of sharing his knowledge only he has sure that he is capable of defending the structure of reasoning at least. The self-confidence can be worked without the interference of others.

The Physical preferences also can be totally controlled by student at home, since he can adapt the perceptual variables, like vision, audition, tactile, etc, connected with the human senses, to his own environment. He can drink at the same time while studying if he wants, or chew gum, that is formal forbidden in regular school. He can choose the time of the day to start and end study, that he feels more comfortable. The student also, when at home, does not need to stand seated all day long, since he can move around a place and interact with it when he feels appropriate to do so. Humans like to have a very wide range of free mobility, so to enjoy it during the process of study can improve the "like" process during some hard aspects of learning. It is not in vain that the most common social networks have a "like" switch that the users can interact. It mimics the process of touching, and moving around the neighbourhood place of the user. Rarely when we study something we are stopped and quiet... we need to move, to have some movement during the process of learning.

The psychological variables are the ones that benefit most when the student studies at home, because in case of some kind of handicap, the student doesn't need to share it with others. He can be analytic or global during the study, orientating the study in order to adapt his own capacity of learning. Also, when it is needed to share opinions, it can be done without

the hurry and stress factors that we can find in a regular class room, at schools.

The existing system

At University of Azores, most teachers follow a traditional teaching model in classroom mode, based on copies of the lectures content being made available to students through the Moodle learning management system. This system is also used to support activities such as the reception of home works and answering to quizzes.

Separately, there is the possibility of synchronous transmission to other *campi*, or poles of the Azores University, of the classes taking place in one of the *campus* with the use of a video conferencing system with terminal equipment located in appropriated rooms distributed by the three *campi*. The number of lessons simultaneously transmitted by video conference is reduced due to the very limited bandwidth provided by the ISDN connection, used by this system. At present, these classes cannot be recorded for later release to interested students.

It is not institutionalized the use of web conference, between the teacher and a small group of students, to support the implementation of learning activities. The access of students and teachers to the Moodle system through the Internet, outside the local network of a *campus*, is very conditioned to the reduced bandwidth available in the interconnection of the University of Azores network to the Internet.

Architecture of the fb-learning system

Our proposal is an integrated flipped-broadcast learning system that combines synchronous (or live) and asynchronous (or deferred) video communications and a learning management system in a central location (*campus*) to which other node locations (*campi*) are connected and communicate with via a network infrastructure.

The symmetric group or multipoint video conference system will enable student classes in a remote location to synchronously attend lectures transmitted from another location and to interact with the teacher.

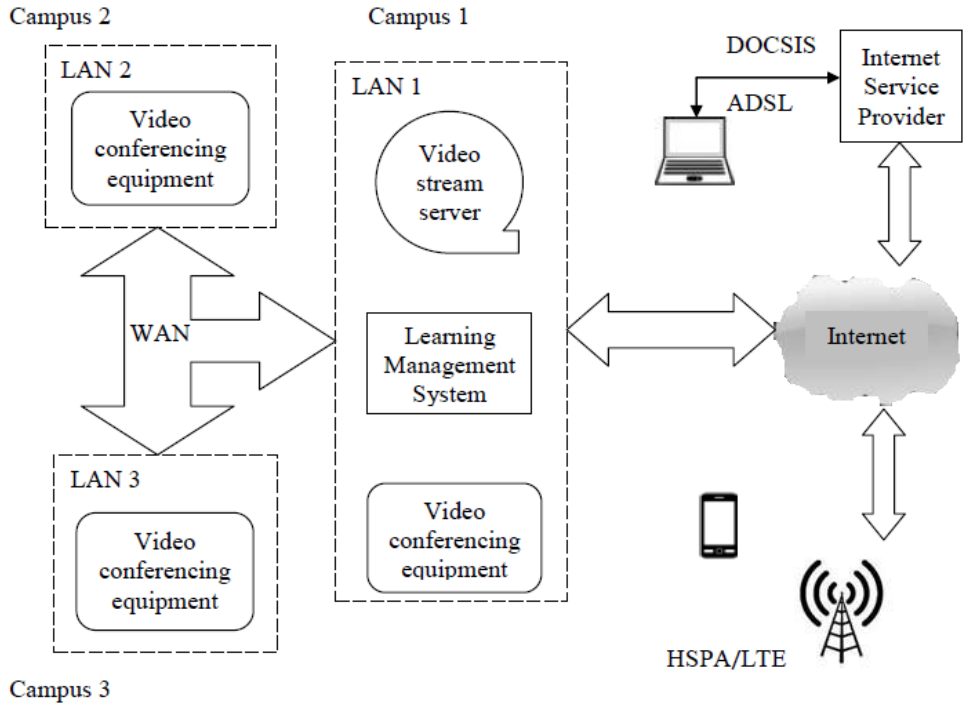

Figure 2: Flipped-Broadcast Learning Model

With the potential of this system we will have at our disposal the means necessary to implement the flipped learning method, figure 2: early disclosure to students of lectures, conducting online tutorials sessions for the whole class or small groups of students and the delivering of supporting materials to completion of learning activities.

The previously recorded lectures and tutorials transmitted by video conference sessions will be placed in a stream server become available for viewing by students that not had the opportunity to watch online or to review the content covered.

These videos will be available through the used learning management system (Moodle) in conjunction with the other resources of a curricular unit.

The various streams can be played on desktop computers or mobile devices connected to the LAN campus, using the players compatible with the formats of video files and suitable for standard delivering systems available for free.

In their homes, students also have access to videos with recorded lessons by choosing the appropriate stream according to the bandwidth available through existing Internet connection.

At each *campus* there will be an optical fibre backbone that will connect the networks of the various buildings, which uses an Ethernet technology at 1 Gbps.

To obtain the maximum efficiency between the various network *campi* and to the outside public network, it is necessary connections with bandwidth up to 1 Gbps, like the ones proportionate to other national universities, which could be obtained with the use of optical fibre ring that already connects the islands of the Azorean archipelago.

The bandwidth needed for video transmission over data communication network is conditioned by three factors: 1- the number of still images (frames) transmitted per second; 2- the resolution of each image (the number of pixels); 3- the number of possible colours for each pixel (colour depth). For medium-quality video transmission, with a resolution of 640×480 pixels, 16-bit colour, 20 frames per second (fps), it is necessary a bandwidth approximately equal to 100 Mbps (640×480×16×20). This previous values would have to be multiplied by the number of simultaneous connections and would originate a very high bandwidth consumption, would result in unaffordable values that could hardly be supported by the capacity of today's networks with existing technology.. To reduce the required bandwidth, the video will be compressed decreasing the colour depth or the number of frames per second, or both, until values are obtained compatible with the characteristics of the networks used.

The bandwidth values typically required for synchronous multipoint video conferencing systems are around 2 Mbps, multiplied by the number of links from one point to all others.

For transmission by streaming the requested bandwidth is 1Mbps for each connection because it is not necessary to support two-way communications, as in the case of video conferencing.

These bandwidths are within the amounts provided by broadband ADSL and DOSIS connections from homes to the Internet, Wi-Fi offered by public hotspots and through the 4G mobile networks, in the latter case, with considerable costs.

This way, we could implement the fb-learning process, supported with a network infrastructure presenting these characteristics.

Conclusion

Our proposal of a learning support system is suitable for modalities of classroom learning and long distance, with it have foundations in the flipped learning method, supported by learning management software and taking advantage of the communication facilities provided by modern computer networks. It was demonstrated that combining these various components we can meet the needs of students scattered throughout the islands of the archipelago using innovative methods that make more efficient learning, motivate students and lead to better results. The teachers, who have some preparation in the e-learning methods, have skills to implement the

proposed method, since it is a possible upgrade of them. The latest technologies that equip the modern networks with strong video transmission capability permit communications between stakeholders in the learning process, which facilitates the integration of interdisciplinary knowledge and learning in the various systems.

The strategic decision making to allocate the material resources to support the feasibility of this distance teaching proposal is conditioned, in a way, by the high implementation costs. So, with these high costs that the University of Azores cannot afford because of other costs resulting from its condition of insular university, prevents to take advantage of the resources that are available to other Portuguese universities because of a political decision. A modification of mentalities is required to change this situation. A modification of mentalities is required to change this situation. There are resources available and already implemented in other enterprises that could be available and shared with the Azores University.

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