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Diseño de una arquitectura IoT-MOOC como una alternativa al encuadre espacio-temporal en el proceso de enseñanza

Design of an IoT - MOOC architecture as an alternative to the space-time framework in the teaching process

Desenho de uma arquitetura IoT-MOOC como alternativa ao framework espaço-tempo no processo de ensino

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Resumen

Un factor esencial en el desarrollo del proceso de enseñanza-aprendizaje mediante el cual el profesor suscita contenidos a un alumno en función de unos objetivos y dentro de un contexto, y donde se da la relación alumno-profesor, es el encuadre espacio-temporal. En este el proceso de enseñanza se desarrolla a través de las clases o tutorías dirigidas, cuya dimensión espacio-temporal es la misma para el alumno y el profesor. En este artículo se aborda el desarrollo de una alternativa remota a través del uso de tecnología inalámbrica y el empleo de dispositivos IoT y dispositivos wearables con el uso de plataformas MOOC. Los resultados experimentales obtenidos demuestran que este tipo de modalidad digital ofrece los mismos resultados que una clase presencial, sin perder la esencia del escenario del proceso de enseñanza-aprendizaje tradicional.

Palabras clave: enseñanza, dimensión espacio-temporal, IoT, MOOC, proceso de enseñanza-aprendizaje.

Abstract

An essential factor in the development of the teaching-learning process by which the teacher raises content to a student, based on objectives and within a context and where the student-teacher relationship is given, is the spatio-temporal framing. The teaching process is developed through guided classes or tutorials whose spatio-temporal dimension is the same for the student and the teacher. This article deals with the development of a remote alternative through the use of wireless technology and the use of IoT devices and Wearables devices with the use of MOOC platforms, the experimental results obtained show that this type of digital modality is possible to apply with success with the same results as a face-to-face class without losing the essence of the traditional teaching-learning process scenery.

Keywords: teaching process, space-time dimension, IoT, MOOC.

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Resumo

Um fator essencial no desenvolvimento do processo de ensino-aprendizagem pelo qual o professor eleva o conteúdo a um aluno com base em objetivos e dentro de um contexto, e onde a relação aluno-professor é dada, é o enquadramento espaço-temporal. Neste processo de ensino é desenvolvido através de aulas dirigidas ou tutoriais, cuja dimensão espaço-temporal é a mesma para o aluno e o professor. Este artigo trata do desenvolvimento de uma alternativa remota através do uso da tecnologia sem fio e do uso de dispositivos IoT e dispositivos que podem ser usados com o uso de plataformas MOOC. Os resultados experimentais obtidos mostram que esse tipo de modalidade digital oferece os mesmos resultados que uma aula presencial, sem perder a essência do cenário tradicional do processo de ensino-aprendizagem.

Palavras-chave: ensino, dimensão espaço-temporal, IoT, MOOC, processo de ensino-aprendizagem.

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Introduction

Teaching, from the constructivist point of view, is conceived as a process through which the student is helped, supported and directed in the construction of knowledge. This approach is constituted by three main stages that represent the empirical tasks of the teacher and their pedagogical training: planning, execution and the estimation of the orientation. In each of these seven dimensions must be considered: the objectives, the space-time frame, the student, the content, the resources, the didactic strategies and the tactics of appraising the learning.

State of the art

The teaching process, from the point of view of Freire (1997), indicates that the purpose of education should not be to transfer knowledge, but to create possibilities for production and construction to be generated. To help the student in this journey, the teacher must start from the conceptual structure of each student and the ideas and preconceptions that already have, because from their own conceptual scheme the learner will provide the first meanings to the subject. Therefore, we proceed from the simple (intuitive or naive knowledge) to the complex (formal, scientific knowledge).

The constructivist teacher has the obligation to promote the conceptual change of the students from the knowledge and previous ideas that they have; Therefore, its main task is to raise questions, develop cases or generate difficult situations to resolve in order to encourage the search for solutions. The teacher, in other words, must generate dissatisfaction and deficiencies in the preconceptions (this Piaget (2012) called cognitive conflict). Manterola (1992) considers that in this process the teacher only mediates between the previous ideas of the student and the conceptions that science contributes.

Teaching from this focus does not focus its effort on cognitive contents, but on its conceptual change, specifically in what refers to the school. It is important to emphasize that all knowledge is built in close relation with the environment, so that it is not possible to separate the cognitive, emotional and sociohistorical aspects present in the context where it is acted.

Methodology and implementation

It has been taken as a basis that every teacher always performs - spontaneously or reflexively - an administrative process to plan, instruct (manage what is planned) and assess the development of instruction. In fact, at the end of this last step there will be an impact on their future planning, with which the teaching process is assured a permanent feedback. In this article, this administrative process and the constructivist model of teaching were

considered so that together they would act as a methodology to be followed and define each of the above aspects with a focus.

In the planning, seven fundamental dimensions of the teaching were considered: the objectives, the space-time framework, the students, the spaces, the didactic strategies and the assessment strategies. They are, precisely, the seven successes that are usually included in a scheme of studies when a classroom is offered. The objectives pursued were fixed at the end of the planning, as the spaces and all other decisions depend on their correct implementation.

1. The objectives are general and specific. In relation to the general objectives pursued, planning must determine whether the purpose of education is to educate 1) workers, unions, citizens or persons, 2) repeating subjects (agents of the status quo), or 3) transforming subjects (change's agents).
2. Space-time frame. This planning involves considering where and when the teaching will be delivered. The places can be the classroom, a square, a museum or the virtual space, in the case of distance education. The spatial framing also includes aspects such as the available physical resources (overhead projectors, chalk, etc.), the distribution of the desks (for example, in a circle), the location of the blackboard, the lighting, etc .; while the temporary frame refers to the hours of recess, the shifts, the duration of the academic year, etc. In general, teachers have greater freedom to choose times than places. Therefore, in this work the latter has been selected to propose a technological innovation based on the Internet of Things (Internet of Things, hereinafter IoT) and the use of Massive Open Online Course (MOOC).
3. Students. Although the objectives, classrooms and times are the same, it is not the same to teach children, adolescents, adults or the elderly. Therefore, the planning of teaching takes into account these profiles. Neuro-linguistic programming (NLP) is another theoretical line that, when it comes to teaching, also takes into account individual differences.

4. Contents. Once the objectives, the ET frame and the student profile have been set, the planning can continue specifying the contents that will be taught. In the curricula, for example, the contents usually also appear under the titles analytical program and bibliography.
5. Resources. Resources, in general, are material or human. Depending on these, its use is fixed: blackboard, videos, desks, colored chalk, projector and living room, physical space constituted by a size, lighting, sound, etc. Human resources are made up of all those people who act as actors in the teaching task.
6. Didactic strategies. Once the objectives are established, the contents are selected; then, depending on these, the teaching strategies are chosen, which can be two: the teacher's task and the activities that this proposes for the students (group discussions, monographs). The selection of teaching strategies is never arbitrary.
7. Strategies for evaluating learning. The planning includes strategies for evaluating learning and how they will be used, as its instrumentation allows the teacher to control if what he taught was effectively learned.

In the execution the planned thing is put into practice. While the planning and evaluation of teaching can be applied anywhere, the time-space of the execution is only the classroom, hence the only phase that is exposed in a tangible way in front of the student.

In the last proposed phase, the teacher evaluates the effectiveness of the teaching that he taught to determine if the objectives were met and to determine if the strategies used, as well as the number of material and human resources reached to teach the contents planned in the intended places .

Given the above, it can be explained that in this study a technology was implemented based on the development of devices of the internet of things, MOOC platforms and wearable devices. In addition, he focused on the spatio-temporal framing.

In this temporary framing proposal, non-locality stands out, since the student is expected to obtain the same cognitive experiences that he / she would obtain with the

interaction in class of the teacher and the student. This concept serves to point out that it is not necessary for professors and students to share the same space-time framework. This methodology, therefore, covered two aspects: implementation of the technological solution and qualitative analysis of the experience.

Implementation of the technological solution

The spatio-temporal framing is considered as another educator, since it is not determined only by its physical characteristics, but also by all the processes that take place in it. Recent research (Archila, 2011, Laorden and Pérez, 2002, Naranjo, 2011, Otárola, 2010, Polanco, 2004) have deepened the theme of the learning space and have shown that this is fundamental in the teaching-learning process, since It becomes significant when it promotes the development of social and cognitive skills of children, which generates enriching experiences that can favor the construction of knowledge and integral development.

Also, authors such as Cabanellas, Eslava and Fornasa (2005) and Polonio (2005) mention that the educational space implies action and is potential for actions. By taking all the elements in an environment of spatial-temporal framing, we determined the construction of an environment based on a MOOC platform, which was structured in its entirety with IoT devices to preserve the experience and maintain contact with the teacher.

MOOCs are massive open and online courses. They emerged as a movement that began in 2008 in Canada, from a course given by George Siemens and Stephen Downes. These professors opened the course for anyone who was interested in that subject to participate, without the obligation to enroll or pay any fee, and without the need to obtain a certificate; in a few words, they wanted people to participate by the simple desire to learn. The intention was to put into practice the concept of connectivism, which Siemens (2004) had pushed a few years earlier to propose that the massive interaction between equals and machines can produce learning. At this time, MOOCs generate mixed feelings. There are those who defend the fundamental disruptive innovation for the dissemination and

democratization of higher education, and also those who abjure them for not being innovators at all and for replicating obsolete teaching models with few guarantees of real learning.

Both are carried away by opinions and intuitions, and are not supported by empirical evidence that supports one or the other position. Perhaps for this reason -and because evidence is still needed to determine the level of learning or problems generated by MOOCs- some organizations and administrations have begun to finance research projects that aim to obtain empirical evidence of the MOOC phenomenon.

According to everything explained in the previous pages, this proposal seeks not only to maintain the teacher's experience with the student, but also to preserve the classroom elements through the use of technology (see Figure 1).

The selected camera was the VUZE 360 4K, which allows a 3D experience, since it has 8 distributed cameras that create depth perception. The 4K image allows you to appreciate any detail and provides a more natural experience for the human eye. Google Course Builder, a tool to use MOOCs, was used for its implementation in the cloud. This is open source, so it allows the popularization and democratization of the courses. It is hosted on Google App Engine, the Google cloud, which means that it is not necessary to rent servers or assemble databases. Its implementation is integrated into a wearable. This term refers to the set of electronic devices and devices that are incorporated into the body to interact with the user and other local or remote external devices in order to perform a specific function

Qualitative analysis of the experience

Qualitative research is defined as any type of inquiry that produces results and discoveries in which statistical procedures or other means of quantification are not used (Foucault, 2002).

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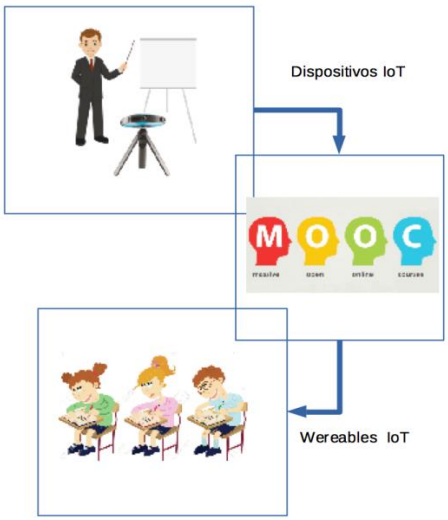
Qualitative analysis refers to rational and non-mathematical reinterpretation with the purpose of discovering key words or concepts and relationships in raw data and then organize them into a theoretical framework (Strauss, 2002). These qualitative methods are used in particular substantive areas to obtain new knowledge (Stern, 1980).

Figura 1. Propuesta tecnológica. En la fase 1 se propone un ambiente tecnológico apoyado por una cámara 360 4K, sonido envolvente. En el escenario 2 el MOOC se configura al curso y, por último, los estudiantes equipados con tecnología IoT.



Fuente: Elaboración propia

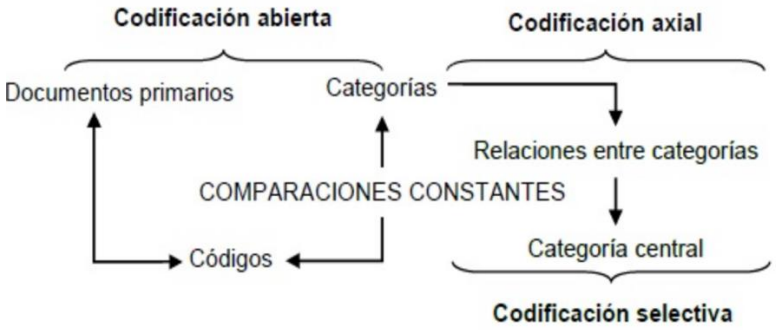
For Hernández, Fernández and Baptista (2010) there are three main components in qualitative research:

1. The data, which may come from different sources, such as interviews, observations, documents, records and films.
2. The procedures used to interpret and organize the data, such as a) conceptualize, b) reduce the data, c) elaborate categories in terms of their properties and dimensions, and d) relate the data by means of a series of propositional sentences (a the previous four are known as coding).
3. Written and verbal reports that can be presented as articles in scientific journals, in

talks (for example, in congresses) or as books.

In agreement with the purpose of this study, the methodology used for the analysis of the data was the grounded theory proposed by Glaser and Strauss (1967), described in (Carrero, Peiró and Salanova, 1998), as shown in Figure 2.

Figura 2. Teoría fundamentada propuesta por Glaser y Strauss (1967)



Fuente: Elaboración propia

For Glaser and Strauss the grounded theory is a research method in which the theory arises from the data collected in a systematic way. It does not start with a preconceived theory, but the theory arises from the data with the purpose that it resembles reality. Since the purpose of the aforementioned authors was to create new ways of understanding reality and expressing them theoretically, then methods would help to build theories. Grounded theory, therefore, is appropriate for this study.

For this research, an interview was used as an instrument, which was applied to 20 elementary schools to highlight the experience of the spatio-temporal framing. For data analysis and coding, the software for qualitative analysis Nvivo 10 (Edhlund, B and Mc Dougall, 2013) was used. After performing the data analysis, results were obtained, in which the most relevant studies linked to the investigated topic were identified to detect trends.

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To elaborate the data analysis, Nvivo 10 stores the information in nodes, which are structured in hierarchies or trees that create topologies. In accordance with the methodology used, we sought to find the elements that formed the keywords or properties to create the categories.

Nvivo 10 also shows when the theoretical saturation has been reached, that is, the supersaturation of the elements and the categories that are being analyzed. This allows focusing the search on the saturated elements and review in the documents those nodes that have not yet reached that level. According to the data entered for this study, the frequency of words is shown in Figure 3.

Figura 3. Nube de palabras creada con Nvivo 10

Fuente: Elaboración propia

As can be seen in the analysis of word frequency represented in a cloud, the main points detected are highlighted, as well as the main dimension of the problem.

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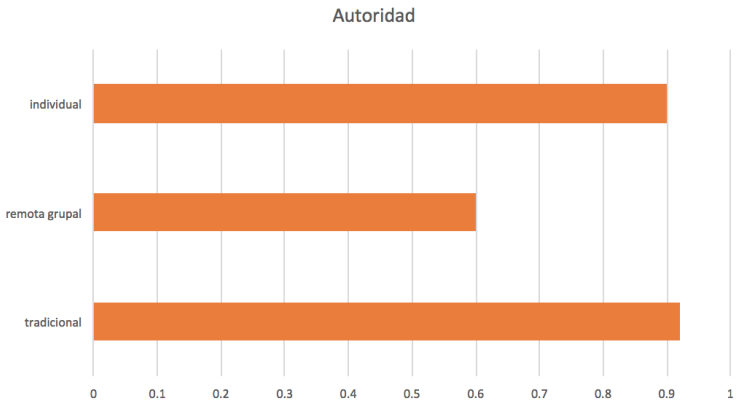
Results and Discussion

After analyzing the information, it was surprising that the most common findings were the following:

1. Need for a present authority.
2. Learning was achieved.
3. The use of technology in students had a significant response in their learning curve.
4. The teacher loved the platform.

These results surprise because it was thought to find data linked to traditional learning processes. Figure 4 shows the data obtained and its percentage.

Figura 4. Comparación de los tipos de clases



Fuente: Elaboración propia

It can be seen that the need for the teacher to be present as an authority is necessary, because otherwise there is no one who controls the group. In this research the individual application of the work was optimal due to the supervision of the investigators or the father of the family. In relation to learning, 10 groups with which this system was used and the face-to-face class were compared; the results were similar (see figure 5).

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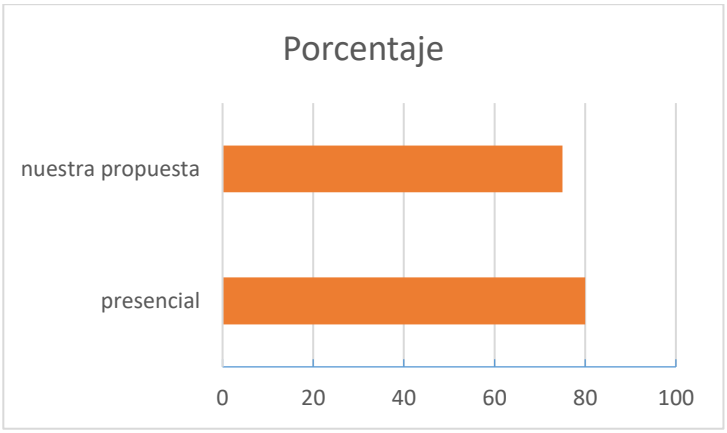
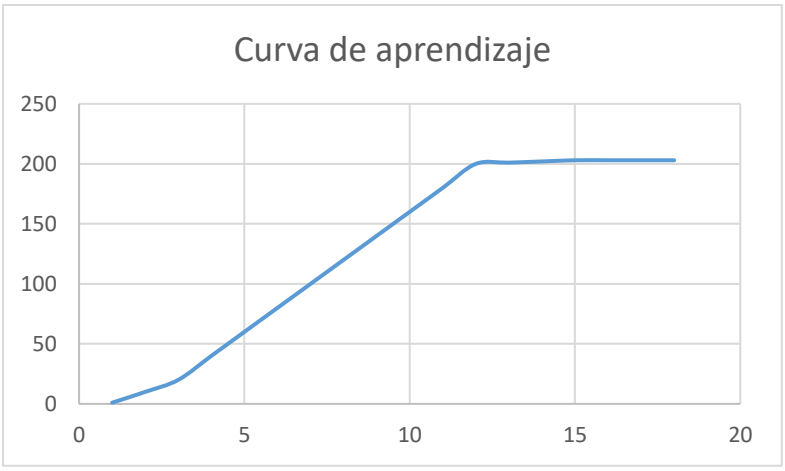
Figura 5. Comparación de las propuestas en aprendizaje



Fuente: elaboración propia

The results of the learning curve are shown in Figure 6.

Figura 6. Curva de aprendizaje



Fuente: elaboración propia

Conclusions

The relationship of growth and the link that technology has with education indicate a novel advance - and not a passing fad - that allows the implementation of other types of learning scenarios.

The MOOC courses also offer a wide variety of didactic possibilities to work with a large number of students. This, however, also produces a large number of dropouts, hence it is necessary to provide well-defined supervision.

Currently, different universities are offering online training through MOOCs, which has served as a viable and mature technology. In fact, the formation of MOOC courses can be combined with basic training subjects without problems.

Finally, it is necessary to make a deep pedagogical analysis of this type of strategies because these should not be focused solely on the use of technology. Likewise, the possibility that social networks become a means of indirect learning that helps to reduce the number of students who leave the courses should be studied, foreseeing that these, of course, can also distract them from the purpose of the course.

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