The role of connectivism in the teaching of future architects

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Abstract: Since the digital revolution with the introduction of new technologies that transformed the design and construction processes, the history of architecture entered a new stage. Technological change not only implies an adaptation in the management of new digital tools but also a transition within the academic field, thus, the technology applied to architecture has allowed to create, think and design a different architecture under a conceptual model of different physical space that allows the elaboration of dynamic images in a multidimensional environment by using digital tools. Therefore, the present essay aims to analyze the importance of the connectivism theory of learning in the area of architecture, since in the academic field of this area there is a dual and complementary training between theory and practice.

Resumen: Desde la revolución digital con la introducción de nuevas tecnologías que transformaron los procesos de diseño y construcción, la historia de la arquitectura entró en una nueva etapa. El cambio tecnológico no solo implica una adaptación en el manejo de nuevas herramientas digitales sino una transición dentro del ámbito académico, así, la tecnología aplicada a la arquitectura ha permitido crear, pensar y diseñar una arquitectura distinta bajo un modelo conceptual de espacio físico diferente que permite la elaboración de imágenes dinámicas en un entorno multidimensional mediante la utilización de herramientas digitales. Por ello, el presente ensayo tiene como finalidad analizar la importancia de la teoría conectivista del aprendizaje en el área de la arquitectura, pues en el ámbito académico de esta área existe una doble formación dual y complementaria entre la teoría y la práctica, entre el pensar y hacer arquitectónico.

Resumo: Desde a revolução digital com a introdução de novas tecnologias que transformaram os processos de design e construção, a história da arquitetura entrou numa nova fase. A mudança tecnológica não implica apenas uma adaptação na gestão de novas ferramentas digitais, mas também uma transição dentro do campo acadêmico, assim, a tecnologia aplicada à arquitetura tem permitido criar, pensar e projetar uma arquitetura diferente sob um modelo conceitual de espaço físico diferente que permite a elaboração de imagens dinâmicas em um ambiente multidimensional por meio do uso de ferramentas digitais. Portanto, o presente ensaio tem como objetivo analisar a importância da teoria conectivista da aprendizagem na área da arquitetura, visto que no campo acadêmico desta área existe uma formação dual dual e complementar entre teoria e prática, entre pensar e fazer arquitetura.

Keywords: connectivism, teaching, architecture.
Introduction

All the knowledge is in the connections
- David Rumelhart

Since the 1990s, the impact of the digital revolution in the field of architecture has increased, both technologically and pedagogically. However, the process of transition to the use of new technologies has not been easy. From the professionals to the schools of architecture, they had to adapt to the digital change, but at the beginning some showed some resistance. According to Gutiérrez, De Lama, Olmo and Sánchez-Laulhé (2012) "the spontaneous and massive appearance of computer material in some North American schools provoked a polarized reaction (...) for some, it was perhaps interpreted as technological intrusion rather than a gradual transition caused by improvements in representation tools". Technological change not
only implies an adaptation in the handling of new digital tools but also a transition within the academic environment.

Education in architecture, as in other areas, is changing with the emergence of connectivism, which has revolutionized the ways of learning and teaching. George Siemens' connectivism theory of learning points out that knowledge and the learning process take place inside and outside the individual. In this regard, Siemens (2004) states that "connectivism presents a model of learning that recognizes the tectonic shifts in society where learning is no longer an internal individualistic activity" (p.7). In this context, we can ask ourselves, what should be the role of connectivism in the teaching of future architects?

Understanding the role of connectivism requires understanding that the learning of the future architect is a process of connecting nodes or sources of specialized information, in which the teacher is a manager of criteria for the appropriate use of new technologies and that knowledge is achieved only through cooperation between these two actors: teacher and student.

Therefore, the purpose of this essay is to develop arguments on the importance of the connectivism theory of learning in architecture, since in the academic field of this area there is a double complementary training between theory and practice, between knowledge and the future architect's practice. To this end,
connectivism must be approached under a pedagogical model that allows learning environments that facilitate the production of knowledge.

The importance of connectivism in the learning process of future architects are numerous, but we can highlight three main ones: the network as an essential element for learning; the challenge of critical thinking in a connectivism environment; and knowledge and cooperative learning.

The network as an essential element in learning

Siemens (2004) considers that traditional learning theories have limitations because they do not explore the impact of technology on information flows because "a central tenet of most learning theories is that learning occurs within a person" (p.3). In that sense, Siemens (2004) states that:

Behaviorism, cognitivism, and constructivism are the three general learning theories most often used in the creation of educational environments. These theories, however, were developed at a time when learning was not affected by technology (p.1).

This is why, in a digital environment, Siemens puts forward an alternative learning theory he calls "Connectivism", which holds that learning occurs "outside" the individual:

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Learning (defined as actionable knowledge) may reside outside of us (within an organization or a database), it is focused on connecting sets of specialized information, and the connections that allow us to learn more are more important than our current state of knowing” (Siemens, 2004, p.5).

Although connectivism states that learning can take place outside the individual, it also considers the individual as a subject of learning but as part of networks. According to Siemens (2004) "a network can be defined simply as connections between entities. Networks (...) operate on the simple principle that individuals, groups, systems, nodes and entities can be connected to create an integrated whole" (p.5).

Thus, networks are constituted as a fundamental element for learning. For Downes (2007) "connectivism is the thesis that knowledge is distributed through a network of connections and, therefore, learning consists of the ability to build and traverse these networks”.

From the pedagogical point of view, it is considered that networks pose a new educational paradigm and its proposal in this sense is networked learning. In this regard, Downes (2007) argues that:
This implies a pedagogy that (a) seeks to describe "successful" networks (identified by their properties, which I have characterized as diversity, autonomy, openness, and connectedness) and (b) seeks to describe the practices that lead to such networks, both in the individual and in society (which I have characterized as modeling and demonstration (by a teacher) and practice and reflection (by a student).

Therefore, the essential idea of networked learning is based on the fact that knowledge, although it remains "inside" the individual, can occur "outside" in the collective through connections and networks. Thus, under a connectivism approach we can identify a new form of learning that should be transmitted in schools of architecture.
The challenge of critical thinking in the connectivism environment

According to Donald Schön, educator at the Massachusetts Institute of Technology (MIT) School of Architecture, the architecture student must develop a dual knowledge: "doing and thinking, expressed, on the one hand, in architectural design and, on the other hand, in the technical, scientific, historical, theoretical and critical foundation of architecture" (cited in Rodríguez, 2018, p.27). This disciplinary dichotomy of the future architect raises the importance of integrating ICT's in architecture schools with appropriate methodologies to develop critical thinking in the student.

The use of ICT's and new technologies based on design allow architecture students to achieve a higher level of scientific knowledge. As Gutiérrez et al (2012) state "scientific thinking never puts a brake on technological evolution and it would be risky to postulate, for or against, the exponential advance of digital tools, which follow a very accelerated evolutionary course that will be difficult to stop" (p.13).

However, it is not that architecture students are trained only in the use of digital graphic tools, because "the most widespread current methodology, part of the result to be achieved: being the main objective, graphing and printing information, teaching is based
on the training of commands that allow them to meet that goal. We could ask ourselves then: Are we training draftsmen or architects?" (Velandía, 2009, p.167). Rather, future architects should be trained in critical skills that allow them to explain the fundamentals of their projects and develop the ability to analyze and create plans and strategies that contribute to their improvement.

Understanding the role of connectivism in the teaching of architecture also requires understanding the importance of teaching support as a manager of criteria for the appropriate use of new technologies in an environment of networks and connections. According to Velandía (2009) "the academy then acts as an intermediary, training future architects to manage them, thus satisfying the needs of the market" (p.167).

In an increasingly digitalized environment, the architecture teacher must develop methodologies and pedagogical strategies to enhance student learning in new technologies, implementing learning networks materialized in projects of knowledge integration, research and practices that favor training to think critically. Under this system of integrated professorships and projects, integrative educational actions are established linking training ("thinking") and practice ("doing").

In summary, architecture educators must rethink the value of the contents of their programs and of networked learning in the
learning process of future architects, in order to transform this information into knowledge.

**Knowledge and cooperative learning**

The new connectivism learning theory is important for knowledge management, because through cooperative actions the learning of the future architect is enhanced. According to Sobrino (2015) "its advantage over conventional media lies in the cooperative management (editing, organization, and retrieval) of information, but this is a plus that can be exploited not so much by novice learners as by experts" (p.42).

Because of this, one must be fully convinced that the more architecture teaching is oriented to knowledge sharing, the more effective will be the use of networks in the student's learning process. In this regard, Pozo (2008) argues that:

The advantages of cooperative learning are complementary: the community favors the emergence of cognitive conflicts (...) And, at the same time, the same social learning network provides support, scaffolding, to resolve those same conflicts. This support is especially significant when it is given among peers, sometimes even superior to that which can be provided by the teacher" (quoted in Sobrino, 2015, p.44).
Connectivism environments are particularly conducive to cooperate by developing spontaneous learning through the integration of new knowledge. According to Guitert and Giménez (2000) "the information that is generated (...) should be shared among all members of the group, especially valuing suggestions that contribute new elements to the reflection" (p. 6).

Learning networks favor the development of competencies and skills related to cooperative activities, through interaction and interactivity. According to Sobrino (2015) "interactions involve
behaviors where individuals and groups influence each other. In contrast, interactivity emphasizes the characteristics of technologies. Both contribute to active learning but in different ways" (pp.43-44).

In this regard, in an experimental study conducted by the teacher Paola Rossado (2016) at the Faculty of Architecture of the Ricardo Palma University in Lima-Peru, to a group of 40 students belonging to the course "Architectural Expression V" of the fifth cycle of studies, to whom a teaching methodology of intra-group cooperation was applied, it was concluded that "applying cooperative work as a methodology, significant learning is generated in architecture students of the URP" (p.8).

Therefore, it is necessary to promote the design of virtual cooperative learning environments in architecture schools in order to transform information into knowledge.

**In conclusion**

The impact of new technologies in architecture has been felt
from architecture schools to professional practice.

The importance of connectivism to integrate ICT's and networked learning to architecture schools under appropriate methodologies that allow the development of critical thinking ("knowing") and the management of digital graphic tools ("doing") in the future architect, highlighting the importance of teacher support as a manager of criteria for an appropriate use of new technologies.

It should also be noted that connectivism promotes cooperative learning in networks oriented to sharing knowledge among peers and between the teacher and the student.

It is important to point out that resistance to technological change in architecture schools could lead to an inadequate use of new technologies, wasting the opportunity to optimize the teaching-learning processes of future architects.
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