

Constructivism and Connectivism in Education Technology: Active, Situated, Authentic, Experiential, and Anchored Learning

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Abstract

The main objectives of this theoretical paper are to produce a schema of some constructivist related learning theories and explore how they can be adequately used in education technology. After a brief introduction, constructivism is defined as a general educational philosophy, encompassing several different learning theories. The article then presents and discusses the following theories: situated cognition or learning, activity theory or active learning, experiential learning, anchored instruction and learning, and authentic learning. Connectivism or distributed learning is also discussed, positioned as a new and important theory of teaching and learning. These theories are then organized in a coherent way, classified under the constructivist philosophy of education, with the indication of the main similarities and differences among them. The text finally proposes further work on how these theories can be properly combined and used as frameworks for constructivist projects and activities in the field of education technology. The article is based on the research and review of peer-reviewed articles on constructivism, connectivism, the other mentioned theories, and education technology.

Keywords: constructivism, connectivism, learning, activity theory, situated cognition, authentic learning, experiential learning, anchored learning, education technology.

1. Introduction

The purpose of this article is to discuss how constructivist related theories of learning can be used in education technology.

As Dede (2008) states, web 2.0 causes a change from classical epistemology of education to a new epistemology, based on active learning pedagogies, constructivism, situated teaching, co-creation of knowledge, peer review, and new forms of assessment. Siemens (2008) argues that technological development and social software are significantly altering the way learners access information and knowledge, and dialogue with the instructor and each other.

In this article, specific theories are discussed: situated cognition, activity theory, experiential learning, anchored instruction, authentic learning, and connectivism. The article tries to organize these theories in a schema, under the constructivism umbrella, comparing and pointing common and unique features.

2. Constructivism

Constructivism can be seen as a major theory of learning, and in a broader sense as a philosophy of education, used as a general title to classify several theories. There is then a need to define what we mean by constructivism, in order to adequately found our work in education, and more specifically in the field of education technology.

Kanuka and Anderson (1999) try to organize a scheme of constructivist theories of learning, criticizing the systematic aspect of instructionism, which does not correspond to the way we learn. Educators should use the time to understand the real and actual interests of learners, and, based on this information, incorporate learning activities that have real relevance for each learner. Instructionism, on the other hand, distances us from critical thinking, with its proposal to follow models of instructional

systems design, though freeing us from confronting the complexity of the world where we have to act, which is problematic, ambiguous, and constantly changing.

Kanuka and Anderson (1999) also review the main constructivist theories that influenced learning mediated by technology, trying to organize them in two dimensions: understanding of reality as objective/subjective, and design of knowledge as a social/individual. The combination of these two continuum result in four types of constructivism: (1) Cognitive Constructivism, (2) Radical Constructivism, (3) Situated Constructivism, and (4) Co-Constructivism. Despite the differences among these four views, the authors argue that they share common beliefs, such as: learning is active, not passive; language is an important element in the learning process; and learning environments should be focused on the learner. The focus of education according to constructivism is not content but process, so educators need to know their learners in order to organize this process.

Tam (2000) relates constructivism, the construction of technology-supported learning environments, and the practice of distance education. Distance learning provides a unique context to infuse constructivist principles, where learners are expected to function as self-motivated, self-directed, interactive, and collaborative participants in their learning experiences. Tam explores how the combination of constructivism theory and education technology combine to transform distance learning from a highly industrialized mass production model to one that emphasizes subjective construction of knowledge and meaning derived from individual experiences.

3. Constructivist Theories

Several learning theories are usually classified as constructivists. This section presents and differentiates some of these theories many times used as synonyms:

situated cognition, activity theory, experiential learning, anchored instruction, and authentic learning. Connectivism is also presented as a new and important constructivist theory.

a. Situated Cognition

Situated cognition emphasizes the importance of context and interaction in the process of construction of knowledge. Jean Lave's *Cognition in Practice* (1988) is generally considered a founding reference for the theory.

Greeno (1989) argues that thinking is situated in physical and social contexts, so cognition (including thinking, knowing, and learning) should be considered a relation in a situation, rather than an activity in an individual's mind. Thinking involves individuals' constructive and cognitive interactions with objects and structures of situations, rather than simply processes and manipulation of symbols that occur in the minds of individuals, as many information-processing models propose. Knowing is a product of the students' individual and social intellectual activity, so teachers should create social settings to support this production.

Brown, Collins, and Duguid (1989) argue that knowledge, learning, and cognition are fundamentally situated in activity, context, culture, and situations. Knowledge indexes the situation in which it arises and in which it is used, and learning is a process of enculturation, supported in part through social interaction. Representations arising out of activity cannot easily be replaced by descriptions: problems do not come in textbooks, so learning methods should be embedded in authentic situations. As an alternative to conventional schooling practices, the authors propose 'cognitive apprenticeship', which tries to enculturate students into authentic practices through activity and social interaction, similar to craft apprenticeship.

Clancey (1994) argues that the world is not given as objective forms, pre-represented; on the contrary, what we perceive as properties and events is constructed in the context of activity. Representational forms are given meaning and constructed in a perceptual process, which involves interacting with the environment and creating information. The author studies how interpersonal and gestural-material processes change attention, what is perceived, and what is represented. Human memory is not a place where linguistic descriptions are stored, but they are created, given meaning, and influence behavior through interactions. In equating human knowledge with descriptions, we oversimplified the complex processes of coordinating perception and action, we objectified what is an interactive and subjective process. Clancey proposes a shift from the individualist point of view of linguistic models, which take what goes on inside the head of a person to be the locus of control, to interactions between people and between internal and external processes. Instructional design based on the constructive nature of learning should take into account these interpersonal and gestural-material aspects of perception. In this sense, situated cognition provides a new way of integrating instructional ideas.

Wilson and Myers (2000) explore situation cognition (SitCog) and learning. SitCog means not only concrete learning, but emphasizes the network of social systems and activity in which the authentic practice evolves. While the theory of symbolic processing focuses on neural mechanisms and symbolic representations of the mind, SitCog focuses on the structures of the world and how they determine and guide behavior. Knowledge, learning, and cognition are social constructions, expressed in actions of people interacting in the communities. The article remarks that the field of study is vast and varied, including both (1) social, cultural, and historical perspectives based on Vygotsky (as the anthropologists Jean Lave and Lucy Suchman), interested in

the cultural construction of meaning; and (2) cognitive scientists (as Allan Collins, John Seeley, Don Norman, and Bill Clancey), interested in cognition at the individual and social levels, based on theories of artificial intelligence, psychology, and linguistics. The general feature of situated cognition is the positioning of individual cognition in a broader physical and social context of interactions, tools, and culturally constructed meanings, as the construction of meaning is a social activity. Design should then be seen more in terms of interaction and less in terms of rational planning, and design theories should be chosen according to the learning situation.

A more theoretical approach is developed by Hung, Looi, and Koh (2004), in which they revisit the foundations of situated cognition relating it to the work of German philosopher Martin Heidegger and the interest in communities of practice.

b. Activity Theory

Activity theory emphasizes the importance of action, on the part of the learner, to support the learning process. Learning is considered an active construction process, inseparable from doing, not a passive reception of knowledge.

Jonassen (2000) explores the use of Activity Theory for the design of learner-centered learning environments. Activity Theory is defined as a philosophical framework, based on Kant and Hegel, Marx and Russians Vygotsky, Alexander Luria and Alexei Leont'ev. Activity and conscious learning are dynamically interrelated and cannot be separated. Therefore, it would be important to examine the activity systems (structures of activities in their sociocultural and sociohistorical) as part of the process of instructional design. These systems are composed of individuals, tools, objects, division of labor, community, and rules, all involved in mutual interactions. In the design process, though, the concepts, rules, and theories that are not associated with action have no meaning. There is no sense, therefore, to simply slice content or

decompose knowledge out of context, as proposed by many models of instructional design.

c. **Experiential Learning**

Experiential learning emphasizes the importance of experience in learning. Two works by Kolb (1984 and 1993) are usually mentioned as references for the concept. Hansen (2000) explores how the discursive and nondiscursive worlds blend in education, and how to balance factual and practical knowledge, adding experience as a central ingredient. As he concludes:

making experience a central element in school curriculum would mean that writing curriculum would change dramatically. Learning outcomes would likely be more difficult to articulate. Their achievement by students would be less controlled and less controllable. In the context of increasing teacher accountability, reducing teacher control on a system-wide basis could be a recipe for disorder if not chaos. On the other hand, interests outside of and inside the schooling infrastructure are calling for greater relevance in the curriculum and an experiential curriculum could be the answer. (p. 30)

d. **Anchored Learning**

For the Cognition and Technology Group at Vanderbilt (1990), who coined the expression, anchored learning is related to situated cognition, authentic learning, and experiential learning. The theoretical and empirical background of anchored instruction starts back with Whitehead's inert knowledge problem (*The Aims of Education and other essays*, 1929 – "knowledge that can usually be recalled when people are explicitly asked to but is not used spontaneously in problem solving even though it is relevant", p. 2) and Dewey's concept of knowledge as a tool (*How we think*, 1933).

Anchored instruction aims to overcome the problem of inert knowledge through immersion: as “novices have not been immersed in the phenomena being investigated, they are unable to experience the effects of the new information on their own noticing and understanding” (Cognition and Technology Group at Vanderbilt, p. 3). CTGV anchors instruction in complex problem solving environments, called macrocontexts, which enable the exploration of a problem for extended periods of time, from many perspectives, serving as environments for cooperative learning and teacher-directed mediation. Concepts that explore the relationships between anchored instruction and situated cognition include cognitive apprenticeship and authentic tasks (Brown, Collins, & Duguid, 1989), with the suggestion of transforming school instruction into apprenticeships. Anchors should provide opportunities for teacher-guided discovery. The Cognition and Technology Group at Vanderbilt (1993) revisited the concept. Other articles were later published, as well as a book (1997).

Young and Kulikowich (1992) define anchored instruction as teaching through situations. Several references about the benefits of teaching in a complex realistic context are presented: Whitehead’s *The Aims of education and other essays* (1929), Dewey’s *Experience and education* (1938), Lave’s *Cognition in practice* (1988), and, again, the concept of cognitive apprenticeship (Brown, Collins, & Duguid, 1989).

Situated cognition states that not only learning, but all thinking is situated (Clancey, 1994; Greeno, 1989). Situated learning is analyzed by the authors from an ecological perspective, and they develop the idea of anchored assessment, to assess situated learning. The ultimate goal of situated learning is defined as cross-situational transfer.

Shih, Shyu, and Chen (1997) evaluate transfer of learning in anchored instruction through knowledge abstraction strategies, in which knowledge is decontextualized from the learning situation.

e. Authentic Learning

Authentic learning emphasizes that learning contexts should be the most authentic as possible, to support transfer of knowledge from formal education to practice. The research, however, did not identify it as a separate theory, but as a general principle present in the other theories studied. As Maina (2004) states, authentic learning “involves increasing motivation and enthusiasm, helping learners to make decisions concerning their learning, as well as identifying non traditional ways learning is enhanced and accounting for such learning” (p. 7).

f. Connectivism

Although some authors argue that connectivism should not be considered a new theory of learning (Kerr, 2007; Kop & Hill, 2008), it is possible to position it as the development of constructivism to the current scenario of the use of technology in education, functioning though as a philosophy of education.

Siemens (2004) discusses the limitations of behaviorism, cognitivism, and constructivism as theories of learning, because they do not address learning that occurs outside of people (i.e. learning that is stored and manipulated by technology) and within organizations. Connectivism or distributed learning is proposed as a theory more adequate to the digital age, when action is needed without personal learning, using information outside of our primary knowledge. Learning theories should be adjusted in a time in which knowledge is no longer acquired in linear manner, technology performs many of the cognitive operations previously performed by learners (information storage and retrieval), and in many moments performance is needed in the absence of complete understanding. Learning is no longer a process that is entirely under the control of the individual, an internal, individualistic activity: it is also outside of ourselves, within

other people, an organization or a database, and these external connections, which potentiate what we can learn, are more important than our current state of knowing.

Cognition and learning are distributed not only among people, but also among artifacts, as we can offload some cognitive work to devices that are more efficient at performing tasks than humans. Bell and Winn (2000) explore not only how this happens naturally in learning, but also how it can be used as an instructional strategy, for designing distributed learning environments. In this direction, Siemens (2008) builds four metaphors for the educator: master artist, network administrator, concierge, and curator.

4. Conclusion and Further Work

Our theoretical journey explored the main aspects of theories generally classified as constructivists, and the main ideas they propose: (a) situated cognition (context and interaction are essential in learning), (b) activity theory (learning is an active construction), (c) experiential learning (experience should be used strategically in education), and (d) anchored instruction (education through immersion in authentic contexts). Authentic learning was not considered a theory, but a general feature of these other theories.

Although the article explored many uses of these theories in educational technology, further work is needed to determine if they can be coherently grouped as a specific set of constructivist theories, and if they can serve as a theoretical framework for educational technology projects and activities. Karagiorgi and Symeou (2005), for example, explore how constructivism supports instructional design, paying specific attention to authentic learning, active learning, situated cognition, and anchored instruction.

The article proposes that connectivism or distributed learning should be considered an updated version of constructivism, understood as a general philosophy of education for the digital age. In this sense, further work is necessary to determine if (and how) connectivism can function, as constructivism does, as a general title for theories such as situated cognition, activity theory, experiential learning, and anchored instruction, or if it does not encompass the main aspects of these theories.

Further work is also needed to explore the application of connectivism in education technology. Empirical research might be necessary to determine if distributed learning can be considered a theory of learning.

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