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## **Constructivist learning theories and complex learning environments**

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### **Abstract**

Learning theories broadly characterised as constructivist, agree on the importance to learning of the environment, but differ on what exactly it is that constitutes this importance. Accordingly, they also differ on the educational consequences to be drawn from the theoretical perspective. Cognitive constructivism focuses on the active role of the learner, and on real-life learning. Social-learning theories, comprising the socio-historical, socio-cultural theories as well as the situated-learning and community-of-practice approaches, emphasise learning as being a process within and a product of the social context. Critical-learning theory stresses that this social context is a man-made construction, which should be approached critically and transformed in order to create a better world. We propose to view these different approaches as contributions to our understanding of the learning-environment relationship, and their educational impact as questions to be addressed to educational contexts.

### **Introduction**

The concept 'constructivism' (or 'constructionism') is used in various ways and disciplines (Candy, 1991). The common denominator is the concept of learning as the construction of meaning, opposing a passive view of the learning process and an objectivistic view of knowledge. Constructivist learning theories differ in that their primary interest is the individual learner and/or the learning context, and in the conceptualization of the relations/connections/links between them. Also, constructivist theorists focus on different learning contexts: educational settings, the work environment, and the broader societal context. We will discuss the constructivist approaches to learning in cognitive, developmental and social psychology, as well as in critical-cultural pedagogy.

### **Cognitive constructivist theories**

Constructivist learning theories often focus on extra-curricular learning to make clear/to demonstrate that learning is more than, and different from traditional school learning (Bolhuis, 2000a; Resnick, 1987). Resnick stresses the context-bound, tool-oriented, social, and situation-specific characteristic of learning outside the school. The model she, and many others with her, prefer is the *cognitive apprenticeship* model. In earlier/former days, apprenticeship meant that, for instance, one learnt to become a tailor by working at a master-tailor's, most of the time with one or more fellow apprentices. Learning took place in a real-life context. The master-tailor assigned the tasks, at first rather simple, but gradually more difficult and complex. In the beginning, the pupils had limited responsibilities, but they gradually became

increasingly responsible for their own work. They learned by doing, by observing and imitating the expert, and by getting/receiving feedback from him as well as from their fellow pupils.

According to Resnick and others, we should develop the apprenticeship system for cognitive learning. Especially when wanting to teach our students how to learn, how to think, and how to solve problems, the principles of the old apprenticeship systems should be rehabilitated: cognitive apprenticeship. Resnick (1987) found the following program characteristics to be successful in the acquisition of school learning skills. They involve socially shared intellectual activities. Activities organised around the mutual accomplishment of tasks. Other elements of apprenticeship are: making usually hidden processes overt, subject to observation and commentary, and allowing skills to grow bit by bit, yet permitting participation of even the relatively unskilled. This is often enabled/achieved by the social sharing of tasks. Finally, the most successful programs are organised around particular bodies of knowledge rather than "general" abilities. Successful programs engage students in processes of meaning construction and interpretation, which has the effect of blocking the kind of symbol-detached-from-sense thinking that is a major problem in schools.

The model of cognitive apprenticeship has led to a revived pedagogical optimism: in the field of American instructional psychology, many researchers now believe that it is possible to improve such abilities as the self-regulation of learning, thinking, intelligence and problem solving. This optimism stems mainly from the remarkable results of training studies by Palincsar and Brown (1984) of reading comprehension, by Schoenfeld (1985) of mathematical reasoning, and by Scardamalia and Bereiter (1986) of writing processes. In these three studies and their later replications, durable/sustainable, generalizable, and transferable results of training programs were realised.

This success was built on combining apprenticeship principles with metacognitive support. Ann Brown was important in the development of *metacognitive theory*. Sometimes, 'metacognition' refers to knowledge about one's own and a third person's/of: and third persons' cognitive processes (e.g. Flavell, 1976). In other instances, the concept of metacognition is used in the sense of steering one's own cognitive processes (e.g. Brown, 1980). Though these two (knowledge and steering) might be closely related, in our opinion it is important to disentangle/separate the two (Lawson, 1984; Garner, 1988). When referring to the first meaning, we will use the term "*metacognitive knowledge*". This refers to the knowledge people have of their own (and other people's) cognitions. Examples are: knowing how one learns, knowing what one knows and what not, and knowing when and when not to apply a certain principle. For the second meaning, we will use the terms "*regulation* and *executive control*", referring to the active monitoring and control of ongoing cognitive processes. This involves actions such as planning, testing one's progress, monitoring the development of one's understanding, and predicting the results. Research on metacognitive knowledge and regulation (overview in Simons, 1994a) has shown that both have important roles to play in successful learning. In her later research, Ann Brown and many others focused on the best ways to teach metacognition (Simons, 1994b; Biemans, 1997; Schunk & Zimmerman, 1998; Bolhuis and Voeten, 2001).

Rand Spiro and his associates developed the so-called *cognitive flexibility theory* (Spiro, Feltovitch, Jacobson and Coulson, 1991). Flexible representations of knowledge are thought to be essential in

complex problem solving. In the beginning stages of new learning, knowledge is often connected to one kind of analogy, one kind of example, one kind of prior knowledge, and simple kinds of interpretations. This is done for good reasons, but can be disastrous to advanced learning and complex problem solving, when we need multiple analogies, multiple examples, and multiple interpretations. Various kinds of connections between old and new knowledge should be made, and, for this cognitive flexibility, an actively constructive role of the learner is a necessity. Advanced learning processes should be like discovering a landscape: sometimes like a tourist, sometimes like a pioneer. Learning is flexibly criss-crossing through the information based on one's own questions, interests, and activities. The learner should be repeatedly revisiting the same materials, at different times, in rearranged contexts, for different purposes, and from different perspectives.

Savery and Duffy (1995, p 32) summarized cognitive constructivism into eight principles:

1. Relate all specific learning activities to a larger task complex.
2. Support the student in gaining ownership of his learning objectives.
3. Design authentic tasks.
4. Design the task and the learning environment to reflect the complexity of the future work environment.
5. Give the student ownership of the learning process.
6. Design the learning environment to support and challenge the student's thinking.
7. Encourage the generation of alternative ideas, views, and contexts.
8. Support reflective thinking throughout the learning process.

Opmerking [L.C.1]: Citaat?

### Socio-historical, socio-cultural theories

A successor of Vygotsky's in the fifties and sixties was Gal'perin (Galperin) (Van Parreren en Carpay, 1980), who developed and tested the theory of stepwise interiorisation. The teaching procedure consisted of five steps. First, students are required to orientate themselves. They should form or get/obtain a complete picture of/they should visualize the activity in its final form: its objectives, the sub-steps involved, the transitions and transition-conditions, etc. One important assertion of Gal'perin's was that the orientation should always occur beforehand, that it should be complete, and that it is best to build an orientation base in a discovery-learning setting. The second step is that students should learn the material/physical, concrete forms of the activity (the 'material' level). Thirdly, they should learn to verbalise what they are doing when executing the material activity. Gradually, the material activity is abandoned, the verbalising is gradually diminished/reduced into a sub-vocal whispering. Finally, the mental level is reached when the whispering stage is abandoned.

Gal'perin postulated four independent parameters of mental activities: a) the level (concrete/material, verbal, mental); b) the extent/degree of shortening/abbreviation (from very extensive to very shortened); c) the degree of automaticity (from unsmooth/faltering/hesitating to fluent and automatic, and d) the generality (from specific to general). This means that one can practice at each of the three levels (concrete, verbal and mental) independently, both the shortening, the automaticity, and the generality.

Opmerking [L.C.2]: Goal = lange-termijn

Engeström (1999) is a recent Vygotskian from Finland, who studied innovative learning processes within industrial settings. He described four characteristics of ideal learning processes and outcomes. Ideally, learning outcomes are complete, holistic, multiply represented, practical and social. Learning outcomes are *complete* when learners reach outcomes that are integrated and functional in the sense that they can be used in practice, and in time. They are *holistic*, when learners reach organised knowledge with strong internal and external connections; when they have an overview of the whole. Learning outcomes that are *multiply represented* can be verbal, schematic, analogous, concrete, abstract, etc: they can take different representational forms. They are *practical* when they can be applied. Finally, they are *social* when they can be shared with other people; when one can explain to others what one knows. An important concept in this respect is the *community of practice*. Learning and thinking, in Engeström's view, is closely tied to the people using the results of learning and thinking in a similar way. It is the culture of use that determines the value of learning and thinking.

In Engeström's more recent approaches to learning, the concept of a working system is central. It consists of 6 components (see Figure 1): the subject who is working within the system, the tools he is using to change (mental) objects, the changed object / outcomes (to be) reached, the (unwritten) rules and norms that prevail in the system, the community of practice (the culture of the working system), and the division of tasks in the system. One of Engeström's basic assumptions is that learning and working should not be considered at the individual level, but at the level of the working system. These working systems are to be studied from an historical perspective, questioning which of the six components changed, creating what kinds of tensions with other components. He claims there are always one or two basic tensions between components of a working system, because of historical changes. When a subject is asked to reach new outcomes, for instance more collaboration with co-workers, there will be a tension between these new outcomes and the current division of tasks. When new tools (computer programs, for instance) are introduced, there can be a tension between the subject (who cannot yet use them or is afraid of using them) and the tools. All connection lines between the six components can be in a state of tension. In studying a working system, one should study the dominant tensions, make people aware of them, and let them find solutions on their own.

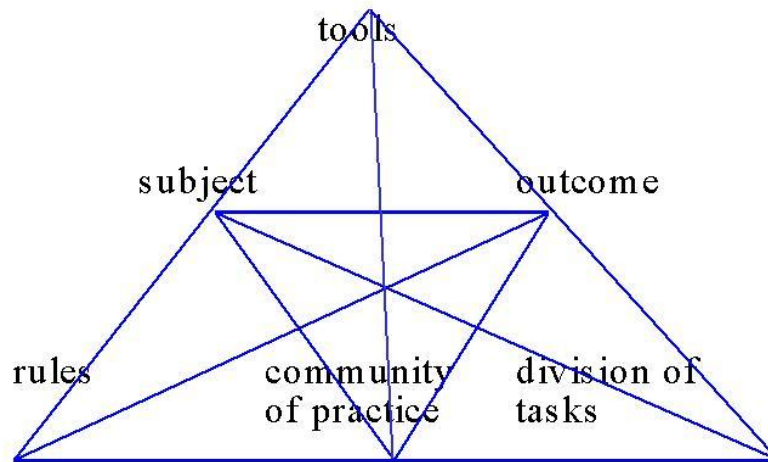


Figure 1: Engeström's triangle.

In a recent paper-presentation, Engeström (2000) claims that we need four kinds of changes in looking at learning.

From individual to collective learning: this change refers to the fundamental question how to expand individual learning to group and organisational learning.

From transmission to creation of knowledge, indicating the need to have more meaningful and active forms of learning oriented towards the creation of dynamic knowledge rather than the transmission of stable knowledge.

From horizontal to vertical learning: referring to the need to learn from and with people in other working systems, with different perspectives and from other hierarchical levels (clients, bosses, other disciplines, etc.).

From empirical to theoretical learning: oriented towards conceptual understanding, instead of taking in still more factual knowledge.

What can we learn from these cultural-historical theories? A first important point is that learning is based/rooted in a material/physical setting with 'hands-on' experience, action, and experimentation. Skipping the material basis leads to incomplete or inert learning results. Second, it is the social environment that challenges learning: parents, teachers, peers, colleagues, and managers. The learning environment and learning process are essentially social. Discussion, dialogue, and co-operation are important. Third, last but not least: it is possible to teach mental skills. Development of thinking and learning skills can become the goal of education when the coaches of learning try to find the zones of proximal development.

## Social learning theory

A third form of constructivism in learning stems from the work of Lave and Wenger (1991). We will call this '*social learning theory*' in order to distinguish it from the cultural-historical approaches. The most influential approach is that of the community of practice (Wenger, 1998). 'A community of practice is a group of people informally bound by a shared practice related to a set of problems [...] they typically solve problems, discuss insights, share information, talk about their lives, and ambitions, mentor and coach on each other, make plans for community activities, and develop tools and frameworks that become part of the common knowledge of the community. Over time, these mutual interactions and relationships build a shared body of knowledge and a sense of identity. (Wenger, 1999, p. 4).

According to Wenger (1999), people in organizations form communities of practice by helping each other out, and discussing the latest developments. Membership of these communities of practice is voluntary; the communities are not bound by organizational affiliations.

A community of practice has three dimensions:

- *What it is about:*  
its joint enterprise as understood and continually renegotiated by its members
- *How it functions:*  
mutual engagement binding members together into a social entity
- *What capability it has produced:*  
the shared repertoire of communal resources (routines, sensibilities, artefacts, vocabulary, styles, etc.) that members have developed over time.

Communities of practice provide homes for identities. Identity is important because, in the overflow of information, it helps us sort out what we pay attention to, what we participate in, and what we stay away from. If companies want to benefit from people's creativity, they must support communities of practice as a way of helping them develop their individual and collective identities.

Social learning theory is also applied in the field of education, e.g. by Scardamalia and Bereiter (1992). They try to develop knowledge building communities in schools using computer supported collaborative learning (CSCL) programs, with their supporting tools. Knowledge Forum is the tool they developed for this purpose (see Lipponen, 2001). Communities of learning together try to build knowledge, instead of taking in/absorbing information prepared by adults. Importantly, these communities are not tied to existing classrooms, but also expand outside of them: from the one classroom to another, from the one school to another (also internationally), and from schools to other institutions such as universities, museums, libraries, etc. Bereiter (in press) makes a distinction between two kinds of social learning: participation focusing on what Popper once called world 2 and world 3 knowledge. World 1 knowledge is the factual and conceptual knowledge. World 2 knowledge is the individual meaning construction, where people develop opinions and explore their views of

reality. World 3 is the world of implicit cultural knowledge that is shared between members of a community or culture. According to Bereiter, meaning construction is different in world 2 and 3, and different kinds of learning are required for these two. He uses the word “knowledge building” for the last category and defines this as creating, articulating, and building different kinds of conceptual artefacts in world 3. Knowledge building is a practice of working for the production of cultural knowledge typical of scientific research groups or other expert communities.

In our view, a distinction should be made between communities of practice and communities of learning. In communities of practice, work is the dominant focus (the foreground) and learning (though very important) is the background. The members have a common interest in (the results of) working. In a community of learning, however, learning is the primary focus, and working is the background. Here members focus on the common interest in the outcomes of learning.

What strikes us in the social learning theories is their focus on the identity of the learners in their communities of practice or communities of learning. In addition, also their focus on collective learning and the importance of cultural aspects are characteristic of the social learning approaches.

### **Critical learning theory**

The ‘godfather’ of critical learning theory is Paulo Freire, whose ideas about the relationships between learning and the social context were shaped by his literacy work with poor peasants in several South-American countries (Freire, 1971). He concluded that these peasants’ literacy was an impossibility without first breaking through/breaching the effects of having been socialised in a repressive socio-economic environment, nor was it possible without transforming this environment. His ‘pedagogy of the oppressed’ aimed at stimulating people to liberate themselves from the mental constraints of an oppressive socialisation, and become active in transforming their situation. Because of his focus on social and political change, Freire has always been considered controversial, but his work has also inspired many educators and liberation movements, and still does (McLaren, 1999). Emancipatory movements, such as women’s liberation, the gay movement, and ethnic minorities elaborated the critical learning theory to include oppression based on gender (Weiler, 1996), sexual orientation and ethnicity (Doyle, 1996; McLaren, 1999).

Five main features characterise critical learning theory.

1. An acknowledgement of the strong impact of the socio-cultural and economic environment on learning, and on the results of learning.
2. The environment is a socially constructed context, which needs critical examination and transformation, unravelling and changing unfair power relations and power mechanisms that dominate learning and other human activity.
3. Impeding learning effects of socialisation can and should be overcome by learning processes different from socialisation that are mostly described as raising consciousness (‘conscientização’). It implies making explicit and publicly available what was implicit before.



Freeing oneself of oppressive ideas and practices may seem naturally rewarding, but the learning process is also difficult and frightening, because it asks for letting go certainties about the world and one's role in it.

4. The critical theory stresses the close connection between thinking and practice, knowledge and acting. In Freire's view, there is no liberation without transforming practice ('praxis').

Individual and social learning are closely interwoven. Learning in socialisation, as well as the raising of critical consciousness and transforming practice, are not primarily an individual pursuit, but a collaborative process and action.

Lankshear and McLaren (1993, from McLaren, 1999) summarised six learning principles from Freire's work:

1. The world must be approached as something to be understood by the efforts of the learners themselves, grounded in their own experiences, needs, circumstances, and dreams.
2. The world must be approached as a historical and cultural world, being shaped by human deed in accordance with their views of reality.
3. Learners must learn how to actively connect their own lives with the making of reality that has occurred to date.
4. They must learn to consider the possibility of 'new makings' of reality, as a collective, shared, social enterprise.
5. In literacy projects, learners come to understand the potency of print for this shared project.
6. Learners come to understand how the myths of dominant discourses oppress and marginalise them, and how they can transcend these myths and change them.

Critical learning theory should not be interpreted as valid or valuable for the 'oppressed' only. The theory is not about a simple division between the good and the bad, the oppressed and the oppressors. Freire (1971) points out that the oppressed are themselves participating in the social reproduction of oppression, by conforming to the given meaning structures, and educating their children in the same way. Also, the 'oppressors' are unaware of the bias in their mental models of the world, and need to start critical learning, examining and changing their assumptions and practices, which means gaining an insight into the injustices in which they play a part, and acting upon this insight. In recent reflections on his earlier work, Freire (1988a; 1998b) urges educators to identify the premises within their own philosophies of teaching (Also Baumgartner, 2001).

Sociology of education contributed to the critical learning theory with the analyses of the so-called hidden or informal curriculum, showing convincingly how societal expectations and notions about gender, race and economic background of student groups permeate the school culture and the enactment of the formal curriculum. However, the analysis has become a-political, and integrated in educational psychology (e.g. McCaslin and Good, 1996), without reference to necessary changes in societal practice. This seems in accordance with the complaint that Freire's work has 'been domesticated and reduced to student-directed learning approaches, devoid of social critique' (McLaren, 1999).

A warning against the reduction of critical theory is applicable in two areas. First, organisation and management literature points out how organisations can profit from critical reflection or double-loop learning (Argyris and Schön, 1978; Bolhuis and Simons, 1999; Brooks, 1999). Critical reflection is regarded as a means to analyse the organisation's underlying assumptions and improve existing practices, and to stimulate the independence and creativity needed to create new value. However, the possible tensions between the interests of (different individuals and groups of) employees, employers and stakeholders are rarely discussed. Second, in the vocational education of today, 'reflectivity' seems to have grown into a valuable goal of its own, often without the adjective 'critical'. Although collaborative learning is lauded/praised, it is not practised very much. Reflection is directed to the prior knowledge (subjective theories, mental models) of the individual student in order to correct whatever misconceptions the student may have. Reflection may also be directed to improving learning from experience, by analysing what happened and bringing theoretical knowledge to bear on the experiences. However, the possibility of structural wrongs and inequities in the professional organisation and what to do about them is rarely discussed.

Although we do not expect revolutionary action or the speedy realisation of Utopia, we believe that the critical learning theory can be valuable in the discussion of learning within complex environments. We think that indeed all parties should be involved in critical reflection on premises, organisational goals and culture, differences in power and interests, and be conscious of the social construction of reality, the way it is reproduced, or could be altered in ways that are more desirable. Especially/In particular, professionals such as managers, teachers and physicians should be aware of their responsibilities in co-creating for themselves and others the complex environments of working and learning (Bolhuis, 2000b).

### **Consequences for research and practice of complex learning environments**

Elsewhere, Simons, van der Linden and Duffy (2000) summarized the existing new ideas about/on learning, mostly originating from (social) constructivism, in shifts towards more independent learning where the learner (co-)determines the objectives, strategies and ways of testing, and towards more experiential learning where learning is a mostly unconscious side-effect of working or problem solving. Table 1 summarizes the 12 tendencies related to it. Most of them can easily be related to the constructivist theories described above.

**Opmerking [L.C.3]:** korte termijn doelen

Table 1: Overview of 12 kinds of new learning processes and strategies originating from constructivism

Shift towards independent learning	Shift towards experiential learning
More active learning	More discovery oriented learning
More cumulative learning	More contextual learning
More constructive learning	More problem oriented learning
More goal-directed learning	More case based learning
More diagnostic learning	More social learning
More reflective learning	More intrinsically motivated learning

From these tendencies and other analyses, Simons (2001) derived six key questions for complex learning environments.

1. Are the intended outcomes of the complex learning arrangement durable, flexible, functional, meaningful, generalisable and application-oriented?
2. Are thinking, learning, collaboration and regulation skills being taught?
3. Is there a shift of focus towards more experiential learning: more active, cumulative, constructive, goal-directed, diagnostic and reflective learning?
4. Is there a shift of focus towards more independent learning: more discovery-oriented, contextual, problem-oriented, case-based, social and intrinsically motivated learning?
5. Is there conscious attention for the gradual increase of independence according to the sequence independent work, strategic learning and self-directed learning?
6. Is there modeling, external monitoring, scaffolding, meta-cognitive guidance, attention for self-evaluation, practice of skills, feedback, and reflection?

These questions relate very well to the constructivist theories described above, and present a good summary of the basic issues. We need, however, some additions when looking at the theories described above:

7. Is learning taking place in the context of either communities of practice or of communities of learning with an emphasis on individual and collective identities?
8. Are there attempts to create a culture of learning?
9. Does learning include the raising to a level of consciousness/awareness and critical examination of socialization effects and of the assumptions and power relations in the learning environment, and do all participants take part and have a responsibility in this process?
10. Is learning a social activity and firmly connected to practice, so that learning is not only the changing of concepts, but also the conscious transformation of the community of practice, in which all the participants take part and have a responsibility?

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