The view of knowledge and the new national curriculum in Norway*

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Abstract: This article highlights how the digital revolution, high technology density, digital confident students and the new educational reform necessitates other theoretical gateways in our contemporary school system. Today we find a consensus among policy-makers, researchers, teacher educators and teachers that competence aims and digital literacy must be given high priority and needs to be explored more deeply in our elementary school as a consequence of the implementation of a new national curriculum. Despite this consensus, ICT (Information and Communication Technology) in previous curricula have been marked by weak theoretical foundations, and therefore implementation of ICT has been more strongly anchored rhetorically than in teacher's theoretical ballast. Consequently, this article focuses on whether we now in the new educational reform, *the knowledge promotion*, are entering a time of upheaval within this area where the increased status of digital literacy and competence aims in the subjects necessitates new, or complementary theories which can capture some of these digital challenges. The article focuses on the "paradigm debate" within education and specially one theory, situated learning, is presented and analysed in light of other theories, educational policy documents and contemporary societal streams.

Key words: epistemology; situated learning; curriculum

1. Introduction

Teachers often are (maybe unconscious) designers of their own environments and situations which are relevant for learning, but this is frequently a *tacit knowledge* (Polanyi, 1967) where the theories they use are not made explicit. And we see, from a number of studies, that teachers have to see the added value of ICT if they are going to use it in their daily work (Lund, 2003; Kløvstad & Kristiansen, 2004a; Erstad, 2004; Krumsvik, 2006; Arnseth, Hatlevik, Kløvstad, Kristiansen & Ottestad, 2007). One can raise the question to what theories can contribute with, that common sense, didactical models or pedagogic experience not gives? The new national curriculum necessitates such question because of this curriculum increased focus on ICT and competence aims. Digital literacy has become the fifth basic competence in all subjects at all levels (1-13) and demands teachers to use ICT in all subject tied to the competence aims. This increased status of ICT is historically and both give new possibilities, challenges and dilemmas for teachers. Therefore, we can assume that since the former curriculum was implemented in 1997, we can say that the digital revolution has made huge impact in the Norwegian society and school, which demands a new debate around which kind of theoretical underpinnings pedagogy and didactic

* This article is supported by grants from the Norwegian Research Council.

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has to consider in the digitized school. Thus, both the Norwegian general teacher education as well as the teacher's professional development in elementary school can be considered more closely in the light of such change of course in the new educational reform and in society. The problem in this article is therefore: How can situated learning as a theoretical lens meet some of the demanding of the increased ICT-status and the focus on competence aims in the new curriculum?

A elementary school teacher in Norway has (until recently) been more a generalist than a specialist, often with a general teacher education, who frequently teaches in many subjects and has followed a curriculum based on a collection code (L97, MERCA, 1996), but who also at the same time highlights interdiciplinarities, project-work and adapted education. With the need to be so flexible and all-round, it seems that teachers make up their own *practice theory* (Dale, 1997, 2001; Handal & Lauvås, 2000; Imsen, 2000), *"back of head"*-model, *folk pedagogy* (Bruner, 1996) or pedagogical *credo*, based on eclectic theories, curriculum, school culture, methods and technological viewpoints. One can therefore often look beyond the narrow, rigid subject-didactic models, and "one-for all theory", to a broader pedagogic perspective for this type of teachers. They are often theory-eclectics and through their professional development, teachers might make their *tacit knowledge* (Polanyi, 1967) and implicit theories explicit, which vary from teacher to teacher and context to context. Koschmann's (1996) different technology paradigms are also relevant in the theoretical complexity teachers' are influenced by and he asks if the technology itself relies on certain theoretical assumptions. Therefore, instead of focusing on narrow didactic aspects in the traditional classrooms, this paper tries to capture the complexity in the teachers' daily, pedagogical practice and the theories they are influenced by. This will be handled in relation to the change of course the new curriculum represent in the Norwegian context and how the increased status of ICT and the outspoken competence aims necessitates new, or complementary theoretical lenses.

2. The view of knowledge

The view of knowledge that underpins the new national curriculum, the knowledge promotion, can be said to be hybrid between a collection code (with central point in constructivism) with stark focus on competence aims in the subjects and a integration code (with central point in the sociocultural approach) with high local, methodical freedom. In many ways the curriculum can be interpreted as paradoxical in this mismatch of knowledge views, but at the same time—this is what teachers has to deal with in this new educational reform. We can thus ask what kind of theoretical lenses which can be in line with this hybrid view of knowledge that underpins the new curriculum. To go beyond common sense solutions of this problem, in the following part I will examine the "paradigm-debate" within the educational field in light of the challenges that we are facing in the new educational reform in Norway.

The view of learning and knowledge has generally been associated with the dominance of different paradigms in different eras. This is also true for the sociogenetic tradition, Valsiner and van der Veer summarise its historical position as follows:

> The sociogenetic tradition in psychology and other social sciences has made an episodic appearance on the scene of the drama of science. At times (like our 1990s, or likewise a hundred years ago, in the 1890s), it was actively discussed. At other times, it was hushed up in favour of the dominance of the biologically deterministic perspectives. But it has returned (Valsiner & van der Veer, 2000, p. 3).

This return happened during the 1970s in Norway and has escalated through the 1980s and 1990s, leaving its mark [1] on, among other things, Norwegian curriculum's such as M74 (Grunnskolerådet, 1974), M87 (Grunnskolerådet, 1987) and (partly) L97 (KUF, 1996). In a way, we can talk about a paradigm shift in the view of knowledge and learning, but this has not occurred without tensions, differences, and debates. In their article *Cognition and Learning*, scientists James G. Greeno, Allan M. Collins and Lauren B. Resnick (1996) reviewed research greatly influencing the pedagogical practice in education. The review article uncovers three main perspectives that can be described as *empiricist*, *rationalist* and situative/*pragmatist-sociohistoric*. The first one is generally associated with behaviouristic models (e.g. Skinner), the second with the cognitive tradition of Piaget, and the third with Dewey and Mead on the pragmatic side and with Vygotsky on the sociohistorical side, with aspects of Lave and Wenger.

Early on, the educational researcher Jean Lave asked questions concerning the experimental design of the empiricist and rationalist traditions and said, "Confining theory testing or theory development to experiments is an excessive limitation on sources of knowledge, and grows out of a model which specifies that the goal of experimentation is to produce a literal reproduction of the target behaviour under study" (1980, p. 90). Thus, the context [2] has had great influence on the view of knowledge and learning within the situative/pragmatist-sociohistorical perspective, "… focus on the way knowledge is distributed in the world among individuals, the tools, artifacts, and books they use, and the communities and practice in which they are a part" (Greeno, et al., 1996, p. 20). Similar thoughts were already formulated by Vygotsky in the 1920s and he expressed, "Education is realized through the student's own experience, which is wholly determined by the environment, and the role of the teacher then reduces to directing and guiding the environment" (1997, p. 50). Vygotsky (1997) placed particular emphasis on the importance of experience and the social history that was mediated by tools.

If we look more closely at recent approaches that are shaped within this situative/pragmatist-sociohistorical tradition, it is worth bringing up *situated cognition* (SitCog), *situated action*, or *situated learning* (Suchman, 1993; Lave & Wenger, 1991; Wilson & Myers, 2000). These terms are sometimes used to endow related perspectives (similar to the sociocultural perspective). In this context, Greeno and Moore (1993, p. 49) express that the situativity theory can be described as:

> … the development of ecological psychology, … the ethnographic study of activity, … and philosophical situation theory … The central claim of situativity theory is that cognitive activities should be understood primarily as interactions between agents and physical systems and with other people .

During the last 15-20 years, several approaches have moved from a rationalist point of view (e.g., cognition, constructivism) to a social constructivist perspective by integrating social interaction (e.g., Pea, 1993; Salomon & Perkins, 1995). In this way, the mainstream psychology has approached the situative/pragmatic-sociohistoric perspective. Elen and Clarebout (1998, pp. 12-13) summarise the situative/pragmatic-sociohistoric perspective on

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[1] Folk Theory is the traditional, "commonsense"—comprehension of learning which can be understood as: "Under the influence of the mind-as-container metaphor, knowledge is treated as consisting of objects contained in individual minds, something like the contents of mental filing cabinets" (Bereiter, 2002, p. 179).

[2] Bereiter thinks we must move away from "commonsense"—understanding of learning towards the participation-metaphor and therefore claims that: "…everyday cognition makes more sense if we abandon the idea of a mind operating on stored mental content and replace it with the idea of a mind continually and automatically responding to the world and making sense of whatever befalls it. I call this the 'connectionist view of mind'" (Bereiter, 2002, p. 196).

learning in three main points that characterise this perspective:

(1) Learning is an activity;

(2) Learning is a constructive activity;

(3) Learning is a contextualised constructive activity.

A typical learning activity based on the situative/pragmatic-/sociohistorical perspective is an activity that is real and realistic where both experienced and inexperienced students participate, and where they help each other to construct new knowledge that is necessary for the situation. The "facilitator" can intervene, but should preferably allow the students to struggle with challenging tasks in such environments.

How, then, do situated theories on which this paper builds stand in relation to this? If we look at situated learning (Lave & Wenger, 1991), one can claim that this theory is anchored on the situative/pragmatist-sociohistoric perspective. However, Nardi (1996a) asserts some of this theoretical entry-point has characteristic of behaviourism (and the empiricists), because the subject's reaction to the environment and the situation generates an action. The mediating influences from objective, object and mental representations are toned down in the situated perspective and the subject's response to the situation becomes central. Learning means active participation in communities of practice, where knowledge is created *in situ*. We can also find other behaviouristic castings in the use of concepts since the informants are not given pseudonyms (which is common in ethnography), but are instead given impersonal designations such as *shopper* (Lave & Wenger, 1988) and *BP* (Baggage Planner, Suchmann & Trigg, 1991, cited in Nardi, 1996). Even if these behaviouristic castings are rather casual, it is interesting to recognise that Greeno and Moore (1993) mention that the situativity theory can best serve as an integrating framework: "We see, in the present situation, a prospect of completing a dialectical cycle, in which stimulus-response theory was a thesis, symbolic information-processing theory was its antithesis, and situativity theory will be their synthesis" (Greeno & Moore, 1993, p. 57). Wilson and Meyers (2000) support Greeno and Moore's view and argue that situated perspectives are well-suited for being an integrating framework. At the same time, they are aware of several camps which have an antipathy towards integrating such perspectives in situated perspectives. However, beyond this, the situated perspective rests safely on a situative/pragmatist-sociohistoric tradition by its strong focus on enculturation and learning in communities in interaction with other students and teachers. In many ways, this is in line with the large local, methodical freedom in the new national curriculum.

Against this backdrop, we should look more closely at the debate between the constructivists (and a more rationalistic view) and the situated learning perspective (connected to the situative/pragmatist-sociohistorical view). Greeno, et al (1996) summarise some positions about knowledge, learning and education, and supplement them with this classification: "The three general perspectives, the behaviourist/empiricist view, the cognitive/rationalist view, and the situative/pragmatist-sociohistorical view, frame each of these issues in distinctive and complementary ways" (Greeno, et al., 1996, p. 16). This review article simultaneously initiated a debate in the journal *Educational Researcher*, where Greeno's situated perspective was challenged by both psychological and educational perspectives (Anderson, et al., 1996; Anderson, et al., 1997; Cobb & Bowers, 1999; Greeno, 1997; Kirshner & Whitson, 1998). The main positions in the discussion can be described as cognitivists viewing the situated cognition theorists as unscientific and the situated cognition theorists regarding the research in classical psychology as invalid and culturally decontextualised (Wake & Williams, 2002). The cognition

theorists therefore consider the situated perspectives' implications for schooling as dangerous, and the situated theorists consider classical psychology's implications as "...narrow at the best, and inequitable at worst" (Wake & Williams, 2002, p. 2).

The problems that also were raised in the review article dealt with *acquisition of skills* (acquirement) versus *participation* (participation in a social practice), based on Anna Sfard's thoughts. The cognitivists Anderson, Reder and Simon (1996) have led this debate and criticised the view of Lave and Wenger (Lave, Smith & Butler, 1988; Lave & Wenger, 1991; Brown, Collins & Duguid, 1989) and others who have advocated the situated approach on learning. The debate can be labelled a "paradigm debate", where the *acquisition metaphor* (connected to the cognitive/rationalist perspective) stands in opposition to the *participation metaphor* (connected to the situated/pragmatist-sociohistorical perspective). The acquisition metaphor is generally associated with the traditional view (Folk Theory[3], Völkerpsychologie), with the brain as a container and learning as the process that will fill this container (Bereiter, 2002). Sfard asserts that: "As long as they investigated learning by focusing on the 'development of concepts' and on 'acquisition of knowledge', however, they implicitly agreed that this process can be conceptualised in terms of the acquisition metaphor" (1998, p. 6). In this way, both the research and the field of practice have "reproduced" an understanding of knowledge and learning predominant in school and education. But Sfard (1998) asserts that they can see a growing interest for how participation and context influence learning and "disturb" our established perception of what knowledge is, how it is being produced and acquired. The participation metaphor[4] raises this point and emphasises that learning is a process that deals with participation in different cultural practices and in various learning activities. In this view, the focus is more on the activity, for example, on knowing, and less on the concept of isolated knowledge, learning outcome, and the product (Sfard, 1998). While the acquisition metaphor stresses what the individual's memory has stored, the participation metaphor shifts focus to learning as the interaction between the individual and others. She continues: "Thus, talking about the 'stand-alone learner' and 'decontextualised learning' becomes as pointless as the attempts to define lungs and muscles without a reference to the living body within which they both exist and function" (Sfard, 1998, p. 6). Nevertheless, Sfard assesses that they need both metaphors because each of them has something to offer. She explains: "The basic tension between seemingly conflicting metaphors is our protection against theoretical excess, and is a source of power" (1998, p. 10). How, then, does situated theory place itself to these arguments?

The situated theory asserts that knowledge does not exist in its own world or merely in the head of the individual, but that it is divided and is a part of participation in a cultural practice (Brown, Collins & Duguid 1989; Lave, et al., 1988; Lave & Wenger, 1991). This position further state that cognition and knowledge are distributed between the individual and his/her environment. From Lave and Wengers' point of view, learning is thus not seen as the acquisition of knowledge by individuals but as a process of social participation, where the situation is in focus. This implies that: "…learning, as increasing participation in communities of practice concerns the whole person in the world" (Lave & Wenger, 1991, p. 49). Accordingly, they rely largely on the participation metaphor, and emphasise that learning is a social process that can be described as *legitimate*

[3] Ontological aspects: (a) the person is constructed, (b) in a social context, (c) formed through practical activity, (d) and formed in relationships of desire and recognition, (e) that can split the person, and (f) motivating the search for identity (Packer & Goicoechea, 2000, p. 228).

[4] This can be interpreted in the light of what Greeno (1993) affirmed that the situated theory can best serve as a part of an integrated framework.

peripheral participation (Lave & Wenger, 1991).

Based on this, it can be said that because the *participation metaphor* is (mostly) associated with situated theory, its emphasis on the setting, the environment, and the practice make it suitable for studying how technology becomes a part of the learning environment and how it becomes woven together with the context.

In a recent issue of *Educational Researcher*, Anderson, et al (2000) sum up a consensus of several areas in relation to the acquisition (cognitive perspective) versus participation (situative perspective) polarisation by taking on a more encompassing view of human behaviour:

> The difference between the perspectives involves different ways of focusing on learning activity, but both perspectives provide accounts of learning that can occur in groups and in solitary activity. Both perspectives provide important insights into the processes of effective performance and learning, and neither is limited to activity by groups or to individuals acting alone (Anderson, et al., 2000, p. 11).

They are affirming this in that: (1) Both individual and social perspectives on activity are fundamental in education; (2) Learning can be general and abstractions can be effective, but at times, they are not; (3) Situative and cognitive perspectives can shed light on important aspects of education; (4) Innovations within education must be evaluated and analysed by recognised research methods. With this backdrop, we see that the two perspectives have moved closer to each other also in relation to the polarisation between the acquisition and participation metaphor. However, the situative/pragmatist-sociohistorical is not precise in regard to the participation metaphor. According to Valsiner and van der Veer:

> …we can—by the way of some gross approximation—distinguish three directions. First, there exists a class of dialogical perspectives upon human psychological phenomena. These perspectives emphasize the notions of discrepancy, opposition, negotiation, and conflict as productive (rather than destructive or "abnormal") aspects of the theoretical constructions. Second, with partial overlap with the former, we can delineate perspectives that set human socially situated activity as the location where human sociality is displayed. Finally, we have a number of directions—again partially overlapping with the activity orientation—that emphasize symbolic construction by human minds as the locus for the social being of the person (2000, p. 389).

It is the second perspective, which is central in this paper and consequently will get most attention here. Due to the fact that this direction emphasises the social, the situated, and the contextual, it is connected to situated theory. This can be an important lens and analytical tool for studying how the school and teachers meet and integrate the technology in the new national curriculum and where *participation* is not only tied to being in the physical classrooms, but also participating in the digital classrooms (digital learning platforms). In this way we have to reconsider how "teachers teach and learners learn" in the digitized school and where formal and informal setting are increasingly blended.

3. The situated theory and epistemology

When discussing different theoretical perspectives, epistemology should be considered in all basic debates around knowledge and learning. As a continuation of the previously mentioned *Educational Researcher* debate (Anderson, et al., 2000), Packer and Goicoechea (2000) have looked at epistemological and ontological parts of sociocultural and constructivist perspectives on learning. They argue for advances in this field.

Concerning the sociocultural perspective, little has been done in this field which can be grounds for

confusion about which epistemic and ontological point of view this perspective stands for. An epistemic perception (and dilemma) is that knowledge, and not simply learning, is situated and localised in the surroundings and distributed between individual and artefact. Jean Lave can be considered as one of our times most important contributors to the criticism of traditional epistemological learning theories and perception of epistemology. Lave's theory about situated learning can be viewed as an effort to create an ontological learning theory, where leaning is "…a way of being in the social world, not a way of coming to know about it" (Hanks, 1991, p. 24). This is in contrast to both *Folk Theory* and the acquisition-metaphor, and forms the basis for ontological questions about whether the social reality is externally influencing the individual or whether it is a result of individual cognition. This is also about whether or not we take a "no-dualistic" ontological perspective. These are relatively complex phenomena. Valsiner and van der Veer assert in their review of the sociohistorical field: "What seems to emerge from the overview of our contemporary thought is the basic lack of intellectual breakthroughs, paired with a number of promising starting points that are not taken to their full potentials by the authors" (2000, p. 416). Here, Valsiner and van der Veer point out a "sore toe" within the sociocultural perspective, which indicates that the perspective struggles with some epistemological and ontological "infancy diseases". For school and education, this also means that if we really want to change this area, it cannot merely be done on the surface, but we must bring out the more fundamental aspects of such change processes. It is a widespread phenomenon that schools do not realise their good intentions, and therefore, for example, the project working method often becomes a hybrid between numbers of traditional methods and then loses much of its value and purpose. This gives call for more in depth theoretical considerations as part of teachers' professional development, and which can constitute a new course of valuing theoretical lenses in the new educational reform in Norway. The lack of theoretical underpinnings of both policy documents, in-service training and in teachers pedagogical credo, has given a situation that "cook book"-pedagogy has been dominating in the field of practise. Even if the picture is complex, we might ask if this is one of the reasons why Norwegian schools are performing badly over time on the international tests like PISA (Programme for International Student Assessment), TIMMS (Trends in International Mathematics and Science Study) and PIRLS (Progress in International Reading Literacy Study).

On a general basis, we can say that the sociocultural and constructivist perspectives (which have been the core actors in the referenced debate) have suffered under epistemological difficulties. In addition, the ontological sides of these perspectives have not been raised. According to Packer and Goicoechea (2000), this is due to the logical positivism's perceptions of the ontology as metaphysical, un-testable, and thus unscientific. In connection to this, we also see the emergence of the dichotomy between objectivism and relativism. Without going into discussing this any further, we can assert that relativism has implications for how we look at and perceive school subjects, but at the same time, we see that the ontological relativism does not harmonise with the sociocultural perspective in several areas.

We can also assert that the Cartesian dualism's perception of ontology was the opposite of what the sociocultural perspective represents. For example, the situated perspective asks the question of individualistic and Cartesian perceptions (and ontological aspects) about thinking and being. However, the problem with sociocultural theories in general is that these ontological assumptions are not expressed clearly, but are often implicit. Packer and Goicoechea assert that Lave's and Wenger's considerations are examples of this and that the identity concept of these must not be understood from a traditional psychological (and epistemological) point of

view, but from a sociocultural point of view. Lave (1992) says that "…learning, viewed as a socially situated activity, must be grounded in a social ontology that conceives of the person as an acting being, engaged in activity in the world" (Lave, 1992, cited in Packer & Goicoiechea, 2000, p. 229). They continue: "She proposed that 'central identity-generating activities take place' in the 'communities of practice' in which learners participate, and explains that 'learning is, in this purview, more basically a process of coming to be, of forging identities in activity in the world'" (Lave, 1992, cited in Packer & Goicoechea, 2000, p. 229). These are important (anti-dualistic) ontological considerations, which all too often are overlooked in discussions about sociocultural theories. On the basis of such problems, Packer and Goicoechea assert that it is necessary to reintroduce ontological questions within learning and development in order to be able to develop the area. Despite a certain amount of vagueness in the area, Packer and Goicoechea claim that they can identify six dimensions in the roots of sociocultural theories, which have (non-dualistic) ontological consequences. From these six dimensions, we can register that transformation of human identity, learning, and construction of knowledge take place through social practice, and that cultural foundations are central aspects that not only touch on epistemological questions, but also on ontological ones. These have (in many ways) become ground pillars in the digitized society and school, where formal and informal settings melt increasingly together.

What, then, are the differences (and the similarities) between the constructivist and the sociocultural perspective in relation to ontology? Even though socioculturalism and constructivism can agree in many ways about these six dimensions, it appears that the disagreement surfaces when this is going to be further expressed. Von Glasersfeld (1985) says that constructivists "…deliberately and consequently avoid saying anything about ontology, let alone making any ontological commitments" (Von Glaserfeld, 1985, cited in Packer & Goicoechea, 2000, p. 228). Conversely, the sociocultural perspective emphasises that learning, knowledge, and understanding are an integrated part of a broader ontological change that takes place in the participation of a community. Here, we can draw the parallel to Sfard's (1998) participation metaphor, which stands slightly in contrast to the constructivist acquisition metaphor. About this, Packer and Goiciechea (2000) express: "Our claim here, then, is that the constructivist perspective attends epistemological processes and structures that the sociocultural perspective is able to locate in an ontological process, and so trace their cultural and historical genesis" (p. 235). The sociocultural perspective also has more sides to it that can be questioned. However, both perspectives provide valuable insight and can in many ways be summarised in the following way: "What constructivists call learning is only part of a larger process of human change and transformation, the process called learning by socioculturalists" (Packer & Goicoechea, 2000, p. 238). We can thus recognise a certain distinction between these two perspectives, but how does the situated theory in this paper place itself concerning these issues?

4. Situated theory and its epistemological and ontological connection

Because I have chosen to highlight situated learning (communities of practice)—this draw a line for how the paper applies to the research problem. In the following, I will look more closely at the epistemology and the ontology in situated theory.

Lave and Wenger can be seen as representatives for the non-dualistic ontological theories. Their epistemological and ontological point of view in relation to situated learning has influenced the epistemology that has formed the basis of the cognitive theory and which, in many ways, has been associated with a propositional

understanding of knowledge. Based on the previously mentioned discussion (Anderson, et al., 2000), we can talk about a reconceptualisation of the concept of cognition and the understanding of educational practice in the classroom. For Lave and Wenger (1991), a situated perspective requires involvement and they claim that learning is "... an evolving, continuously renewed set of relations" (Lave & Wenger, 1991, p. 50). They also argue that to be enculturated in a community of practice, we must be involved in the practice and in the learning that takes place in the community in question. Thus, situated learning also has consequences for how we think about school and education, even though Lave and Wenger do not delve deeply formal schooling. However implicit in the concept is a criticism of the existing epistemological perceptions of knowledge and learning in the school (cf. the dichotomy of the practice field versus communities of practice in Krumsvik, 2005a). If schools develop according to the principles inherent in the notion of situated learning, they will become less scholastic and decontextualised and thereby challenge widely held beliefs about how we learn. They therefore rely on *procedural knowledge* and tone down *propositional knowledge*. For Lave, the social aspect of the learning process has come first, such that participation becomes the fundamental cornerstone in her thinking. As Lave expresses it, "cognition observed in everyday practice is distributed—stretched over, not divided among mind, activity and culturally organised settings" (1988, p. 1). In this way, ontology is a prerequisite for the epistemology and thereby breaks with traditional perceptions about cognition.

In many ways, the situated approach carries a potential that is a useful corrective for the established perspective within the cognitive tradition. Thus, both Lave (Lave, et al., 1988; Lave & Wenger 1991) and Suchmann (1987) make important contributions in areas where the cognitive tradition falls short. In many ways, Lave and Wenger touch on how we deal with everyday (contextual) situations where situated learning takes place. Levi-Strauss (Levi-Strauss, 1966, cited in Brown & Duguid, 1991) describes this as *bricolage*, for example, the ability to utilise all available resources in the situation in question. Based on this, we can understand that in situated learning, it is central that the learner learns in a social practice and by participation in a cultural context. Learning is thus an integrated part of a productive social practice in the world one lives in, and where legitimate, peripheral participation in a community of practice is essential. This legitimate participation indicates that one is brought in as a member of the community and moves (and is included) from peripheral participation (apprentice/novice) to central participation (insider, expert) through a process. The fundamental thought in the situated theory is consequently learning through participation in *real activities in real situations* in communities of practice (Lave & Wenger, 1991; Wenger, 1998). Vygotsky's ZPD (Zone of Proximal Development) is important in this situated theory and in contrast with (traditionally) learning as an internalisation: "...learning as increasing participation in communities of practice concerns the whole person acting in the world" (Lave & Wenger, 1991, p. 49). Lave and Wenger (1991) treat three interpretations of ZPD, which also have strong parallels with Rogoff's (1990) discussion around the application of the concept of *appropriation*. The third view which Lave and Wenger lean on dissolves the dichotomy between the external and internal, and also the affirmation that the learner should rather be seen in relation to a community of practice:

> … a third type of interpretation of the zone of proximal development takes a "collectivist", or "societal" perspective. Engeström defines the zone of proximal development as the distance between the everyday actions of individuals and the historically new form of the societal activity that can be generated as a solution to the double bind potentially embedded in … everyday actions (Lave & Wenger, 1991, p. 49).

They also see it as essential that individuals learn through participating in authentic activities that only slightly deal with instruction. Lave (1991) concentrates on the production aspect, for example as a core in the situated activity and of which the student is a part. Acquiring knowledge and skill in this theory involves that the individual's identity is changed through an activity and consequently a clear ontological dimension. About this, Wenger expresses that identity becomes "… a negotiated experience. We define who we are by the ways we experience ourselves through participation as well as by the ways we and others reify our selves" (Wenger, 1998, p. 149). He also says that because learning transforms that we are and what we can do, learning is an identity experience. This view of learning has moved Lave and Wenger (1991) to analyse different forms of apprenticeship systems. Lave and Wenger emphasise that in their example they do not use classical education in the classroom as a basis, but they see that learning through participation can contribute to school-settings.

Using such a theory on human activity and thinking as a basis, is both interesting and on the verge of becoming a commonly held notion. In this theory, however, we also meet several problematic sides: "… how is 'learning' to be distinguished from human activity as such? Within cognitive theories, it has been assumed that learning and development are distinctive processes, not to be confused with the more general category of human activity" (Lave, 1993, p. 12). Lave does not accept the earlier discussion and the classical division that cognitivist's often make (and which understands the individual as an analytical unit) between the learner and other human activity. Because learning is about change in and through activity, and because every decision that is made in an activity affects the activity as a whole, there is no natural boundary between learning and action (Lave, 1993). Nardi (1996) asserts that in situated learning, the object cannot be separated from anything else and consequently objective and object are *retrospective and reflexive* (Lave, 1988). The activity and the values are generated simultaneously and the object is regarded as merely *retrospective reconstructions*, *artefacts of reasoning about action* after action has taken place (Nardi, 1996). Thus, e.g., the activity theory's (Engeström, 1987) perception of the object as something established and operations and activity as something established, will be difficult in the situated theory because Lave (1991) asserts that the situated and every situation are unique. In the situated theory, objective and plans are thus first realised after action has taken place (Nardi, 1996a). However, even though we can agree with much of what Nardi mentions here, we can ask if the object still has a certain place: "Invisibility of mediating technologies is necessary for allowing focus on, and thus supporting visibility of, the subject matter. Conversely, visibility of the significance of the technology is necessary for allowing its unproblematic—invisible—use" (Lave & Wenger, 1991, p. 103). In this context, *subject matter* can be interpreted as the object of the activity and in order to see this, we must use a transparent technology that does not "disturb" the object. To use the artefact, then, we must also have access in general to the context in question and understand the object within the learning environment. Here, attention is focused on the (more abstract) concept of *affordance* (or visibility/invisibility, Lave & Wenger, 1991, pp. 102-103) in order to get a perception of the possibilities which the particular learning context is offering. Lave and Wenger use the analogy of a window you look through, where the window is invisible but the object outside is visible. So saying, this stands in a dialectic relationship, which has great importance for how the student perceives both the learning context and the artefacts. Nardi (1996a) nevertheless affirms that the concept of *situation* in particular is so unclear that it is difficult to operationalize this and give it a content unless we bring in object, intention, interest, and consciousness. Nardi (1996a) is mentioning an analogy that problem arises this, for example, is the situation where a research meteorologist, an ornithologist,

and an entomologist go on a hike together to study their respective areas. The situation is identical and their gazes are turned upwards to the sky, but the research objects are completely different because they want to study the weather, birds, and insects, respectively. This illustrates the problem with the situated perspective, where if we do not include the subject's object, we have problems evaluating what is really taking place in the *situation*. This is highly relevant to the new educational reforms that focus on competence aims, which clearly demand teachers to have a clear focus on learning aims- and outcome for the pupils. Therefore, the situated theory can give a little too glamorous picture of the situated of every situation as unique, without considering the learning aims (competence aims) in different educational settings. Nevertheless, Kaptelinen (1996) asks whether the aversion of situated learning to incorporate the subject's intentions can be seen as a reaction against the traditional cognitive theories on learning. It is possible that this is being drawn a little too far in this perspective, and that this places limitations on analyses based on such thinking. Kaptelinen asks whether it is not possible to incorporate the situated where the subject and the object have their place (Kaptelinen, 1996). In the new educational reform, we must consider this as quite necessary if we shall take the new national curriculum seriously.

How then does situated learning relates to ICT? Lave and Wenger are concerned with how the artefacts (such as ICT-artefacts) carry with their epistemic implications in relation to the concepts of *access* and *transparency*: "In focusing on the epistemological role of artefacts in the context of the social organisation of knowledge, this notion of transparency constitutes, as it were, the cultural organisation of access" (Lave & Wenger, 1991, p. 102). In this way, they move away from the perception of the artefacts as simply tools, and emphasise that the view on them has epistemological consequences. This can be seen in relation to another criticism that Nardi (1996a) directs against situated learning, where she thinks that it tones down the value of stable structures because the activity is situated and occurs there and then. This appears to be a legitimate criticism. In some areas, however, we can interpret this in different ways, because in several studies Lave touches on the value of "stable structures" as technological artefacts (Lave & Wenger, 1991, p. 101), which are central in the community of practice. Here, Lave and Wenger express: "The artifacts employed in ongoing practice, the technology of practice, provide a good arena in which to discuss the problem of access to understanding" (Lave & Wenger, 1991, p. 101). They also say: "… understanding the technology of practice is more than learning to use tools; it is a way to connect with the history of the practice and to participate more directly in its cultural life" (Lave & Wenger, 1991, p. 101). Lave and Wenger emphasise that such artefacts must be transparent so that the learner can understand how the artefact should be used in the context in question: "The black box can be opened, it can become a 'glass box'" (Lave & Wenger, 1991, p. 102). This indicates that the situated theory emphasises artefacts as (more or less) stable structures. And today's digital literate pupils find the technology transparent, so this give quite a new and interesting entry point to learning compared to the situation during the previous curriculum ten years ago (L97), where the technology was hard to handle for the majority of the pupils.

Learning in such situated contexts is therefore about mastering the activity satisfactorily. But how does this affect non-authentic contexts like traditional school learning? As concerns learning in non-authentic practices such as the school, analytical tools are needed to differentiate between learning and action in as much as education is traditionally about learning pure skills (cf. *Folk Theory* and the acquisition metaphor), and which Resnick describes as: "… what individuals can do without the external support of books and notes, calculators, or other complex instruments" (Resnick, 1987, p. 13). The situated theory's lack of an overall conceptual vocabulary and

by focusing on the situation makes it difficult to study such phenomena in practice. This is (as mentioned) based on the fact that it takes little consideration of the stable phenomena that we find in different situations and that they ignore the subject's different perceptions of the object. Bellamy (1996) emphasises that if we are going to achieve practical results by introducing technology in the classroom, we have to understand the object of both the situation and education. It is thus important to take account of the different subjects' understanding of the object when we are going to design such learning environments. In the situated theory in relation to technology, we can make a distinction between the results that arise in interaction with the artefact and those arise from and as a consequence of the interaction with the artefact. The first part of the distinction deals with how the artefact affects the possibilities that exist within the system, which the actors and the artefacts constitute. The system that the individual and the artefacts constitute together can hold possibilities to perform actions that can exceed the actions, which the individual can himself/herself perform. The second part of the distinction deals with the qualities the actors take with them from the situation, for example how the artefact, in a broad context, contributes to teaching the actors something that they should not have learned at all, or learned in another way without this artefact. Today's digitization of society and school in general as well as digital confident youngsters, give quite new possibilities in this regard in the new educational reform.

In summary, situated learning is thus most concerned with everyday activity or persons acting in a setting (Lave, 1988), where artefacts and values are implicit in the setting. In many ways, *common cultural heritage*, *reproduction cycle*, and *interdependent systems* as dawning conceptual concepts can stand as central in their thinking, and as more superior constituting communities of practice (Barab & Duffy, 2000). We can also look at the terms of *access*, *transparency,* and *affordance* as concepts in more specific community of practice settings and, in a way, together they also create a kind of analytical focus for the study of such settings. There are different opinions in regard to the value of the artefact concept (as a stable structure) in situated learning (Nardi, 1996), but as previously mentioned, Lave and Wenger has a number of observations about this. The relationship between the individual and the context is in focus, and this constitutes a setting that can be described as a relation between acting persons and the arenas in relation with which they act. By emphasising that which arises in these settings (*in situ*, something which is a central element in this study), we are therefore less concerned with studying more stable phenomena which we can find across settings and situations. A key aspect of this is that the situated theory only somewhat prepares for structured activities, but instead lets the activity grow out of the situation and the setting (Suchman, 1987). According to Suchmann and Lave, the rationale for this is that we have (e.g., in cognitive science, etc.) overestimated the value of problem-solving in series of objective, rational pre-specified means to ends (Lave, 1988), and work that has over-focused on the value of plans, etc. In this way, they have erred in treating the environment/context (and the ontological dimension) as an important part, and as creator of activity. We can summarise this by saying that the situated theory relies on the sociogenetic, the situative/pragmatist-sociohistorical, the participation metaphor, procedural knowledge, an anti-dualistic ontology, and an epistemology based on an expanded view of knowledge (*knowing* more than *know).*

5. Summary

When considering the new demanding in the new educational reform, one possible approach for setting out a wider view of knowledge is to consider Lave and Wenger's (1991) concept of situated learning in communities of

practice as “lenses” for both digital literacy and competence aims. Part of the reasons why their ideas are now being received with renewed enthusiasm is the way in which the digital revolution has acted as a catalyst for the spread of online communities and collective processes on a cultural, local, national and global level. We are also seeing a move away from cognitive psychology to more sociocultural perspectives on what constitutes learning in the new, virtual learning arenas (Barab & Duffy, 2000). The most common example of this is young people’s “online existence” and the digital world they inhabit with its chat forums and online communities such as MSN, MySpace, Facebook and Second Life. However, the learning platforms (LMS: Learning Management System) used in schools also sometimes pave the way for more collective processes in a new, digital class(room) which all upper secondary schools in Norway has implemented (and the majority of lower secondary schools as well). Individual work by pupils may be supplemented by an expanded form of knowledge formulation in such virtual learning arenas, which has similarities to situated learning. The most common example is pupils who communicate continuously via a number of open chat windows while working individually on their homework. Much of this is non-academic communication, but occasionally we also note that it is relevant to knowledge building. Knowledge formulation of this kind is to an increasing extent situated, i.e. “Learning relating to participation in various social relationships in everyday life rather than solely to the teacher-pupil relationship. Learning is connected with the development of a personal aptitude for taking part in various specific behavioural contexts in society in practice” (Lave & Wenger 2003, P. 231). This situated learning is therefore independent of time, space and place, which influences the underlying premises of schooling, pedagogy and subject. One educational implication of this for teachers is that core didactic concepts such as *what, why* and *how* must be supplemented by *who*, *where* and *when*. This is not without its problems and presupposes that the teacher recognises that many of these situated, collective processes bear the hallmarks of what we might term communities of practice. Whereas the concept of practice fields (Senge, 1994) operates with school and the “real world” as two distinct fields, the concept of communities of practice interweaves these fields and puts much greater emphasis on transcontextual, collective processes (Barab & Duffy, 2000). In many respects today’s digital field may be the “glue” which melt informal and formal settings together and makes communities of practice in a school context a more realistic prospect than before the digital revolution. In schools a broadly based approach to such communities of practice may represent a sort of collective erection of scaffolding around the pupil. This refers to Vygotsky’s (1934/1986) and Jerome Bruner’s (1996) use of “scaffolding” concept, often associated with teacher-pupil interaction. A collective erection of scaffolding goes further and is characterised by the fact that the participants (teachers, pupils, classmates, parents/guardians, siblings, etc.) are “novices” individually but “experts” collectively, contributing support, guidance, opinions and questions to such communities of practice.

Although the term communities of practice were not developed with a school context in mind, it is clear that the concept still has been relevant to the ways schools operate. This appears to have been reinforced further in the wake of the digital revolution whereby an increase in digital communities of practice and new learning spaces has injected new “energy” into collective behavioural patterns. But could this contribute to further development of situated learning as a theoretical lens and can this be reflected with regards to the new competence aims? There is good reason to be critical both of theory and of abstract terminology as frameworks for both situated learning and new competence aims. When I choose to use some of Lave and Wenger’s ideas as a guideline, it is because they can prompt teachers to reflect upon how the massive digitization of society and school can alter how we perceive

and assess knowledge building among “screenagers” in their on line existence where participation in several communities of practices is quite common. The problem, however, is that competence aims has its central point in the cognitivist approach (constructivism) with a mark of Blooms taxonomy, while situated learning in many regards stand for the quite opposite. From my point of viewing this mismatch can be solved with a more complementary entry point to the problem. First, if we consider situated learning as a useful theoretical lens that encapsulates the new digital terrain in school today, there is reason to establish this as a cornerstone in teachers’ professional development. Secondly, if we admit that there has to be an object in learning processes of today’s new millennium learners (Pedro, 2006), we can consider competence aims as the objects in the subjects’ learning processes. This has of course a central point within the cognitive approach and constructivism, but nevertheless it has its value in the digitized school. One main reason for this is that several Norwegian studies (e.g., Krumsvik 2006) find that in technology dense learning environments the learning aim often becomes diffuse and vague, partly because of teacher’s digital illiteracy. With a more narrow focus on the competence aims will help digital illiterate teachers to cope in technology dense classrooms and avoid the diffuse and vague learning focus based on digital literate pupil’s eagerness to e.g. show everyone their latest posting on Facebook or YouTube. These complementary aspects of situated learning and constructivism in the digitized school, seem to be a good solution for the average Norwegian teacher in the digitized school. These are still digital inconfident and thus the ICT-use must (the first years) be based on their premises and with a more narrow focus on subject content, more than on advanced ICT-use in subjects (e.g. utilizing blog, chat, second life, mobile phones, computer games, etc. in educational settings).

The problem posed by such a metaperspective on situated learning and competence aims is that the greatest difficulties faced by teachers occur when they try to put such well-meant visions into practice. This is often linked to the school culture and the willingness to change and could prove testing for teaching staff. It shows that local curriculum planning is difficult and a source of conflict, but still absolutely necessary if one really wants to make structural changes to the organisation in light of an increasingly digitalised school. I would therefore like to stress that teachers must examine specific structures such as assessment forms in a new light in relation to situated views of knowledge. This type of curriculum planning is both time-consuming and complex, but it is the implementation of those wide-reaching, structural changes that will eventually prevent this necessary and innovative work to be carried out parallel to, but not incorporated in, the everyday running of the school. And the new national curriculum gives a lot of local methodical (and theoretical) freedom to carry out such local curriculum work attached to local needs and conditions.

6. Implications

This paper has attempted to highlight some theoretical foundations which can contribute to the teachers’ professional development in light of the new educational reform in Norway, which highlight digital literacy and competence aims considerably. The problem in this article has been: How can situated learning as a theoretical lens meet some of the demanding of increased ICT-use and the focus on competence aims in the new curriculum? From a critical point of view one might ask how such situated theories can contribute to the teachers’ everyday practice and the major challenges in the new educational reform. This is a difficult area without any easy answers. Nevertheless, a possible solution is to see action research and teacher’s professional development together if the

aim is to utilise such theoretical contributions in school development-processes. The situated theory can be used to focus on everyday activities, where the community of practice-perspective might capture how the practice field is changing when implementing ICT in school, and how collective processes emerge and affect how knowledge and learning are considered. In this way we might capture how "learners learn" in the digitized society and school.

References:

Anderson, J. R., Reder, L. M. & Simon, H. A. (1996). Situated learning and education. *Educational Researcher*, *25*(4), 5-11.

Anderson, J. A., Reder, L. M. & Simon, H. A. (1997). Situative versus cognitive perspectives: Form versus substance. *Educational Researcher*, *26*(1), 18-21.

Anderson, J. R., Greeno, J. G., Reder, L. M. & Simon, H. A. (2000). Perspectives on learning, thinking and activity. *Educational Researcher, 29*(4), 11-14.

Arnseth, H. C, Hatlevik, O., Kløvstad, V., Kristiansen, T. & Ottestad, G. (2007). *ITU Monitor: Skolens digitale tilstand 2007* (ITU Monitor: The digital conditions in school 2007; in Norwegian). Oslo: Forsknings- og kompetansenettverk for IT i utdanning.

Barab, S. & Duffy, T. (2000). From practice field to communities of practice. In: D. Jonassen & S. Land. (Eds.). *Theoretical foundations of learning environments.* New York: Lawrence Erlbaum Associates Publishers, 25-55.

Bellamy, R. K. E. (1996). Designing educational technology. In: B. A. Nardi. (Ed.). *Context and consciousness. Activity theory and human-computer interaction.* Massachusetts: MIT Press, 123-146.

Bereiter, C. (2002). *Education and mind in the knowledge age*. New York: Lawrence Erlbaum Associates.

Brown, J. S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, *18*(1), 32-42.

Brown, J. & Duguid, P. (1991). Organizational learning and lommunities of lractice: Toward a unified view of working, learning, and innovation. *Organizational Science*, *2*(1), 40-57.

Bruner, J. (1996). *The culture of education.* Cambridge, Mass.: Harvard University Press.

Dale, E. L. (Ed.). (1997). *Etikk for pedagogisk profesjonalitet* (Ethics for pedagogical professionality; in Norwegian). Oslo: Gyldendal.

Elen, J. & Clarebout, G. (1998). Problem-based learning in technologically rich environments: The issue of teacher support. In: T. Chan, A. Collins & J. Lin. (Eds). Global education on the net. *Proceedings of the 6th International Conference on Computers in Education.* Bejing: China Higher Education Press & Heidelberg: Springer Verlag, 473-480.

Engeström, Y. (1987). *Learning by expanding.* Helsinki: Orienta-Konsultit.

Erstad, O. (2004a). På sporet av den digitale kompetanse (On the trail of digital competence; in Norwegian). In: H. Sigmundsson & F. Bolstad. (Eds.). *Læring. Grunnbok i Læring, Teknologi og Samfunn* (Learning. Basic book in learning, technology and society; in Norwegian). Oslo: Universitetsforlaget, 81-109.

Greeno, J. G. (1997). On claims that answer the wrong questions. *Educational Researcher*, *26*(1), 5-17.

Greeno, J. G. & Moore, J. L. (1993). Situativity and symbols: Response to Vera and Simon. *Cognitive Science*, *17*, 49-59.

Greeno, J. G., Collins, A. M. & Resnick, L. B. (1996). Cognition and learning. In: D. C. Berliner & R. C. Calfee. (Eds.). *Handbook of educational psychology*. New York: Macmillan, 15-46.

Grunnskolerådet (The National Council for Primary Education). (1974). *Mønsterplan for grunnskolen* (Curriculum for primary school; in Norwegian). Oslo: Aschehoug.

Grunnskolerådet (The National Council for Primary Education). (1987). *Mønsterplan for grunnskolen* (Curriculum for primary school; in Norwegian). Oslo: Aschehoug.

Handal, G. & Lauvås, P. (2000). *Veiledning og prakstisk yrkesteori* (Supervision and practical occupational theory; in Norwegian). Oslo: Cappelen.

Hanks, W. F. (1991). Foreword by William F. Hanks. In: J. Lave & E. Wenger. (Eds.). *Situated learning*. Cambridge University Press: Cambridge, 13-24.

Hegel, G. W. P. (1807/1977). *Phenomenology of spirit*. Oxford: Clarendon Press.

Imsen, G. (2000). *Lærerens verden* (The teacher's world; in Norwegian). Oslo: Tano Ashehoug.

Kaptelinen, V. (1996). Computer-mediated activity: Functional organs in social and developmental contexts? In: B. A. Nardi. (Ed.). *Context and consciousness: Activity theory and human-computer interaction*. Cambridge, MA: MIT Press, 45-68.

Kirke, Utdanning og Forskningsdepartementet (KUF) (Ministry of Education, Research and Church Affairs, MERCA). (1996). *Læreplanverket for den 10-årige grunnskolen* (The curriculum for the 10-year primary school; in Norwegian). Oslo: Nasjonalt Læremiddelsenter.

Kirshner, D. & Whitson, J. A. (1998). Obstacles to understanding cognition as situated. *Educational Researcher*, *27*(8), 22-28.

Kløvstad, V. & Kristiansen, T. (2004). *ITU Monitor: Skolens digitale tilstand 2003* (ITU Monitor: The schools' digital condition 2003; in Norwegian). Rapport 1/2004. Oslo: ITU.

Koschmann, T. (1996). Paradigm shifts and instructional technology: An introduction. In: T. Koschmann. (Ed.). *CSCL: Theory and practice of an emerging paradigm.* New Jersey: Lawrence Erlbaum Associates, Publishers, 1-23.

Krumsvik, R. (2005a). ICT and community of practise. *Scandinavian Journal of Educational Research*, *49*(1), 27-50.

Krumsvik, R. (2006). *ICT in the school. ICT-initiated school development in lower secondary school*. (Doctoral Doktoravhandling, Universitetet i Bergen).

Lave, J. (1980). What's special about experiments as contexts for thinking. *The Quarterly Newsletter of the Laboratory of Comparative Human Cognition*, *2*(4), 86-91.

Lave, J. (1988). *Cognition in practice: Mind mathematics, and culture in everyday life*. Cambridge: Cambridge University Press.

Lave, J. (1992). Learning as participation in communities of practice. *The Annual Meeting of the American Educational Research Association*, San Fransisco, CA.

Lave, J. (1993). The practice of learning. In: J. Lave & S. Chaiklin. (Eds.). *Understanding practice: Perspectives on activity and context*. Cambridge: University of Cambridge Press, 3-34.

Lave, J., Smith, S. & Butler, M. (1988). Problem solving as everyday practice. In: R. I. Charles & E. A. Silver. (Eds.). *The teaching and assessing of mathematical problem solving*. Reston, VA: National Council of Teachers of Mathematics, 61-81.

Lave, J. & Wenger, E. (1991). *Situated learning. Legitimate peripheral participation.* USA: Cambridge University Press.

Levi-Strauss. (1966). *The savage mind*. Chicago: Chicago University Press.

Lund, A. (2003). *The teacher as interface.* (Doctoral Dissertation, University of Oslo).

Marx, K. (1867/1977). *Capital, Volume 1*. New York: Random House.

Nardi, B. (1996a). Studying context: A comparison of activity theory, situated action models, and distributed cognition. In: B. Nardi. (Ed.). *Context and consciousness: Activity theory and human-computer interaction*. Cambridge, MA: MIT Press, 7-16.

Nardi, B. (1996b). Activity theory and human-computer interaction. In: B. Nardi. (Ed.). *Context and consciousness: Activity theory and human-computer interaction.* Cambridge: MIT Press, 69-102.

Nardi, B. & O Day, V. (1999). *Information ecologies: Using technology with heart.* The MIT Press: London, England.

Packer, M. J. & Goicoechea, J. (2000). Sociocultural and constructivist theories of learning: Ontology, not just epistemology. *Educational Psychologist*, *35*(4), 227-241.

Pedro, F. (2006). *The new millennium learners: Challenging our views on ICT and learning*. OECD-CERI. Paris. Retrieved April 20, 2008 from: http://www.oecd.org/dataoecd/1/1/38358359.pdf.

Polanyi, M. (1967). *The tacit dimension*. New York: Anchor Books.

Resnick, L. B. (1987). Learning in school and out. *Educational Researcher, 16*, 13-20.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context.* New York: Oxford University Press.

Sfard A. (1998). On two metaphors for learning and the danger of choosing just one. *Educational Researcher*, *27*(2), 4-13.

Suchmann, L. (1987). *Plans and situated actions*. Cambridge: Cambridge University Press.

Suchman, L. & Trigg, R. (1991). Understanding practice: Video as a medium for reflection andesign. In: J. Greenbaum & M. Kyng. (Eds.). *Design at work: Cooperative design of computer systems*. Hillsdale, NJ: Lawrence Erlbaum, 65-89.

Valsiner, J. & van der Veer, R. (2000). *The social mind*. New York: Cambridge University Press.

Von Glaserfeld, E. (1985). Reconstructing the concept of knowledge. *Archives de Psychologie*, *53*, 91-101.

Vygotsky, L. (1934/1986). *Thought and language* (Trans. A. Kozulin). Cambridge, MA: Harvard University Press.

Vygotsky, L. (1997). *Educational psychology*. Boca Raton, FL: St. Lucie Press.

Wenger, E. (1998). *Communities of practise: Learning, meaning and identity*. Cambridge: Cambridge University Press.

Wilson, B. G. & Myers, K. M. (2000). Situated cognition in theoretical and practical context. In: D. H. Jonassen & S. M.Land. (Eds.). *Theoretical foundations of learning environments*. New York: Lawrence Erlbaum, 57-88.

Williams, J. & Wake, G. (2002). Understanding workplace practice with college mathematics: A chain of signs mediated by metaphor, discourse genres and models, linking two semiotic practices. *AERA 2002, Maths at Work*. Retrieved March 20, 2005, from http://www.education.man.ac.uk/lta/conferences/aera2004/workplace.pdf.

(Edited by Lily and Lee)