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Chapter 3

Transformations Towards Mature Thinking – Challenges for Education and Learning

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Introduction

While the previous chapter examined the concept of human psychological development in general terms with historical background, this chapter focuses on transformations in adult cognitive development and especially in what can be described as epistemic understanding and dialectical thinking. Development of thinking has been a central focus in recent research in the field of cognitive development stemming from classical theories of children's thinking by Inhelder and Piaget (1958) and followed by various neo-Piagetians who extended the research field to include studies on adult thinking (Basseches, 1984; Baxter Magolda, 1999, 2001; Kuhn, Iordanou, Pease, & Wirkala, 2008; Kuhn & Weinstock, 2002). Studies of cognitive development during adulthood pose challenges to educational practices and the understanding of learning processes. The cognitive constructivist perspective on learning has emphasised that students' learning processes are influenced by their approaches to learning, their epistemological beliefs and their thinking skills, especially reflective thinking skills (e.g. Biggs, 1999; Phan, 2008).

One of the issues discussed in research on learning, development and human growth has been the rapid change in society and the mental demands that individuals face for their growth as adults through an ever changing future. Continuous change and the flow of information in different areas of life, external expectations and demands challenge the ways of thinking processes and the ability to manage complex reality. Leggett, Kinnear, Boyce and Bennett are among the researchers who have claimed that formal education should include the teaching of skills that prepare individuals to handle complex problems and situations across life-span, to exercise skills which transfer to differing situations, and to prepare for a future which is not known yet (Barnett, 2004; Leggett, Kinnear, Boyce, & Bennett, 2009). Other researchers have even suggested and constructed special learning programs which focus on nurturing

complex thinking skills in postmodern educational settings (Farrar & Suggs, 2010; Helsdingen, van den Bosch, van Gog, & van Merriënboer, 2010; Sinnott, 1998).

The purpose of the present chapter is firstly to describe and analyze some adult cognitive development models, and secondly to demonstrate how these models have educational implications. The term 'advanced form of cognition' or 'mature cognition' will be used here to refer to developmental models of adult thinking. Three models will be described: the first is based on work by Basseches, the second on Kuhn, and the third on Baxter Magolda's work. The first model focuses on certain points of change and transformation in thinking by describing these processes from the point of view of the model of dialectical thinking presented by Basseches (1984; 2005). In the field of adult cognitive development, dialectical thinking framework is often presented as a form of continuation of the idea of Piaget's formal operations. Dialectical thinking includes philosophical perspectives which include assumptions about the nature of existence (ontology) and knowledge (epistemology). According to Basseches (1984, p. 21) "These world-outlooks, while differing from each other in many respects, share a family resemblance based on three features – common emphases on change, on wholeness and on internal relations". The second model deals with the development of epistemological understanding and epistemic strategies will be discussed on the basis of the model presented by Kuhn et al. (2008). Recent research has also focused on the connection between epistemological beliefs and epistemic strategies and how these influence on how people learn to self-regulate their learning (Baxter Magolda, 1999, 2001; Bendixen, 2002; Hofer, 2001; Hofer & Pintrich, 2002; Kuhn & Weinstock, 2002; Linnenbrink & Pintrich, 2002; Richter & Schmid, 2010). The third model focuses on, Baxter Magolda's (1992) model of epistemic reflection and the development of self-authorship. It will be discussed as an example how epistemic understanding has been connected to mature self-regulation. Baxter Magolda's model focuses especially on how autonomy in knowing is developed. Together these elements constitute the framework of this chapter.

Question of Forms of Mature Thinking in Adulthood

The so called 'postformal thinking' has been the object of keen interest during the latest decades in psychological discussion. There are models, which have been critically discussed by Kramer (1983), Marchand (2001) and Kallio (in press). They seem not to accept this term in itself describing new developmental stage. In contrast, other researchers have claimed that

postformal thinking stage exists (eg. Commons, Galaz-Fontes, & Morse, 2006; Fair-Worthen, 2000; Felder & Brent, 2004; Fischer, Yan, & Stewart, 2003; Hoare, 2006; Hofer & Pintrich, 2002; Irwin, 2002; Labouvie-Vief, 2006; Merriam, 2004; Morton, Worthley, Testerman, & Mahoney, 2006; Sinnott, 2005).

The concept of postformal thinking has some interesting connections to the term 'postmodernism'. Kramer (1983) claimed that in postformal thinking, one has relativistic conception of knowledge: 'anything goes', and multiple viewpoints can be understood to be relatively right at the same time. Thus truth depends on factors which are open to debate and nobody knows if there is an ultimate and final truth. This includes possibility to accept multiple, even contradictory truths and claims. The 'big stories' which have defined our world view so far have been collapsed and there exists various truths in the postmodern world; it is difficult to state that any theory or model has ultimate truth status. One has to note, however, that a 'postformal thinker' does not stop in the midst of relativistic plurality, but tries to coordinate and synthesize the differences and make self-authored conclusion (Baxter Magolda, 1999, 2001).

According to Kramer (1983), there are two features included in mature thinking: (1) the realization of the relativistic, non-absolute nature of knowledge along with acceptance of contradiction (relativism), and (2) integration of contradiction into an overriding whole (dialecticism). It has been also claimed that both of these two thinking forms differentiate from the earlier, absolutistic form which is characteristic for 'premature' thinking. Absolutistic thinking is based on true-false -logic, in which only one possible alternative can be logically true. One important feature in defining the boundaries between these two thinking forms is the nature of problem which can be solved. Wood (1983) has demonstrated that it is possible to name at least two alternative problem structures: ill- and well-defined ones (or open- and closed system problems). Ill-defined problems have no clear and given solutions and the problem structure in itself is puzzling. Whereas, well-defined problems have a clearly-defined structure and one possible solution (as, for example, in formal reasoning problems according to Inhelder and Piaget, 1958).

The concept postformal thinking has been derived from Piaget's developmental theory. He had demonstrated (Inhelder & Piaget, 1958) that formal-causal (i.e. cause-effect) thinking develops in certain hierarchical order in human ontogenesis. The concept of postformal

thinking refers to a supposed higher stage of thinking after formal thinking. There is theoretical problem here, however. It is theoretically questionable if the phenomena described as formal thinking and postformal thinking essentially focus on the same component of thinking, namely on causal-logical reasoning, as well as closed, well-defined problems as Piaget's theory otherwise presents the theory originally (Kallio, in press; Kramer, 1983).

Moshman (2003) argues that in Piagetian theory, the qualitatively new transitions always mark a new developmental stage. According to Piaget's theory, the cognitive structures are general in nature and these structures transform understanding of the world and ways of reasoning. However, because development takes different forms and has different qualities during adulthood compared to childhood, it is therefore hard to evaluate achievements or progression in stage-like fashion (Moshman, 2003). Preferably, the domain or subcomponent of cognition under study should be isolated which characterizes the 'essence' of adult cognition. The major component of various models of adult cognitive development has been given as examples of integrative thinking (Kallio, in press). In integrative thinking, ill-defined, puzzling and fuzzy problems can be solved, as complex socio-emotional and almost irrational factors have to be taken into account in the thinking processes.

There are also other models which come very close to the neo-Piagetian models of postformal thinking already mentioned. For example, several models of epistemic understanding have been created (e.g. Hofer & Pintrich, 2002), as well as models of expertise (Merriam & Clark, 2006) and wisdom (Yang, 2008). All of them share common features, and, according to Kallio (in press) the major factor shared is the transformational integration of various elements to greater complexity (as integration of experience and knowledge, of different systems in thought, emotion and cognition, implicit and explicit knowledge). Though there are theoretical difficulties in postulating a new postformal stage of reasoning, the phenomenon itself deserves close attention as its' focus is on cognitive advancement in adulthood, which is a topic long time neglected in the scientific community. These models analyze and describe the richness of adult mature and advanced cognition.

Dialectical Thinking as a Form of Mature Thinking

The philosophical background of dialectical thinking is grounded in the dialectical ontologies which, although they differ in some parts, all emphasize change, wholeness and internal

relations. The dialectical thinking framework of adult cognitive development approaches the question of what exists by assuming that there are fundamental ongoing processes of change or of becoming in which old forms give room to new suitable forms (Basseches,1984). He describes dialectical thinking model to include world-outlooks of the processes and continuous change, where knowledge is seen as continuously evolving movement, which is influenced by contexts of knowing and placing knowledge in larger perspectives. Besides this philosophical perspective, dialectical thinking includes the approach to a dialectical analysis of knowledge, which can be used in various situations (Basseches, 2005). Dialectical epistemology emphasizes active processes of conceptually organizing and reorganizing phenomena rather than the acceptance of the accumulation of fixed truths. Dialectical epistemology also emphasizes conceptual systems and collective knowledge as wholes, rather than as individual mutually independent facts and ideas (Basseches, 1984). For this epistemological emphasis on active reorganization of knowledge, the basic description of forms that thinking takes can be separated from Piaget's notion of knowledge construction, although Basseches also admits that Piaget's theory has one kind of dialectical nature (Basseches, 1984).

Wholeness in dialectical thinking is emphasized in two ways: stressing the sense of coherence; and the ontological importance of structure. The assumption that there are no fixed truths leads to considering thinking process as a tool for evaluating the relationship between the parts and the totality of the object of thinking. (Basseches, 1984, 2005). The dialectical thinking perspective can be described as an intellectual tradition which represents a third alternative to two powerful styles of thought, which have exerted considerable influence on contemporary humanistic, scientific and social thought. Basseches (1984) describes these forms or styles of thought as: universalistic formal thinking; relativistic thinking; and discusses dialectical thinking as an alternative approach.

Universal formal thinking presupposes that there are fixed universal truths and that truth can be acquired in one formal way (as according to Piaget's formal reasoning model). In contrast to universalistic formal thinking, relativistic thinking assumes that there is not one universal order to things, rather that there are many orders. Knowledge is relativistic in nature and there are several ways of inquiry. Both Perry (1970) and Kramer (1983) have defined relativism as a plurality of points of view, interpretations, frames of reference, value systems and contingencies in which the structural properties of contexts and forms allow for various sorts

of analysis, comparison and evaluation in multiplicity. Dialectical thinking separates from these two ways in that while it assumes that knowledge is relativistic and changing, knowledge also is constructed in the process of inquiry (Basseches, 2005). Therefore dialectical thinking emphasizes the individual's own internal coordination of knowledge construction. The dialectical view of development has grown from the idea that both internal, maturational forces and more external, environmental effects must be simultaneously considered in the explanation of individual development (Stevens-Long & Commons, 1992). Dialectical thinking has its roots in the relativistic conception on knowledge and emphasizes interactive aspects and conception on knowledge. It is based on assumption that there is not only one universal truth. Therefore formal analyses of phenomena have restricted applicability (Basseches, 1984, 2005).

Basseches (1984) describes the nature of dialectical thinking:

1. it looks for and recognizes instances of dialectical developmental transformation occurring via constitutive and interactive relationships;

2. its roots are in a family of world outlooks in which knowledge and existence are viewed as essentially dialectical processes;

3. it draws attention to the limits of the context in which formal analyses are applicable;

4. as a result, dialectical analyses have a power to deal with relationships and transformations beyond the boundary conditions of a formal analysis, while still making use of the power of the formal analysis within those boundaries, and

5. dialectical approaches are more permeable than formalistic approaches by the perspectives of other people who may define a problem in fundamentally different ways (Basseches, 1984, p. 55).

When conflict or contradiction arises in dialectical thinking, there are different ways of approaching these situations. The dialectical thinker is aware of contradiction and conflict in the object of thinking and for that reason can use this knowledge in producing change and facing conflict (Dixon, 1990). In short, this form of cognition can be described as a way of orientation to changes in world, which can lead to describing it in appropriate terms. Orienting towards dialectic leads the thinker to describe changes as a thesis-antithesis-synthesis movement. The dialectical thinking framework consists of 24 cognitive schemas, or patterned movements in thought. Basseches (1984) argues that what makes thinking

dialectical is the total coordination of the different aspects of the 24 schemas tied together. Some of the schemas focus on the description of how to analyze phenomena dialectically, others describe ways of introducing such perspectives as existence and knowledge into processes of inquiry. Some of them describe ways to maintain dialectical movement within one's own thought (Basseches, 1984). Briefly, the schemas are named as motion-, form- and relationship-oriented- and meta-formal ones (Basseches, ibid.).

In summary, dialectical thinking can be considered as a form of mature and advanced thinking, which can be understood as a way of coordination of different logical operational thought systems in balance. It is achieved by continuous interactions between opposition of thesis and antithesis. Synthesis is achieved by integration of previously separated forms of organization into some new one (Basseches, 1984). At the same time, dialectical thinking can be understood as creative thinking whenever it includes new ways resolving problems. If dialectical thinking is seen as a goal of mature adult thinking, it is reasonable to ask how the educational contexts and institutions take into account this form of development. As regards the context of higher education, for example, Basseches (2005) argues that educational institutions should acknowledge and present students with multiple frames of reference and multiple justifiable coherent ways of interpreting facts based on diverging assumptions which can be contrasted. The educator or teacher directs students' attention to relativistic side of the world and trains students to recognize active and relativistic nature of knowledge interpretation.

Epistemology and Epistemic Change

As a developmental sphere epistemic development is connected tightly to other areas of human socio-cognitive development, especially to the development of mature thinking, and therefore research on epistemic development requires specific description and definition. In general, it can be described as a multidimensional research field, for it is interested in cognitive, motivational and social dimensions of epistemic understanding. When one asks about the origins of knowledge and processes of knowing the interest focuses on major questions in epistemological thinking. How to know, how knowledge is constructed and developed are the major questions in which research on epistemic understanding is interested. For example, Schommer-Aikins' (2004) extensive study discusses epistemological beliefs and belief system, Kuhn and Weinstock (2002) focus on scientific argumentation and -

thinking, and King and Kitchener (1994) construct models on the development of reflective thinking and judgment making. Much of research on epistemological thinking focuses on how individuals' underlying epistemological beliefs about knowledge and knowing are a part of the process of learning and how these beliefs mediate the knowledge construction process (Hofer, 2001). Many models suggests that epistemic development develops from a dualistic, objectivist view of knowledge to a more subjective, relativistic stance and ultimately to a contextual, constructivist perspective of knowing (Hofer & Pintrich, 2002; Perry, 1970).

Kuhn's Model of Epistemic Thinking

Kuhn, Cheney and Weinstock (2001) define three levels of knowledge construction, which are, essentially, quite close to the already mentioned classification of absolutistic, relativistic and dialectical thinking (Kramer, 1983) or to Basseches' ideas of different phases of dialectical thinking. Kuhn's model argues that in the absolutistic level, knowledge is considered as a fact as such, it can be known directly and there is no hesitation about its uncertainty. Usually the truth value is evaluated by opposites, that is, whether some knowledge is right or wrong, true or false. At this level knowledge is seen in objective terms, as coming from the external world and is knowable with certainty. At multiplist level person notices the conflicting nature of knowledge in assertions and locates the source of knowledge from a known object to knowing subject, therefore understanding the subjective nature of knowing. The world and the objects in it are not directly knowable, because there are different interpretations of the world. Knowledge is produced by individual minds and therefore knowing is subjective in nature. At the highest stage individual integrates the objective- and subjective knowledge together. Kuhn and Weistock (2002) describe this level of epistemological understanding as the evaluativist level. An evaluativist knower understands that while there are multiple ways of knowing and different opinions of the same thing, it is nevertheless possible to make some conclusions or synthesis by some claims, which have more merit than others. In science this means learning to use argumentation as a tool for understanding the nature of science (Kuhn et al., 2008).

To study the coordination of the subjective and objective nature of the knowing process and mechanisms of change Kuhn and Weinstock (2002) have formulated several short tasks and assessment instruments. Their core question is what develops in the attainment of mature epistemological understanding. However, to use this knowledge in practice requires concrete

judgment- and decision making situations where the thinking process is studied. Kuhn and Weinstock have also invented a task for studying complex problem solving and epistemological understanding by a developing measurement device for argumentation called Livia-task. It consists of two different stories of same fictitious event, the fifth Livian war, and the idea is that subjects have to evaluate what has happened in the war by using the evidence from the two contradictory stories. After reading the accounts, respondents are asked to summarize what the fifth Livian war was about and what happened. The conclusion is therefore based only on individuals own judgment procedure.

Baxter Magolda`s Epistemological Reflection Model and Self-Authorship

Baxter Magolda's (1999) concept of self-authorship has been influenced by the idea of the critical pedagogy that the aim of education is to train and educate people to empower oneself to overcome domination. The focus of this model is the relationship between belief in authority on knowing; and growing from that position to have one's own voice and learning to use that voice in different contexts. Self-authorship is defined as the process of becoming self-directed learner through lived experience in a learning situation. The process is enhanced by teacher-student dialogue and reflection together on the meaning of their experience and their knowledge (Shor, 1992). In this model several aspects of development are perceived simultaneously. Cognitive aspects of development are connected to interpersonal and intrapersonal aspects of development forming one's self-authorship. These themes are reflected in Baxter Magolda's (1992, 2001) epistemological reflection model. Baxter Magolda's model considers the development of self-authorship from the individual's perspective on epistemic development and also from the perspective of constructive-developmentalism. Constructive-developmental pedagogy incorporates two major concepts: a) that students construct knowledge by organizing and making meaning of their experiences and b) that it takes place in the context of their evolving assumptions about knowledge itself and their role in creating it (Baxter Magolda, 2001).

Baxter Magolda`s model has its origins in Piaget's premise of knowledge construction as well as on Perry`s scheme (1970) of college students' thought processes and their development from dualistic, absolutistic thinking to autonomous decision making. From interviews of college students' learning experiences and personal stories Baxter Magolda (1992) formulated categories of knowing, which present socially constructed patterns of

thinking. The assumption is that students' ways of knowing and approaching the world is constructed when they bring their initial assumptions in contact with their teachers and peers in various learning contexts. The levels of thinking are named: absolute, transitional, independent, and contextual knowing. Baxter Magolda (1992) argues that the ways of knowing have changing nature as situational and environmental issues may impact on reasoning patterns and these patterns may change over time. Even though the epistemological stance is highlighted, the importance of inter- and intrapersonal dimensions are connected to epistemic development.

Baxter Magolda's self-authorship model has an inherently placed assumption about how learner's epistemic understanding evolves. Students learn to deal with uncertainty of knowledge in various ways. The turning point for change in this comes with the realization that external knowledge may be uncertain and there is the possibility to form one's own judgment based on reasoning. Furthermore, the attitude about the uncertainty of knowledge influences the patterns of knowing. Baxter Magolda (1992) describes the role of the learner in the absolute knowing pattern as a receiver of knowledge from the instructor and he argues that this way holds the certainty of knowledge. In transitional knowing one sees understanding of knowledge as the main goal of learning; one understands that there is uncertainty in some knowledge, while some knowledge is certain. In independent knowing the focus shifts to creating one's own perspective on knowledge and sharing it with others. In the highest level, in contextual knowing one emphasizes the exchange of knowledge and problem-centered thinking. In these two latter patterns one has accepted the uncertain nature and subjectivity of knowledge.

According to Baxter Magolda (2001) worklife and other settings foster thinking independently and reliance on one's own judgments. The meaning of the organization of experiences is emphasized also in Kegan's (1994) argument about self-authorship, where the evolving natures of knowledge assumptions are central to learning. Kegan claims that in order to understand thinking, teachers should understand the way students are making meaning of their experiences.

Inter- and intra-personal dimensions of knowing and notification of interpersonal knowledge in decision making is also one element in self-authorship. These qualities of knowing or elements of knowing are important in developing mature, integrative thinking. The general

outcomes of education are defined as including qualities where mere knowledge acquisition and information collecting and critical position to knowledge are not enough. The positions which are seen as the goals of education demand a transformative aspect of learning. Reasoning and decision making are seen as influenced by life-events and the processes of decision making between learning contexts and other life areas. According to Hodge, Baxter Magolda and Haynes (2009), the ability to integrate different areas of knowledge, skills and taking social and personal responsibility during education are major goals in learning and forming self-authorship. They suggest that cognitive meaning making-structures influence learning, because an individual's earlier experiences influence the way one makes meaning out of new situations. These structures are used as long as there is no other understanding available, unless experiences are encountered that mould previous understandings.

Learning in Adulthood and Transitions

Adulthood as a life period has its own unique challenges and transitions which an individual goes through. Adulthood includes both changes and stable phases, which follow in different patterns throughout life. According to Levinson and Levinson (1996, p. 22) these periods of change and stability can be called a person`s life structure, *"the underlying pattern or design of a person`s life at any given time*." They can be described as tasks or goals that adult individuals have to fulfill at different periods during the course of human development (Wapner & Demick, 2003). Transitions can take different forms during adult life; they can be expected or unanticipated, nonevent, or "sleeper transitions". Anticipated transitions are life events that are expected to occur in most adults` lives such as finishing school and going to work, or getting married and forming a family (Merriam, 2005). Unexpected transitions do not occur at a typical time in adult life but are described as sudden situations. Unemployment in the middle of one's best work career and sudden widowhood are examples of these events. Nonevent transitions are periods of life that an individual had expected, but which did not occur. Sleeper transitions refer to gradual change and slow transitions which take place during long periods of time, and the individual notices these changes only afterwards (Schlossberg, 1989). One example may be the increase of self-confidence, which an individual realizes only when he or she notices that his or her role, relationships and routines have changed. Several transitions may occur simultaneously and transitions are not usually linear processes. Transitions in adulthood also vary in how people experience them. The processes are often multi-dimensional and connected to how individuals perceive and

construct themselves through their life-experiences and learning. In addition to external goals and fulfillments, adult life consists of the task of balanced movement (Sinnott, 2003), that is, the development towards a mature self-regulated behavior.

A typical element in adult learning theories is the emphasis on learning from or through experience (e.g. Jarvis, 1992; Kolb, 1984; Merriam, 2005; Merriam & Caffarella, 1999; Mezirow, 2000). However, the experience itself does not induce learning. What is important is personal reflection on one's experiences. For example, Schön (1983, 1987) highlights the significance of reflection-in-action and reflection-on-action for learning in professional practice. In the same vein, Kolb's (1984) experiential learning model presents reflection on experience as a basic element in the learning cycle, other elements being abstraction and experimentation. Mezirow's (1991, 2000) concept of transformative learning similarly involves the idea of critical reflection through which the learner becomes aware of his or her tacit assumptions and starts to question and challenge them in a process which finally leads to new meanings and new perspectives. The idea of reflection on one's beliefs and conceptions is also present in studies of school learning, although in this context the process has been conceptualised in terms of metacognition, metaconceptual awareness, or conceptual change (e.g. Vosniadou, 2008) instead of perspective transformation. The basic cognitive processes, though, are the same: critically analysing one's previous knowledge, conceptions and basic assumptions in the light of new approaches and insights, leading to the transformation f one's knowledge and thinking (Tynjälä & Häkkinen, 2005).

The second important point concerning adult learning, or learning in general, is that it is basically a social process. Wenger (1998) has described learning as identity development taking place through participation in communities of practice, that is, informal groups of people working with each other. In these communities common values, understandings and practices are formed, mediated and shared through social interaction.

A third typical feature of adult learning is problem orientation and the complexity of problems. For adult education, Revans (1982, 1985; see also Kramer, 2007) presents an action learning model, which is a process starting from questions raised by a problem, leading to a hypothesis, experiment, verification and review. In more informal learning settings, such as the workplace, problem-orientation comes naturally as the starting point of the learning process. Work-based learning is typically related to context specific problems, and shared

practice and experiences (Billet, 2004; Collin, 2008; Tynjälä, 2008). Everyday work related problems vary from well-defined problems requiring one correct solution to ill-structured problems (Wood, 1983) which involve more complex thinking and action processes and in which several alternative solutions may be possible. Especially ill-defined problems pose challenges to individuals' thinking patterns requiring higher order thinking in work situations. Ill-structured problems or multiple perspectives taking and other tasks of higher order complexity are evident in other areas of adult life which makes the role of mature thinking and consciousness essential for successful living. According to Sinnott (1998, 2003) advanced ("postformal") thinking is needed when an individual confronts complex life situations during adulthood. This kind of mature thinking requires the ability to coordinate several logical thought systems simultaneously, evaluate each of them, choose between them, and make adequate situation related judgments. Learning to think in this way is presumed to be connected overall to a more adaptive approach to life situations.

There have been suggestions about how to promote higher order thinking skills by incorporating ill-structured problems into curriculum. King & Kitchener's (1994) reflective judgment model is one example of this approach. Tynjälä and Kallio's (2009; Tynjälä, 2008, see also the chapter by Tynjälä & Gijbels in this volume) model of integrated pedagogy goes even further by suggesting that schooling should integrate different forms of knowledge. While typical thinking skills programs deal with theoretical and abstract knowledge, integrative pedagogy makes students use not only theoretical but also practical and self-regulative knowledge in problem solving - and fuse them. In this process the learners are involved in integrative thinking (Kallio, in press) the form of thinking that requires integration of different elements to form a new coherent whole. As applied to adult learning in general, and workplace learning in particular, the model of integrative pedagogy would mean developing what Boreham (2002) calls epistemic working practices in which people reflect on their work experience in the light of theoretical frameworks and concepts, thus deepening their understanding of their work and themselves as workers.

Conclusions

In this literature review, three frameworks of adult cognitive development have been presented and suggestions to learning and pedagogy have been proposed. It is important to see which kind of impact environmental and social changes have on individual development

and learning. There are obvious challenges to education: how to organize education in a way that it meets the complexity of reality in which prediction of the future has become more and more difficult. Learning and educational practices should take account the notion of adult development as multidimensional, complex, rich and integrated process. In all the perspectives presented in this chapter there is a common theme to understand the direction of development towards more integrated and personal ways of knowing in an increasingly complex world. This evolution includes in itself the transformational aspect, for to develop more integrated ways of knowing and learning, it demands constructing more coherent perspectives on knowledge and reality, using one's own experience as a platform for new knowledge and forming more suitable structures for growth.

Transformation of thinking as a goal of educational practices requires placing students own experiences at the center of teaching, and includes sharing knowledge and authority with students. To facilitate previously presented forms of dialectical and epistemic thinking and self-authorship of students, teachers need to acquire conceptions of teaching and learning that are multidimensional in nature: students' beliefs about knowledge, and how to know have to be integrated into the learning processes. We see the model of Integrative Pedagogy (e.g. Tynjälä, 2008; Tynjälä & Kallio, 2009, see also the chapter by Tynjälä & Gijbels in this volume) as a promising model to realize this idea. In learning environments built on the basis of this model, theoretical, practical, self-regulative and socio-cultural knowledge will be fused, which requires learners to practice integrative thinking.

As the three perspectives of adult cognitive development are evaluated one notices that they differ regarding what is considered as the focus of development. The dialectical thinking framework (Basseches, 1984, 2005) has connections to Piaget's theory in nomenclature: patterns of thought are named as schemas, which, however are emerging chronologically during adulthood. The model is also similar to Kuhn's (Kuhn & Weinstock, 2002) and Baxter Magolda's (1999, 2001) models in that development is seen to follow either stage- or phase-like route towards complex ways of thought. Thus, it is question of the longer tradition which springs from Perry's (1970) innovation of epistemic transitions in adult life – though at the same time, there is also an obvious contribution to Piaget in Basseches' model. It differs from the two other models in some ways, however. The description of the thought process is punctual, as various different schemas are used to analyse operations of thought. Basseches does not straightforwardly classify his model as one to describe epistemic development,

though it is clear that it focuses, at least implicitly, on knowledge-formation processes. Instead, Basseches uses a general term 'dialectical thinking', and not specify it to its' one component, epistemic understanding.

Kuhn's (Kuhn & Weinstock, 2002) epistemic development framework focuses on reasoning and argumentation is central in studying a person's intellectual abilities. It has also its roots in Perry's (1970) influential theory, with the idea of hierarchically structured levels of thought from belief of outer facts to mature evaluation of given information. Furthermore, the coordination of objective and subjective dimensions of knowing is important. The argumentative nature of human intellectual development is also emphasised. In Kuhn's model the ability to make reasoned arguments and defend them, finding evidence to support one's claims is an essential part of mature thinking skills. Baxter Magolda's (1999, 2001) model focuses on the development of epistemic understanding, as is the case with Kuhn. However, Baxter Magolda emphasizes the importance of autonomy and role of self in the knowledge-formation experience and reflection on it. The integration of various viewpoints, claims and assumptions is the highest form of thinking in all the models mentioned, but Baxter Magolda underlines the fact that integration is based one's own decision and is the result of intentional conclusions. As an individual develops towards autonomy more integrated and contextual ways of knowing emerge. Thus the focus between the models of Kuhn and Magolda has shifted from skills of argumentation to the importance of one's autonomy of decision. Also, an individual's own subjective experience is crucial to understanding their own internal goals and purposes. In sum, while these three perspectives and models of adult thinking differ in some points, they seem to share the same conception of mature intellectual capabilities. They all share the assumption that adult cognition is described best as a route or road which has three phases or steps. The first steps are contextually dependent, naïve realistic views of reality. These turn secondly to relativistic attitude, as one begins to understand multiplicity of viewpoints. The last phase or step is highly matured thinking, where contradictions are solved through autonomous opinion- and decision-making.

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