Teaching Expertise

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CHAPTER 9

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TEACHING EXPERTISE

Empirical findings on expert teachers and teacher development

1. RESEARCH ON THE NATURE OF EXPERTISE

Research on teacher expertise can be advocated from at least two frameworks. The first is the concern and dissatisfaction with the schools and quality of school education. Policy makers, particularly in the United States, have often complained about the quality of teacher education and called for changes in the training and certification of teachers (e.g. The Holmes Group, 1986; U.S. Department of Education, 2002). These statements have often been criticized by educational researchers, who argue that much of the criticism is politically motivated and is not supported by the research evidence (Berliner & Biddle, 1995; Darling-Hammond & Youngs, 2002). From this point of view it is important to understand, for instance, what kind of knowledge successful teachers have and how teacher education can promote the acquisition of this knowledge.

Another motive is the theoretical interest in the phenomenon of expertise. It is important to understand expertise to be able to promote its development in the work environments and further education.

In the following I will focus on the latter point of view. I start by reviewing empirical studies on expertise and particularly teacher expertise and summarize the results into a few propositions. My second purpose is to review research theorizing the phenomenon of teacher expertise. I will also discuss the future research on teacher expertise.

Although the focus in the chapter is in expertise it is important to notice that there are several other approaches to studying teacher knowledge (see e.g. Munby & al., 2001). For instance, Shulman (1986) has described experienced teachers' knowledge base by dividing it into several content categories and forms of knowing. That knowledge is represented in the mental structures of one's knowledge base. Bromme and Tillema (1995, p. 263) refer to the activity-oriented knowledge of practitioners as professional knowledge. This knowledge includes representations of theoretical rules and statements but also images, metaphors, and attitudes for

H. P. A. Boshuizen, R. Bromme, & H. Gruber (Eds.), Professional learning: Gaps and transitions on the way from novice to expert, 1-16.

successful practice. They also include teachers' beliefs and orientations into the professional knowledge base (Bromme & Tillema, 1995).

Different approaches to studying professional knowledge are needed for many reasons. One of those is that the domain areas differ. For instance, the most recent research on expertise has suggested that expertise between domain areas may differ in such amounts that even the research paradigms are hard to transfer from one area to another (e.g. Boshuizen & al., 1995, Bromme & Tillema, 1995).

Studies on expertise have made an important contribution to our thinking about professional knowledge and skills. The beginning of research on the nature of expertise can be traced to the 1960s, when de Groot (1966), among others, studied the playing skills of chess masters and their information processing during a game. Those studies proved that chess masters did not function as predicted, but rather used a high level of intuition. Computer programmes developed at the time, although designed to emulate the way people played chess, functioned quite differently. De Groot's studies (1978) showed that world class chess players accessed the best moves during their initial perception of the game board situation rather than searching for possible moves and analysing their consequences for the situation. It was later estimated that master level chess players have at least 100,000 different game situations in store and these can be recalled rapidly and intuitively in the game situation (Chase & Simon, 1973). According to these researchers the development of expertise requires more than ten years of experience and full-time practice.

Since the late 1960s and early 1970s, the nature of expertise has been studied in many professional fields. In addition to chess players, for example, physicists, radiologists, computer programmers (Chi, Glaser, & Farr, 1988) and social scientists (Voss, Greene, Post, & Penner, 1983) have been studied. The first studies were conducted in the domain areas that can be called knowledge-rich; rich referring, for instance, to well defined and developed theories in the domain area. According to these studies, novice physicists, for instance, who possessed the necessary knowledge to solve a physics problem, tried to solve it backwards from the question, whereas expert physicists retrieved a solution plan the other way round, as part of the normal comprehension process. Chi, Feltovich, and Glaser (1981) showed that the physics experts had more knowledge than the novices and that it was better organised in their memory. The experts could therefore represent the problems in terms of relevant physics theories, whereas the novices' representations were mainly based on salient surface features of the problems.

On the basis of the above studies and many others, it is possible to draw at least two conclusions on how research has approached expertise (Ericsson & Smith, 1991). First, research efforts have been focused on observing outstanding performance in relatively standardized conditions. In these studies, expertise has usually been defined as the ability to successfully execute problem-solving tasks related to one's professional field.

The second conclusion is that the theoretical concern of the studies has been with the analyses and descriptions of cognitive processes related to expert performance. One of the results of this approach has been the development of methods not only for measuring but also for eliciting expert knowledge and describing its structure and organization in specific domain areas (Cooke, 1994; Hoffman, 1992, 1995). In

many cases the processes studied are the same as those described in the theories of skill acquisition (Anderson, 1983, 1993).

The efforts of the first two decades in finding out the "secrets" of expertise have led to fairly clear conclusions on the nature of experts' knowledge bases. Experts seem to possess better-organized and more specific knowledge structures that they can access almost intuitively in the problem situations. Nevertheless, it is not clear what the mechanisms of the development of this knowledge are and how they are related, for instance, to the amount and quality of experience or the innate characteristics of a person. Typically experts show superior performance in the domain areas in which there are well-developed theories that support reasoning, such as medicine, physics, chess, bridge and so on (Ericsson & Lehmann, 1996). In the earlier expertise studies performance and the structure and content of one's knowledge base are shown to be closely related.

Experience has also been linked to expertise in several studies. For instance, Leprohan and Patel (1995) found that the number of years of experience correlates positively with nurses' performance in screening emergency calls for medical help. The amount of auditors' experience was found to relate poorly to the accuracy of their performance in the study by Bonner and Pennington (1991). Similar results were obtained in the studies by Rosson (1985) and Doane, Pellegrino, and Klatzky (1990). All these studies have shown that experts do not always demonstrate superior performance in the activities representing their domain area tasks. Sometimes the reason seems to be in the nature of expertise, which is highly specialized and restricted to a narrow domain area.

2. THE NATURE OF TEACHER EXPERTISE

In contrast to the domain areas described above, in which the problems given to subjects are often specific and isolated from the social or cultural context, teaching is very different. The effectiveness of individual performance can be relatively easily described in such domain areas as physics or chess, but the phenomenon seems to be different in the school classroom. Instead of being good at a specific and well-defined problem, expert teachers have to be performers in the problems situated in socially and culturally complex contexts.

The first problem is to find the expert teachers for the studies. One of the criteria that have been used is student learning in academic subjects. Expert teachers are those whose students perform well in the achievement tests. For instance, Leinhardt has used teachers' long-term success in their profession as a criterion for expertise, measuring success by the students' results in academic achievement tests (Leinhardt & Greeno, 1986).

However, there are problems in this kind of criterion because we do not know enough about the functions teachers have in student learning and in their test results. Teachers are supposed to make a difference in student learning, but this relation is not simple. Teaching as a domain field can be described as a knowledge-lean domain area because of the complexity of the instructional context and the lack of comprehensive theories explaining it. The theories of teaching and instruction are vague and the school context is too complex to be described with only those

theories. This all makes it difficult to explain how a teacher's expertise influences student achievement or to assume that the students whose achievements are excellent must have expert teachers.

However, teachers have important roles in organizing studying, directing the conversation and affecting the students' lives in many other ways in schools. Therefore, we may say that teacher expertise in such partly intuitive and artistic, partly learned interventions, can be assumed to make a difference in student learning (Gage, 1978).

If we adopt such a conception of the nature of teacher expertise, the perspective on teacher knowledge and performance becomes very complicated. Artistic and intuitive decisions may be based on knowledge, but their origins may be more in the situation. It is, therefore, important to approach teacher expertise from a more contextual point of view than in some other fields. One example of this kind of theorizing is the stage model first proposed by Dreyfus and Dreyfus (1986).

According to this the development of expertise proceeds in five stages: Novice, advanced beginner, competent performer, proficient performer, and expert (Dreyfus & Dreyfus, 1986). Berliner (1988) has described a novice, advanced beginner and a competent performer as rational and the proficient performer as intuitive in decision-making, for instance, in a problem situation. Berliner (1988) describes experts as irrational. Experts possess intuition with which they can create an overall representation of a situation. Their actions are flexible and fit the situation at hand. Experts seem to know what to do without necessarily being able to describe to an outsider the grounds for their action or how their thinking proceeds. Thinking seems to be rational in the sense that there is logic behind it. However, the rules of decision-making are hidden and intuitive, or tacit if we want, even for an expert himself/herself. A person is an expert because he or she seems to understand the requirements of the situation better and is able to fit his/her own decision, actions and interaction into the context.

A popular research strategy in describing expertise in domain fields similar to teaching has been to identify typical differences between the experts and novices. Those studies have produced a list of factors or characteristics that seem to differentiate expert teachers from novices. I summarize those results in the following six propositions.

2.1. Expertise develops in only a narrow field of knowledge and the knowledge base is tightly bound to a context

Expertise can only emerge after long experience. It has been estimated that chess masters have spent between 10,000 and 20,000 hours at the game, expert radiologists during their active career have studied about 100,000 X-rays and expert teachers have taught at least 10,000 contact hours, prior to which they have spent at least 15,000 hours in the classrooms as students (Berliner, 1990). Thus it does not seem possible for an individual to obtain thorough knowledge in many different areas. Expertise cannot be particularly wide-ranging, either.

Berliner (1990) describes the situation-specific nature of knowledge in a study in which a group of expert and novice teachers as well as beginners were asked to

teach a 30-minute unit to high-school students. The subjects were given half-an-hour to plan the contents of the unit, after which they taught the lesson. The lesson was videotaped and afterwards, while watching the video, the subjects were asked to describe what they had been thinking in the original situation. To the surprise of the researchers, the expert teachers were very emotional about the situation. None of the experts liked the task they had been given, though they seemed to possess the skills to handle the situation more effectively than the beginners or novices. One of the expert subjects dropped out of the study, one began to cry while watching the lesson, and all the rest expressed hostility towards the researchers. The reason for their hostility seemed to be that the experts did not feel they did well in a situation where they had been removed from their own class and from familiar situations. While they had been given 30 minutes to prepare, some wanted three hours or even a whole week to prepare the lesson. In addition, they were unhappy about not personally knowing the students in the class.

The studies on the nature of teacher knowledge show that teachers seem to develop situation-specific action patterns for classroom instruction. This may indicate that they have a related, situation specific knowledge base, too. I take two examples from the research findings. The first deals with teachers' questioning during the lessons and the second teachers' methods of scaffolding student learning.

Questioning has been studied extensively in the past. For instance, Evertson, Emmer, and Brophy (1980) have found that more successful teachers ask more questions. Their average number of questions during a successful mathematics period was 24 whereas less successful teachers asked only 8.5 questions per period on average. In a related study Ropo (1990a) found that experienced mathematics teachers asked 32.6 questions and less experienced student teachers 17.1 questions per period on average. For experienced teachers of English as a second language the average number of questions was 32.2 and for less experienced novice teachers 24.3 questions per period (Ropo, 1991). The number of questions seems to be systematically greater for experienced teachers in typical face-to-face instruction.

Scaffolding student learning is a metaphor derived from building construction (Wood, Bruner, & Ross, 1976). Scaffolds provide support, they extend the range of a worker and they allow the worker to accomplish tasks not otherwise possible. Palincsar and Brown (1984) applied this concept in their study of reciprocal teaching. The extent to which children need scaffolding seems to vary. Teachers also differ in the extent to which they provide scaffolds for their students. Ropo found that experienced mathematics teachers applied 8.2 scaffolds per period whereas novice teachers had only 4.3 scaffolds per period on average. There was also a qualitative difference between the scaffolds provided. Experienced math teachers divided the original questions into more simple partial questions more often than novices, if a student could not answer the question correctly. Experienced teachers also applied more a strategy in which a student was given a series of sub questions or specific questions that aimed at leading his/her thinking to the ideas or thoughts needed to answer the original question correctly (Ropo, 1990a).

Experienced teachers of English applied 6.9 scaffolds per period and novices 5.7 on average. This difference is not as large as that found in mathematics teaching. However, it is similar to mathematics teachers. One qualitative difference between the scaffolds of experienced and inexperienced teachers was found in the use of

examples. Experienced teachers gave examples 2.5 times per period whereas novices did not use this at all (Ropo, 1991). The samples in the above studies were small and the results cannot be generalized in a larger population. However, they indicate that expert teachers also differ from novice teachers in their teaching behaviour.

2.2. Experts have automatic ways of reacting to frequently recurring situations

Expertise studies have focused on describing the development of cognitive skills, particularly, subjects' automatic patterns or responses in specific task situations. Glaser (1987), for instance, notes that the quick and automatic comprehension of written text typical of skilful readers frees some of their working memory capacity for processing other aspects of the situation. This same phenomenon is well known in the area of motor skills. Processing capacity increases because the verbal mediation in the performance of a task disappears and the procedure becomes more and more automated and rapid (Anderson, 1985).

In teaching, the automatisation of instructional actions allows teachers to direct their attention elsewhere, thus enabling them to better manage the teaching period as a whole. One example of the automatisation of teachers' skills can be found in Leinhardt and Greeno's study (1986) in which they compared the ways experts and novices started a mathematics lesson in elementary school. The results showed that on average an expert teacher took about a third less time to start a lesson than a novice. Second, during the start of a lesson an expert was able to observe the activity of the students, find out who had done their homework, and assess who would need help later during the lesson. Third, as a result of the automatic routines that both they and their students had learned, experts maintained a fluid control of their classes.

In the same study novices' lessons could be described nearly the opposite. Novices were not in full control of the progress of the lessons. They had difficulties in getting the students to be attentive and in ascertaining who had done their homework. The questions novices asked about homework were not as clear as those of the experts, and this led the novices to judge the difficulty of the homework assignments incorrectly (Leinhardt & Greeno, 1986).

An interesting example assumed to be related to the level of automaticity was found in the language usage of experienced and novice history teachers. In a study of Finnish teachers of history it was found that experienced teachers did not use their native accent during the lessons but used the standard, written language expressions and accent while novices having the same background did not switch their language to standard usage during the history lessons. Both groups used their native accent during the interviews (Ropo, 1992). This result may be interpreted to show that the automaticity of the lesson routines allowed the experienced teachers to monitor their language while novices had to direct most of their information processing capacity to controlling the flow of instruction.

2.3. Compared to novices, experts are more sensitive to individual students in class situations and the characteristics of task situations

In the study of problem solving it has been found that experts are more able than novices to take into account the specific characteristics of a given context and the limitations inherent in a specific problem (Chi, Glaser, & Rees, 1982; Glaser, 1987). Housner and Griffey (1985) studied this issue by comparing experienced and novice physical education teachers. The subjects of the study were given the task of planning and implementing a relatively short teaching unit. In the planning stage, teachers in both groups asked similar numbers of questions concerning areas such as numbers of students, their age and gender distribution. However, the experts asked more questions than the novices about the abilities, experience and background of the students as well as about the features of the space and equipment available. Five of the eight experienced teachers even wanted to see the space they were to teach in before they started planning, while none of the novices asked to do so. Later when they were doing the teaching, the experienced teachers adapted their teaching according to the situation more than the novices, thereby deviating from their initial plans.

Another interesting difference between expert and novice teachers has been found in the teachers' knowledge of their students. For instance, Carter, Sabers, Cushing, Pinnegar, and Berliner (1987) compared expert, novice and postulant teachers' processing and use of information about their students in a simulation of taking over a class. Postulant teachers were people working in business or industry and having an interest in teaching. However, they had no formal teacher education. The study showed that expert teachers seemed to have deeper knowledge of the students and classroom problems than novices or postulants. Experts made richer analyses of the students' earlier experiences than the other groups. They also seemed to rely more on their own information gathering about the students than the two other groups (Carter et al., 1987).

In a related study I compared experienced (at least 10 years of experience) and novice (2-3 years of experience) elementary school teachers' knowledge of their own students (Ropo, 1990b). The teachers were asked to describe four randomly selected students from their class. The results showed that overall experienced teachers gave longer descriptions than novices. Experienced teachers' average protocols were 559 words per student compared to the novices' 414 word descriptions per student. Typically both groups described almost 30 different characteristics per student. Qualitative analyses showed that experienced teachers seemed to know more than novices about the past or current family events of their students. They also made more connections between the student's family background and his/her school behaviour or problems. Experienced teachers had more explanations for the origins or reasons for students' performance in different school subjects. However, the novices seemed to know more about the students' hobbies outside school than the experienced teachers. The experienced teachers discussed only the school-related hobbies whereas the novices listed at least three other hobbies for each student. There were also differences in the time span of describing students' performance or difficulties in the school. The time span was longer for experienced teachers who seemed to use the past as the basis for predicting the future success of the students at school.

The conclusion of the study was that both teacher groups seemed to acquire knowledge of their students. This acquisition seemed to follow two principles. The

first principle may be stated as "Collect and store information relevant in helping students to learn and adapt to life in school". The second principle was "Orient to individuality and individual features". The results indicated that experienced teachers seemed to be more advanced in applying those principles than novices (Ropo, 1990b).

2.4. Expert teachers are faster and more accurate in their observations than novices

This characteristic has been observed in studies of chess masters and experienced radiologists. The representations that experts make of the situation may not be judged as correct or incorrect. Even experts differ in their explanations or subjective theories of a specific situation. Rapid recognition and interpretation of situations is based on the quantity and quality of knowledge stored in one's memory. Another prerequisite for fast interpretation is that knowledge structures are organized in a way that enables rapid recognition without the need for extended processing. Rapid recognition of situations is useful, since it reduces the processing needed in various situations, thereby freeing an individual's processing capacity for measures required by the situation.

It has been found that expert teachers are typically quicker than novices at recognizing specific task situations and interpreting them. In instructional conversations experienced teachers typically follow the students' learning more carefully than novices and make focused efforts to correct misunderstandings with specific scaffolds (Ropo, 1990a, 1991). Experienced teachers also have more accurate plans for lessons and they even seem to be better at following the flow of time during a typical 50-minute period (Ropo, 1992).

2.5. Experts take longer to represent a problem to themselves, but they end up with a better representation of it

Results obtained by analysing problem-solving processes of physicists and social scientists have shown that experts spend more time forming a representation of a problem than novices (Chi et al., 1981; Voss et al., 1983). Hanninen (1983) observed similar differences in problem-solving between expert and novice teachers. In his study subjects were presented with a problem concerning the teaching of gifted students. Hanninen measured the time it took for the subjects to start writing the solution. The novices spent an average of 2.6 minutes whereas experienced expert teachers of gifted students took an average of 9.8 minutes before they began to write out their solutions. Experienced teachers of normal students took an average of 3 minutes to do the same task (Berliner, 1990). From these results we can deduce that a person's level of experience correlates with the amount of time it takes him/her to represent and solve a problem. The more an individual knows, the better s/he is able to take into account the complexity of a situation in his/her representation of the problem. With physicists and social scientists this was manifested through incorporating theory into problem-solving (Chi et al., 1981; Voss et al., 1983). With expert teachers solutions related to situations in classrooms included more lengthy

and thorough analyses of situational factors or more substantial and more logical arguments for the solutions selected.

2.6. Compared to novices expert teachers' knowledge is wider concerning the levels of abstraction and more hierarchically organized

Differences have been found in the ways experts and novices organize their knowledge. These results suggest that experts are able to organize their knowledge into more hierarchical levels than novices. In a study by Chi et al. (1981), for example, expert physicists represented a problem involving an inclined plane by including the basic laws of physics, which the novices (beginner physics students) did not mention at all in their representations of the problem. Voss et al. (1983) found similar differences of hierarchical representation in the ways social scientists formulated and solved problems.

In my own studies experienced teachers were found to categorize the instructional goals differently from novice student teachers. Experienced teachers grouped the objectives hierarchically making a difference between the school levels (e.g. elementary and middle school), grade levels (e.g. grade levels 7, 8 and 9), and the generality of the goals and objectives. For instance, one expert expressed her overall goal for mathematics education that she wants to show students how beautiful mathematics is. Expert teachers also divided the overall goal into more specific goals for each grade level. They also seemed to have individual goals and teaching objectives for particular students in their classes. Novices typically described their instructional goals at the level of individual lessons without having the same kind of hierarchies of objectives (Ropo, 1987).

3. A PROTOTYPE VIEW OF TEACHER EXPERTISE

The above propositions and the studies behind them indicate that expert and novice teachers' groups differ a lot. The studies have also shown that in addition to the differences between the groups there is variance within the groups (Ropo, 1990a, 1991). Experts are not similar in every respect and do not constitute a typical category in the traditional sense of the concept. However, experts seem to be similar in many respects. This kind of research evidence raises a question on the nature of expertise. Can it be described and defined by the above type of propositions based on the lists of differences or do we need different types of theories of expertise?

We have already described the so-called Dreyfus and Dreyfus (1986) model in theorizing the nature of expertise and its development. Sternberg and Horvath (1995) have also addressed the question of the nature of expertise and proposed a model that they call a prototype view. The purpose of this model is to explain the within group variance among experts. The prototype view serves as middle ground between a definitional and ad hoc description of teacher expertise. With the definitional description authors refer to conceptions in which expertise is defined restrictively in terms of certain characteristics (e.g. reflective practice, or the teacher as a researcher). The ad hoc fashion refers to the lists of characteristics differentiating experts and novices (Sternberg & Horvath, 1995).

In the prototypical view the main idea is to postulate a central or "prototypical" category member that serves as a summary representation of the category (Rosch, 1978; Sternberg & Horvath, 1995). According to this view members of a category may resemble the prototype member to differing extents in different features. If this were true, then two members of a category would not necessarily be similar in a given respect, even if they belong to a category because of overall similarity in other respects. The second aspect of the prototype view is the differential weighting of features in the computation of overall similarity to the prototype (Sternberg & Horvath, 1995). The third characteristic of the model is that the features making up the category may be correlated, which means that they may occur together in a category member at a level greater than chance.

Sternberg and Horvath (1995) use their model to sketch an outline of features important for a prototype expert teacher. They use the same literature base we have referred to in this article to identify the features that differentiate experts from novices. The first feature Sternberg and Horvath (1995) choose is knowledge. Experts bring more knowledge to problem situations and as a result solve them more effectively. The second feature is efficiency of problem-solving. Experts are faster and more efficient in their problem-solving than novices. The third feature is insight. This has been included in the prototype model because experts seem to be more likely to arrive at novel and appropriate solutions to problems within their domains than novices.

One implication of the prototype view is that it seems to respect the naturally fuzzy nature of expertise found in empirical studies. Experts are different from each other, although they are at the same time similar. One teacher may have wide knowledge of subject matter, another a lot of pedagogical knowledge on teaching of a subject matter, and a third is insightful about students. All may be categorized as expert teachers. Sternberg and Horvath (1995) argue that the prototype view broadens the picture of teacher expertise without making every experienced teacher an expert.

Another implication the authors mention for the model is that it makes it possible to describe an expert with a smaller set of features than other theorizations offer. Bereiter and Scardamalia (1993) give an example of this by saying that an expert can be defined as one who works on the leading edge of his or her knowledge and skill. This means that a real expert complicates even simple problems to the edge whereas a nonexpert seeks to reduce the problem to fit available methods into it (Sternberg & Horvath, 1995).

The last implication of the model refers to the perception of expertise in the social context. If we define teacher expertise as a broad and rather fuzzy prototype then this may enlarge the view people have about an expert teacher. In particular policy makers who may have a restricted picture of teacher expertise may find that the prototype model broadens their own view significantly. This may have implications for ways of evaluating teachers or for the recruitment and training of teachers.

Overall, Sternberg and Horvath have formulated an interesting proposition that helps in understanding the nature of teacher expertise. It is related to the earlier Dreyfus model in the fuzziness of the category of expert teacher. However,

Sternberg and Horvath take more detailed account of the later empirical research than the Dreyfus model.

4. DEVELOPING EXPERTISE IN NATURAL CONTEXTS

So far we have reviewed research focusing on the typical characteristics of expert teachers and the nature of the concept. We have found that there are experts and novices who differ from each other in many crucial ways. In addition to knowing this, it is also important to understand the processes of acquiring expertise.

The literature on the acquisition of expertise can be divided into at least three rather separate perspectives. First, the acquisition of expertise may be viewed from the standpoint of individual giftedness, intelligence, or exceptional abilities that develop through experience or interaction between heredity and experience with the environment. The second perspective is the so-called cognitive view that emphasizes the role of acquired knowledge (both declarative and procedural) in the process of developing expertise. The third framework in the current literature deals with the social theory of learning in which the acquisition of knowledge and expertise is typically seen as a kind of side effect of gaining membership of a social network.

The last two frameworks both emphasize the role of experience in the process of acquiring expertise. We may argue that one of the key issues in understanding the acquisition of expertise is to understand better the functions experience has in the process. Studies addressing expert performance in open and ill-defined tasks have shown that the nature of subjects' experience explains the performance better than the amount or length of experience (Sonnentag, 1995; Waltz, Elam, & Curtis, 1993). Bereiter and Scardamalia (1993) have suggested that the central determinant of high-level expertise is the subject's ability to surpass his or her previous level of knowledge and competence. Consequently, we may ask if the experts are those who have had qualitatively exceptional experiences or if their experiences and individual characteristics, such as giftedness, have interacted in an appropriate manner resulting in the development of expertise. I will discuss this notion in the following.

4.1. Expertise and giftedness

The concept of expertise has started to attract growing attention among researchers of intelligence and giftedness. For instance, Sternberg (2001) has made a proposition in his recent article that relates expertise and giftedness in an interesting way. He asks if giftedness could be seen as developing expertise. Sternberg's argument is that by the concept of developing expertise we can integrate two theories of giftedness –static and dynamic. The static conception states that intelligence is a relatively stable entity. Although certain kinds of intelligence areas may increase or decrease with age, rank orders remain fairly stable over time (Sternberg, 2001). An alternative, dynamic, view is that giftedness is to be found within a zone of proximal development. This means that it is an ability itself 'to advance from abilities that are ready to be developed to those that are developed' (Sternberg, 2001, p. 159).

From the expertise research point of view we may turn Sternberg's idea the other way round and ask if expertise could be conceptualised as developing giftedness. If

so, the abilities and giftedness underlying expertise would be seen as developing from novice level to full blown expertise. Expertise develops because of "the ongoing process of the acquisition and consolidation of a set of skills needed for a high level of mastery in one or more domains of life performance" (Sternberg, 2001, p. 160).

Sternberg's idea of the close relation between abilities and expertise is an interesting one. Although the existence of this kind of relation has not been denied, the discrepancy between the two research traditions has been a paradigmatic one. Typically expertise researchers have emphasized the role of knowledge in the acquisition of expertise and left such concepts as abilities and gifts to researchers interested in the nature of intelligence. Theorizing on giftedness and intelligence has most often emphasized the static view of human performance in which the more or less inherited abilities have been seen to be in the main role.

However, it is possible also to view expert performance from the perspective of exceptional skills and abilities. Particularly, if our goal is to find out why some individuals develop into experts and others do not, it may be fruitful to analyse the individual characteristics interacting with the environmental factors. Sternberg's idea of seeing giftedness as developing expertise may narrow the gap between the research on expertise and on intelligence. Experts may have had skills and abilities that have 'reacted' well to the practice in a constructive environment. If the research on intelligence and giftedness adopts Sternberg's idea, this may lead to advances in the research on expertise as well.

4.2. Expertise and knowledge

The cognitive approach to expertise research has dominated the field since its beginning. It hypothesizes that exceptional performance is due to well organized knowledge that experts can access rapidly in a problem situation. Empirical evidence supports this view. How this knowledge is acquired is an important question. Cognitive research has typically looked for explanations for exceptional performance either in the information processing skills or in the contents of an expert's knowledge base. The cognitive view typically assumes the existence of knowledge structures in memory.

In the current research on learning the so-called situative, sociohistoric, or social view has gained popularity (Greeno, Collins, & Resnick, 1996). This view emphasizes the notion that learning is inherently a social process. Learning is a way of becoming a member of and participant in the culture and social networks and acquisition of expertise is part of that process (Lave & Wenger, 1991; Wenger, 1998). Therefore, expertise is not as much as the cognitive view assumes, an individual characteristic of one's knowledge structures, but an outcome of being a member of the social and communicational networks of individuals and groups. Expertise from this point of view is a kind of side effect of acquiring membership of and legitimate rights in a social network. This perspective views knowledge differently from cognitive framework. Knowledge is not a static schematic structure, stored in one's head, but rather a way of relating and participating in the immediate

social networks around oneself (Agnew, Ford, & Hayes, 1997; Brown & Duguid, 1994; Wenger, 1998).

The concept that is widely applied among social theorists of learning is identity. Identity has had at least two different meanings in the studies. First, it has been applied to refer to the membership aspect of the social network. It is assumed that in the process of becoming a group member a person's growing identity as a legitimate member having more expertise and power supports the acquisition of knowledge. Second, a person's identity as an active and responsible learner is also assumed to support the acquisition of knowledge (Greeno et al., 1996).

It is assumed that identity processes and knowledge construction are related, although we are only at the beginning of empirical research on this issue. There is, however, interesting literature on the issue that can direct future studies. For sociologists identity is a concept related to one's relation to the historical, cultural and social environment. In the changing world an individual identity is "a reflexive project" that is under continuous change and development (Giddens, 1991). Although sociologists have typically discussed the development of identity and self in a broad context such as the global post-modern society, there is also literature that may offer more concrete frameworks for empirical studies on the relations of identity and expertise. For instance, van Langenhove and Harré (1999) have proposed the so-called positioning theory, which argues that the human self develops by taking positions in specific contexts. A position is related to a concept of role and it is conversational in nature. A person takes a position and changes it as the conversation develops (van Langenhove & Harré, 1999) From this perspective expertise might develop if a person makes deliberate decisions of taking a developing expert's position in a specific situation. For instance, a child might take a position on becoming a mathematician at school. This position will lead to personal identity and the acquisition of mathematical knowledge if it persists long enough. However, situational positioning can only persist if the environment supports the positioning. The will and motivation to surpass one's level of earlier performance may be supposed to come from the processes related to the construction of personal identity (Bereiter & Scardamalia, 1993). At the moment we have very little empirical research on this issue. The existing empirical research suggests that contextual factors are important in developing expertise and that it may have different roles at different stages of acquisition process (Eteläpelto & Collin, 2001, this volume; Schmidt & Boshuizen, 1993).

5. CONCLUSIONS

In this final section I discuss a few conclusions emerging from the past theorizing on teacher expertise. First, I argue that teacher expertise is an important research area that should be studied in the future, too. Although empirical research on teaching expertise has decreased during the last decade these studies have important implications in understanding the development of excellence. Being a pedagogical expert is at the same time similar and different from expertise in other domain fields. Pedagogical expertise can be regarded as a domain area having its own specialties in the same sense as engineering or medicine. Expert teachers have knowledge, skills,

and social networks that are typical for them alone. The core of school teachers' expertise, for instance, is in a person's performance in a classroom with a group of students teaching a specific and complex mixture of values, knowledge, and skills.

Teachers as experts are professionals whose work is accomplished in a social situation in which they are typically alone with their students. The concept of an expert teacher and expertise in teaching is relevant for the current political discussion on the quality of education or teacher education. For instance, the recent results of the OECD organised PISA studies on comparing student performance in the OECD countries has shown that good teaching makes a difference in the students' performance in the school (PISA 2000). It is therefore necessary that we continue research on the nature and development of teaching expertise.

The second conclusion of the research on teacher expertise (or pedagogical expertise if you like) is that it is necessary to study expertise in authentic contexts. Educational practice benefits most of the studies describing the characteristics of expert teachers in relation to the social context of their authentic work or duties. Studies on expertise in other fields indicate that expertise develops as long as the individuals are exposed to situations in which they have to overcome the restrictions of their earlier knowledge. The work context has, consequently, a major role in directing or affecting the person's development in expertise. This notion is not only important for our conceptions of teacher expertise but our conceptions of teachers' work and working conditions. We need to ask if the changes taking place in the work and its context support the continuous development of teacher expertise.

Let me refer to a related discussion in the area of school education. According to Apple and Jungk (1990), many factors indicate that the nature of teachers' work has in the last decades taken a turn for the worse from the viewpoint of professional development. According to him, teachers' work has become more one-sided and less rich, teachers' abilities to manage their work as a whole have declined, and the intensity and quantity of work has increased. This has resulted in increased stress among the teachers. At the same time there are developments that emphasize the accountability of teachers' work assessed by simple measurements of student learning.

The last implication deals with the nature of theorizing behind the empirical studies on teacher expertise. It seems fruitful to adopt a multidisciplinary framework in the research on expertise. Our discussion has already shown that many of the novel ideas in the current research are multidisciplinary, coming from various directions, such as sociology, philosophy, psychology as well as education. In the future research we have a lot of new ideas to explore. For instance, autobiographical theory and the processes related, studied in literature, philosophy, psychology, and sociology has not yet influenced on the analyses of expertise and professional development.

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