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Science in Early Childhood Education

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Abstract

Based on an action research project with 12 preschools in a municipality north of Copenhagen the article investigates and takes a first step in order to create a preschool science Didaktik. The theoretical background is double-sided. The pedagogical / didactical approach consists of a German critical constructive Bildung Didaktik, and the learning approach is based on a vygotskian cultural-historical activity theory. As a tool for educational thinking and planning a so-called science oriented dynamic contextual didactical model was elaborated. The article contributes with formulation of five educational principles which might be seen as fundament for a preschool science Didaktik. In the end several problem are discussed, among other the main problem: How can preschool teachers balance children's wonder, their own construction of knowledge (which often result in a anthropocentric thinking) with a teaching approach giving children a scientific understanding of science phenomenon.

Keywords: Science Didaktik; children's science thinking; science educational principles; critical education

Introduction

This article deals with science or emergent science in preschool, which can be defined as all concrete experimental activities children carry out in social interaction, which contribute to children's interest and slowly emergent understanding of nature, technology, health, mathematics, biology, chemistry and physics. Through such activities children achieve knowledge on plants, animals, the circuit of nature, nature phenomenon plus nature regularity and accordingly understanding of subjects like light, water, magnetism, electricity, air current etc. Based in the Danish school subject 'nature and technology' and the theme 'nature and nature phenomenon' in the preschool curriculum, this definition holds to science dimensions: On the one hand nature science which has an orientation toward the biological nature like animals, plants, fungus, the environment and the universe. On the other hand technological science, which focuses on elements from following school subjects: geography, physics and chemistry, and holds for example experiments with magnetism, circuit, water and air. This definitionholds several important dimensions, among others children's appropriation of scientific skills and knowledge through social experiences (Johnston, 2008), and through an experimental, exploration and discovery activity (Siraj-Blatchford, 2001). Because preschool teachers do not in a direct way transfer knowledge to children, but opposite children themselves in a guided process step by step construct the science knowledge, the concept emergent science is also used (Johnston, 2008; Siraj-Blatchford, 2001).

Pedagogical Profile of Nordic Preschools – Early Childhood Education and Care

Early childhood education and care in the Nordic countries have been characterized different compared with many other countries. In the OECD papers *Starting Strong* two distinct approaches to early childhood education and care have been identified (OECD, 2001, 2006): the early education approach and the social pedagogy approach.

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The early education approach generally results in a more centralizing and academic strategy towards curriculum, content and methodology. Opposite with roots in Rousseau, Pestalozzi, and Froebel the social pedagogy approach gives a background embracing concepts such as play, child-centeredness, self-directed activity, self-development, and holistic development (Broström, 2003). Also Swedish research points out, that many preschool teachers have a resistance to learning in preschool. They argue with phrases like "let the children be children" and "it is better to be left alone rather than having to learn" (Sheridan, Pramling Samuelsson, and Johansson 2009, p. 258) However during the last decades in the Nordic countries education and care in preschools has changed. We have seen a movement from a child-oriented approach based in a developmental psychology understanding towards a German inspired critical Didaktik (Klafki, 1998; Broström, 2012a).According to Klafki Didaktik is a "comprehensive term for research in educational science, for the elaboration of theories and concepts with regard to all forms of intentions reflected in any way in *teaching* and in the *learning* taking place in connection to this teaching" (Klafki, 1995, p. 188). Besides such an intentional and goal-directed (didactic) practice there is also seen a tendency to focus on different subjects like early literacy, mathematics and science; accordingly to this we see an increasing interest to construct a subject oriented Didaktik and curriculum. This interest is in close connection to a practice focused on preparing children to school. Research has shown, that children's engagement in early literacy pave the way to their later reading abilities. Corresponding focus on math in preschool makes up a solid ground for children's mathematical achievement in school (Gagarina et al., 2012).

The Appearance of Science Education in Preschools

In line with the slowly appearance of literacy and math subject orientation in preschool also nature and nature phenomenon (nature science and technology science) are put on the agenda. This is visible in curricula from all Nordic countries. For example in the Norwegian curriculum in connection to the compulsory subject area "nature, environment and technology" many aims and a big numbers of science content is listed (Kunnskaps departementet, 2011).The Swedish curriculum (National agency for education, 2010, p. 10) states that children are to "develop their understanding of science and relationships in nature as well as knowledge og plants, animals and also simple chemical processes and physical phenomena."In the Danish curriculum the theme "nature and nature phenomenon", which is one of six themes in the curricula, it is stated, that "children should act and get first experiences with the nature's animal, plants and materials, and get experiences with causes and connections" (Ministry of Social affairs, 2003).Although science education is a part of Nordic preschool policy, there is a tendency to de-emphasize this dimension. Danish research shows that preschool teachers have a diffuse understanding of science education and only in a limited range introduce children for science questions and phenomenon (Broström, 2014; Østergaard, 2008). A new Danish evaluation rapport shows, that preschool children's study of "nature and nature phenomenon" are the theme, which preschool teachers give less attention (Danmarks Evaluerings institut, 2012).Such a low priority is also seen in other countries. American research reports that children's emergent skills on science learning are not taken into consideration in early childhood classroom (Tu, 2006; Saçkes et al., 2011). Compared with studies on early literacy and mathematics, children have fewer opportunities to learn science (Early et al., 2010; Greenfield et al., 2009).Other studies show that teachers themselves do not have science competence and are not familiar with using science equipment and to follow children's science questions and wonder (Greenfield et al., 2009; Nayfeld et al., 2011).However a review by Edwards and Loveridge (2011) describes more factors which influence preschool teacher's inclinations to support children's science learning. The main significant factor seems to lie with the individual teaching professional: The teacher's attitude, beliefs, level of science subject knowledge and understanding of the nature science.

Above factors are also found in a new study by Saçkes (2014), who investigates how often 3.305 early years science teacher's teach life science, physical science, and earth ans space science concepts in kindergarten (6 years old children). The study points out a numbers of variable which influence the range of teacher's focusing on science education. Among other variables the study shows: Teachers with science education were more likely to teach science concepts. Similar teachers who have science and nature area at their disposal, and also teachers who view the child as a competent person were more likely to teach science. However years of teaching experience and teacher's perception and control over the curriculum were not variables which influence the frequecy of teacher's teaching of science.Regardless of lack of science education in Danish preschools there is a big number of so-called forest preschools or nature preschools, where children and preschool teachers during the day spent a shared life in nature, which should give a possibility for children's science learning. The nature preschool is based on a (Nordic) idea: children's experiences in nature have a symbolic value as a place for positive childhood (Halldén 2011).

And in addition research point out, that preschool children in nature contributes to their healthy and motor skills (Grahn et al., 1997). However, surprising enough new research do not conform the hypothesis of children's science learning in nature preschool (Ejby-Ernst, 2012).A similar finding is seen in Swedish research on children's experiences in nature during nature excursions (Gustafsson et al., 2012). Here children very often are left alone in order to do their own experiences without interaction with preschool teachers to help them to reflect nature dimensions and concepts. Based on data from 40 preschool teachers and 500 children, among other things Ejby-Ernst (2012) found following tendency as regard to children's learning in nature preschool:

- The educational approach is mostly characterized by a social pedagogy understanding based on play, child-centeredness, self-directed activity, self-development, and holistic development.
- In general preschool teachers think that nature mediates itself through the direct meeting between child and nature.
- To great extent preschool teachers understand nature from same basic assumption as children.
- In general preschool teachers value a here-and-now nature experience.
- Preschool teachers only to a limited degree reflect the educational science content.

Taking above dimensions as a whole science education in Danish nature preschool seems to be rather limited, and in addition also problematic. First of all preschool teacher's science practice do not budge children's misconception or pre-conception of science phenomenon. This is problematic while a wrong science understanding (for example instead of a biological explanation about growth of plants, photosynthesis, children think plants absorb nutrition from the earth), remains during school-life (Driver et al.1985). Based on Ejby-Ernst (2012), Thulin (2011) and Thulin and Pramling (2009) Danish and Swedish nature science education in preschool contributes to a limited and also wrong science thinking. Children's science understanding is characterized by an anthropocentric thinking, they think the world is created by humans and human beings are center of the world. More children hold an anthropomorphism understanding while they attribute human characteristics to non-human beings, objects, phenomena or concepts. This is due to preschool teacher's way to present nature science, for example when children look at animals, the preschool teacher comments: "Look at the mother blackbird", and "let us give the girl fish some flowers to look at" (Ejby-Ernst, 2012).Finally children's thinking is bound to the world as it looks like. Children only focus on the form of appearance, its presentation, for example children think the water is clean because it is clear, and according to the theme pollution, children think there is no more problems, when we have eliminate the waste (Ejby-Ernst, 2012). Based on the fact that Nordic investigations (Ejby-Ernst, 2012; Thulin, 2011) show that preschool teachers in some respect do not support children's nature and science learning, there is a need for to construct a science Didaktik, that means a theoretical foundation for a science education in preschools. Above mentioned problems call for research and educational developmental work in order to strength a science education in Nordic preschools. However in the Nordic countries often preschool teachers reject such a wish because they fear a schoolification of preschools and a loss of play and children's self-organized and experimental activities. In a period where preschool education become more and more goal-directed, narrow and assign to a constant measuring, there is a realistic risk (Biesta, 2010). Thus an outline for a science education must balance the best dimensions from a child centered Nordic tradition and a critical democratic Didaktik (Broström. 2012a, 2013) and try to avoid a narrow schoolification.

However still one can ask why should science be implemented in early childhood education and care?

Why Science in Preschool?

There are a number of reasons for construction a science Didaktik and implementation of science activities in preschool (Eshach 2006, p. 6). First of all in science activities children have fun, thy enjoy observations and thinking about nature (Eshach, 2006). They participate in science activities with a strong presence, and are engaged and absorbed in experimental and creative activities (Davies 2011). This is due to the fact that science activities build on children's own wonder and questions and their curiosity on the surrounding world. Research shows that young children aspire to understand their world, and they are not afraid of foreign word and concepts (Thulin, 2011). More in some extend children are able to use and understand scientific concepts and to connect theory with practice (Eshach, 2006). At least children have a biological basis and need for to explore and conduct experiments in order to find answers to challenges they meet (Gopnik et al., 2002). More young children's early play oriented science experiences can shape positive attitudes towards science.

And in addition this can lead to a better understanding of scientific concepts studied later in a more formal way (Eshach, 2006). In addition such science experiences in early years can raise a general interest for science. This can be followed up in school and higher education, which is of importance since there is a societal need for science knowledge. However regardless of actual politician's call for extended numbers of student in scientific studies, a more important argument is the development of a critical and creative Bildung (in German) or formation (in English); in short a liberating dimension (Klafki, 1998; Broström, 2003, 2013).A Didaktik approach is oriented to the goal of guiding all children to greater capacity for "self-determination, co-determination and solidarity"(Klafki, 1995, p. 191). Though solidarity really is a part of a future education, namely the child'sability to act in solidarity with those whose self-determination is threatened as a result of political or other oppression, the preschool teachers have to struggle with implementation of this dimension. Through a science Bildung children's appropriated science knowledge and skills will help them to understand the surrounding world and inspire them to participate in solution of important societal question or with Klafki concepts: Epoch typical problems, for example questions according to change in the global climate, pollution, environment and health (Klafki,1995). Such a democratic dimensions is stated in educational policies in the Nordic countries (Einarsdottir et al., 2014), and too in The Lisbon Treaty (2000) where eight key competences for lifelong learning is expressed, and social and civic competences is mentioned in order to equip individuals to engage in active and democratic participation. Thus both from a macro- and micro level one can argue for implementation of science activities in preschool. In a long perspective science experiences can contribute to children democratic Bildung, and seen from a here-and-now perspective in a play oriented science approach children enjoy to follow their interest and wonder.

An Action Research Project

The present study focuses on the possibility to inspire preschool teachers to implement science in preschools. This was tried out through an action research project in 2012 with twelve preschools in a municipality north of Copenhagen (Broström and Frøkjær,2013). The starting point was results from a Nordic investigationon Danish and Swedish preschool teacher's view on children's learning (Broström et al., 2014). Among other things the research shows that Danish preschool teachers compared with Swedishdo not see themselves as a mean for children's learning. They do not weight the interaction between preschool teachers and children very high, but opposite as the most importantthey emphasise: "Children learn when they are allowed to be in peace and quiet" (p. 8) and to when children are "playing together with other children and the child becoming absorbed in something" (p. 9). Based in a critical view at the preschool teacher's understanding of own role, the politicians launched the action research project in order to raise a new professionalism and they linked this to the science theme. In cooperation with the whole group of preschool teachers the attached researchers (the author of the article and associated professor Thorleif Frøkjær)put the project into practice. Among other things they together formulated the research questions.

Research Questions

Through many dialogues the involved preschool teachers and researchers formulated a common interest: to develop a science pedagogical / didactical approach without destroy the play-oriented practice, to experiment with different forms of practice and to be involved in continuous discussions about how to act together with children. Three research questions were expressed:

- Is it possible to create a preschool science Didaktik, which balances a social pedagogy and a critical democratic Didaktik without tendency to schoolification?
- Which educational principles might be possible and necessary for a science Didaktik in preschools?
- What role should the preschool teacher have in order to engage the child in science activities and during the activities?

Seen from a cultural-historical activity theory (Vygotsky, 1978; Hedegaard and Fleer, 2008; Rogoff, 2003) four dialectical and interrelated levels must be reflected: 1) Society, 2) institution, 3) the social situation, the interaction between child and preschool teacher plus 4) the individual level (the child's activity, motives etc.). Bronfenbrenner (1979) gives a similar understanding: An ecological approach describing the child's development under influence of four interrelated levels: Marco-, exo-,meso- and microsystem. Regardless of the fact that an adequate investigation claims an analysis of data from all four levels, the present action research had main focus on children's activity and the social interaction between children and preschool teachers. However, because children's activities are embedded in an institutional context influenced by norms, values and educational traditions plus political documents and laws, these dimensions have been taken into consideration as an influential background (Einarsdottir et al, 2014).

The three research questions and above described focus on the social interaction demarcated the research interest during the research process. Following the observations of social interactions and dialogues between the preschool teachers and children were very much focused on and related to the didactical *how* question. In other words an interest to analyze in which ways children and preschool teachers cope with science questions was brought into focus. Such a focus on qualitative different ways to focus an act with science phenomena might produce data related to question two about construction of educational principles. However the didactical question about learning *what* (subject knowledge) that means analyze of the educational science content, was not overlooked. Special a German oriented critical Didaktik focuses on the importance of the content. According to Klafki the content should shake and enchant children. But the how and what question are united and cannot be separated. With special focus on science Shulman (1986) connects the what- and how questions by using the concept pedagogical content knowledge. During the action research project preschool teachers, children and researchers were active engaged in a number of science subjects as for example study of astronomy and doing experiments with air, water, magnetism and electricity, but the main interest was on the how question in order to construct a number of educational principles.

Theoretical Background

The underlying theoretical basis of the action research project was two-dimensional, partly a didactical approach and partly a learning theoretical approach.

The Didactical Approach

The didactical approach consist of a critical constructive Bildung Didaktik (Klafki, 1998; Broström, 2012a, 2013, 2015) elaborated and applied in a science oriented dynamic contextual didactical model (Broström and Frøkjær, 2015). Such a model is partly a tool for preschool teacher's educational thinking and partly a tool for educational planning. Many tools are available, and most models make use of the concepts in accordance with the Tylor (1949) curriculum model. The so-called Tyler Rationale:

- The educational purposes, defining appropriate learning objectives.
- Selection of the learning experiences, the content.
- Organization of the learning experiences in order to maximize their effect.
- Evaluation of children's learning experiences.

Using such a hierarchical model the risk is obviously, namely the tool is seen as a finished plan for action. Instead of a hierarchical listing of the didactical categories (objectives, content, organization of practice and evaluation) and filling them out step by step, the categories are organized in a circular or spiral way which opens for a dynamic interaction between the categories. We see a number of such dynamic, circular models which also incorporate an analysis of children's background, their learning readiness, interest, the learning context etc. a so-called situation analysis (Print 1993). In the action research project a contextual and dynamic situational didaktic model was constructed (Broström and Frøkjær, 2015) holding following didactic categories:

1) First of all the *situation analysis* (Print 1993), mapping the specific children's livelihood, their envorenment, interest, relation to peers and much more. Knowledge of children's total background are important for preschool teachers reflection and decisions related to all didactical concept in the model. Not only related to choice of content and attached concepts, but corresponding to for example reflection of purpose and objectives. This is similar to the idea of 'conceptual intersubjectivity' (Fleer, 2010) which reflect how preschool teachers can interact with chiden in order to enchance conceptual learning. The coice of concepts (content) are based in and connected to knowledge about the context described via the situation analysis which Fleer (2010) names 'contextual intersubjectivity'. Use of a contextual, situational and dynamic didactic model shapes relation between all didactical categories, also between context and content (choice of concepts) which units the contextual and conceptual intersubjectivity. When preschool teachers combine knowledge and concepts children cope with in the everyday life with concepts and (science)subjects presentet in interaction with children, this is a kind of 'double moove' (Hedegaard and Chaiklin, 2005).

2) The Bildungs ideal or the *overall purpose*.This deals with the 'why' question,a reflection of the future man in a future society, as an example1the childshould"gain capacity for self-determination, co-determination and solidarity"(Klafki,, 1995, p. 191). Such a perspective calls for a view of the child as an active participating subject which is central in a science Didaktik, where the child in interaction with other children and preschool teachers construct and produce knowledge. Thus the Bildung ideal or overall purpose contains a view of the child and too a view on society.
3) *Objectives* or 'the where to' question, that is a description of knowledge, skills and competencies the child should achieve during a shorter period.
4) The *educational content*, the 'what' question. What kind of experience should be a part of children life, how can this be justified. Preschool teacher's choice of content is central. The content must have a double dimension, partly an objective dimension, to be in accordance with the national curriculum, and partly aspire to higher things, a content with critical and liberating dimensions, as earlier mentioned epoch typical problems and themes (Broström,2012a; Klafki, 1995).The preschool teacher's selection of such categories is the pivot, which also is seen in Paulo Freire's (1996) theory about the concept "themes of generative character". Besides content with such an extent perspective children's wonder and questions make up a basic for science educational practice.

The figure 'the didactical triangle' (Hopmann and Riquerts, 2000) illustrates the dynamic relation and interaction between child and preschool teacher and the educational content. The bottom line of the triangle expresses the relation between the child and the preschool teacher reflecting the empathic relation to the child, and thus the care dimension and the intersubjectivity (e.g. Broström, 2006b; Trevarthen, 1998; Stern, 2006).However because the relation between children, their friendships and shared activities also are of importance, he triangle could be widened to a square, and thus add the relation child-child/children (Broström, 2009).

5) *Educational principles* are the fundamental guidelines and superior procedures and methods which are basis for constructing of practice and meeting between children and preschool teachers. The general idea is seen as back clothacting together with children. The high ambitions formulated in the Bildungs ideal, among others the view of child and society are transformed as principles and are guarantors for transforming the idea of the participating chid.
6) The concept *practice and children's learning* covers preschool teacher's implementation of all didactical decisions according to the overall purpose, objectives, the educational content and principles. Practice holds both teacher and child initiated activities, and also planned and spontaneous activities in which children interact with each other and with preschool teachers. Through this manifold life children have opportunities for learning.

The learning processes and resultas are in focus for preschool teacher's observation *documentation and evaluation,* which calls for a variation of methods, among others learning stories (Carr, 2001). Based on analysis of the collected documentation materials preschool teachers have a possibility to critical reflect the used educational princples, children'slearning etc. wich opens for a *reconstruction of practice*. Above didactical model kan be a tool for both 'backwards' and 'forward'planning and organzation. The Danish philosopher Søren Kirkegaard used the phrase "life must be understood backwards, however must be lived forward" (Kirkegaard, 1996,p. 63 and 161).In life you act and react in the moment, in the sitiation (foreward), but in order to understand life, you must analyse and reflect and understand (backwards).Backwards planning are uderstood as a reflectet, planned and organized practice with chidren where most of the didactic categories are taken into cinsideration. Forward pracice is a shared here-and-now life with children where the preschool teacher together with the children seize the situation and opportunity (Broström and Frøkjær, 2015).Foreward planning takes often achild's perspective" where children themselves take a more active role as participants. They express ideas and based in the idea of the capable or competent child the preschool teacher listens to the child and attempt to understand, often through imagination, the thoughts and views children have of their own life and the existing (science) question (Broström, 2006a; Sommer et al., 2010). I Nordic preschool education the foreward approach is also named 'the dead mouse pedagogy' referering to the idea of let the themes come to the children: When we find a muse, children become excited, which is a basis for interesting investigations and activities. In both approaches children and preschool teachers are involved in social interaction and both are structured, but they differ in regard to different level of prearrangement. When preschool teachers have planned ahead they have to raise children'smotivation, which typical is more in front in spontaneous arranged practice. The concepts backwards and forward planning are related to formal and non-formal learning (Eshach, 2006). The two approaches have different qualities. Sure in backwards planning the preschool teacher has opportunity to prepare science theory, clarify science concepts and make up science materials. Opposite forward planning starts with children's motivationand calls for a preschool teacher who has science knowledge as trivia knowledge.

However Nayfeld et al.(2011) and too Danish research show that preschool teachers do not have such a science competence (Broström, 2004; Ejby-Ernst, 2012; Østergaard, 2008).

The Learning Approach

In general the learning approach was based on cultural-historical activity theory (Vygotsky,1978; Leontjev, 1978; Hedegaard and Fleer,2008; Rogoff,2003). Based on Vygotsky's (1978) idea of 'learning leads the child's development', which also is discussed by Holzmann (1997), three cornerstones (Stetsenko, 1999) are seen as pivot for children's learning and development of higher mental functions:1) Social interaction between child and preschool teacher. 2) Cultural tools as intermediate and mediating factors. 3) The concept and theory on zone of proximal development as main road for the child's learning. All three corner stones are dialectical united and are so to say cemented together by the child's activity. Because the action project focused on the 'how' aspect there is a weight on how preschool teacher and children investigate science phenomenon, how they interact and how they are able to make up a shared attention on the object they study. According to Dewey (1960), experiences or learning will appear through the child's interactions with people and the surrounding world. Thus, experiences are the result of interactions performed on the basis of previous experiences, which are the result of other actions in a process which Dewey calls the 'continuity of experiences'. Correspondingly, Leontjev (1978) emphasises the child's own activity, participation and interaction with other people. Through this process, the child appropriates the culture in which they live and in other words: they learn. Appropriation of culture is not possible for the child in isolation. As noted by Vygotsky (1978), social interactions with preschool teachers and in cooperation with peers enable children to transform and internalize experiences in a dynamic and subjective process. Vygotsky (1978, p 57) states that the transformation of the exterior to an interior level will only succeed through social interaction with other people. According to Vygotsky (1978, p. 57):"First, on the social level, and later, on the individual level; between people (inter psychological), and then inside the child (intrapsychological)".

Related to science education in preschool the preschool teacher has to take an active role. Sure children's learning comes through via their own activity, through their wonder, curiosity and active exploration of science phenomenon. However in order to achieve a deeper understanding, to go beyond the appearance of the science objects, they need a preschool teacher with science knowledge. A number of science scholars (Hatch, 2010; Fleer, 1995, 2010; Segal, 1996) argue that science phenomena are too complex to explore and understand via an individual activity. Thus the preschool teacher plays an active role in the child's (science) learning process. Not as a person who transforms knowledge but as a person who is able to support the child to take a personal step in his or her own learning and developmental process.This happens when the teacher provides an active learning environment, which allows children to create a zone of proximal development (Vygotsky, 1978). A zone of proximal development occurs when "learning awakes a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with peers" (Vygotsky 1978, p. 90). Learning can be considered a social interaction in the zone of proximal development (Vygotsky, 1978), where the preschool teachers present and and also are involved in a shared og joint activity. This is a 'guided participation' (Rogoff, 1990) in which the preschool teacher supports the child and acts as scaffold (Bruner,1985).However, studies in Sweden and Denmark have shown that the joint participatory opportunity for this to occur is quite limited (Emilson, 2007; Hansen, 2013;Johansson and Pramling Samuelsson, 2006; Sandberg and Eriksson, 2010). Though such a guided participation is important in a science practice, there is a risk of simplification in using the idea of zone as proximal development and too guided participation as mechanical instruments for appropriation existing knowledge (Cole and Griffin, 1984; Engeström 1987; Stetsenko, 1999). Holzman (1997) warns us by saying the zone of proximal development is not at all a 'zone' but a 'life space', which human beings are involved in, and through which higher mental functions arise and develop. The transformation from the external to the internal does not happen automatically and the concepts may not to be understood literally. It is a dynamic and subjective process. Thus Rogoff's interpretation is that the preschool teacher leads the child in accordance with the child's perspective. If the preschool teacher takes too much responsibility, the child's own initiative, motive and interest may be overlooked. So not only the interaction with the child is of importance, more important is the question of *how* the interaction is carried out. This claim is to establish intersubjectivity, a mutual dialogue and complementarity, an interaction between child and preschool teacher where they have a shared focus, shared feelings and understandings.

Research by Tomasello shows that even very young children can make up such a communication (Tomasello and Carpenter, 2007).Corresponding Brunerand Watson (1983, p. 18) argue for 'shared reality', where he child through participation establish a shared perspective with the preschool teacher in order to understand the preschool teacher's intentions. Through this the child makes up a 'common ground' as 'hot spot' for cultural learning (Tomasello, 2008, p. 158-159) and with that 'joint attention' (Tomassello, 2008, p. 157). In order to realize intersubjectivity, join shared attention, the preschool teacher has to adjust the communication to the child's capacity (Wertsch 1985), but still challenge the child. According to Bakhtin (1981) the intersubjectivity reaches a new quality when the dialogue contains 'voices in conflict'. Thus intersubjectivity is not seen as a harmonious situation. According to the principle of the zone of proximal development the existence of challenges are important. A balance between to follow to child's intention and to bring challenge into its life is optimal. This is in line with dialectical development theory described by Hegel and Marx, namely the principle of conflicts as sources for development. This idea is expressed in modern learning theory with the concept variation. Martonand Tsui (2004) argue that the child has possibility to learn when he or she discerns the object or phenomenon and when the investigation takes different point of departures, in other words to find out what is different or distinct from another phenomenon: black differ from white, one object float another sink. In preschool practice there are lots of aspects they can discern. The more children the more different ideas and solutions will be expressed. Instead to decide what is right and what is wrong (a diachronic approach) it is a more fruitful and democratic learning to approach variation, a synchronic presence of many possibilities (Marton et al., 2004). Variation theory is also in accordance with the fundamental idea in (science) education: An open, wondering and inquiring approach to the study of the phenomenon.

Research methods

Action Research

Because both politicians, preschool teachers and researchers had a shared interest, namely to change practice, to construct a science practice and theory plus a new preschool teacher role, the research build on a critical theory science (Frankfurt school) and with reference to Habermas (1972) a liberating epistemology. Based in this paradigm an action research project was conducted. During almost a two years period every second month preschool teachers and researchers met in a working laboratory, in a new community of practice (Wenger 1998). In addition in some degree the researchers participated in educational practice in preschool. In the laboratory preschool teachers presented their experiences from practice, data were analyzed and discussed. Through this and also presentation of new theories and methods, the practitioners were 'disturbed' which contributes to new knowledge and in big extend opened for new forms of practice. Because the preschool teachers learn through practice the action learning is used. And because a systematic description and analyze of practice shaped a foundation for constructing new knowledge the term action research or Handlungsforschung (Klafki et al., 1982) is used. The project made use of Kurt Lewin's classical cultural-progressive model plus some new variations (Lewin, 1958; Clark, 1972; Kemmis and McTaggart, 2005). A spiral process of change was made up containing four repeatedly phases: 1) Researchers and preschool teachers formulate the research questions, 2) they set up a general idea and plan, describe and decide the first action step, 3) and parallel with this a level with data collection elated to first action step is carried out, and 4) based in this knowledge decisions about next action step is taken etc. etc. Action research wants to make up changes. Change "to something better". Thus values are embedded in the all four levels. As described above a cultural-historical activity theory and with that a social-constructivism learning understanding. Due to the fact that this ideal theoretical foundation has affected the involved preschool teachers understanding, the described practice, 'the findings', namely the educational principles, correspond with the theoretical foundation. During the year long process where preschool teachers tried out and implement new educational science ideas the researchers and preschool teachers made observations of children's interactions with preschool teachers. Mainly focused participant observations (Adler and Adler, 1994) with use of handwritten notes but also video observations (Arlø and Dircking-Holmfeld, 1997).The observations were transcribed, presented and discussed with preschool teachers as basis for planning next action step. The preschool teachers transformed the observations to narratives illustrated by digital photos based on Nordic ideas and guidelines (Broström and Frøkjær, 2006) according to learning stories described by Carr (2001). Over time the preschool teachers changed their practice, they achieved new knowledge via the shared work in laboratory, and their intuitive understanding, their tactic knowledge, were articulated and transformed to a theoretical educational thinking (Polany, 1996; Schön, 1983). Corresponding via analyse of data the researchers achieved new understanding of science practice in preschool.

Analysis of Data

All data material was discussed with preschool teachers as a part of defining next action step, but the final analysis were carried out by researchers. Using the didactical categories from the didactical model data was coded, and in order to get an overview a data reduction was made and organised in a display (Dahler Larsen, 2002).However, due to research question number 2 (Which educational principles might be possible and necessary for a science Didaktik in preschools?) the analysis weighted the *how* dimension: the educational principles.

Ethical Dimensions

All ethical precautions were taken into consideration, e.g. requirements for confidentiality, written informed consent, information and autonomy, and highlighting that participation in the study was voluntary. This was both in relation to parents and children. Children were also informed of their rights to withdraw from the researchHowever, because the children were actively involved in the action research and almost as co-researchers (Broström, 2012b), this new practice also raises ethical questions (e.g. Dockett et al., 2009; Putman and Landsverk, 1994). For example, because children may not fully realize the consequence, how much will be required of them in participating in a study when they first agree to take the role of co-researchers, children's informed assent was seen an ongoing process (Hill, 2005). Concerning documentation by photos and videos of educational practice the involved children and preschool teachers gave specific permission in accordance with Danish ethical rules (Humanistic Social Science Research Council, 2002).

Results

The result of the action research is under influence of the theoretical background which in the early start of the project was presented to the preschool teacher. More the results occurred continuous during the whole process and not as a result ofa final in-depth analysis of all data in the end of the project period. Many of below the described educational principles were expressed very early in the shared laboratory work as germ of an idea. These outlines of principles were transformed and tried out in practice. During this interchange of theory and practice the principles become more and more visible and step by step anchored in a theoretical understanding. The following principles are so to say in expressed continuation of the earlier section 'theoretical background'. The principles are analytical concepts, in practice they are mutual related and make up a overlapping whole.

Child's Perspective, Wonder, Inquisitiveness and Experiences

From the very start the preschool teachers were challenged to be aware of children's wondering and questions, and also to give children possibilities to reflect themselves, and not hand out a correct answer.So the starting point was an open, wondering and inquiring approach to the study of science phenomena. Wondering occur when the preschool teacher bring children in situations, which call for questions and wondering and then open for shared investigative activities. Preschool teachers experienced hat the most interesting and meaningful science activities emerge on the basis of children's wonder, curiosity and question produces by children themselves. However not all question lead to science solid activities. Opposite closed and controlling questions, open questions or 'productive' questions (Elfström, et al. 2012) lead to discussion and reflection and are seen as most fruitful. Such a science practice appears when the preschool teacher succeeded to balance children's initiatives and expressions with adult actions and voices initiatives (Sheridan et al., 2009; Siraj-Blatchford and MacLead-Brudenell, 2003; Sylva et al., 2010). Productive questions (Elfström et al., 2012) lead to shared investigative practice. As example from the preschools:

How comes I hear music in the loudspeaker? (altså "hvordan kan det være?"), How comes sometimes the moon is visible, though nobody are at sleep? How comes light in the lamp? Why is the paper flat, it is made out of wood and the tree is round? Why are objects big when I look at them in a magnifying glass? The idea of to take children's wonder and question seriously is also in accordance with the Dewey (1960) approach 'continuity of experiences' because the child interprets and understands a question and problem based in his/her own experience (Marton and Booth, 2000). When preschool teachers are able to support this continuity of experiences, children will witness the learning process meaningful. That is when the child'smotive corresponds with the purpose of the activity (Leontjev, 1978).

Taking cildren's existing knowledge as starting point is a robust principle (Ausubel and Robinson, 1971), however while children's own construction of explanation often are inadequate, for instance characterized by an 'anthropomorphical understanding (Thulin and Pramling, 2009) at the same time the preschool teacher has to challenge, discuss and put the child's thoughts in perspective. Opposite as earlier mentioned such an understanding can be stabilized and last over years (Driver, 1981; Driver, Guesne, and Tiberghien, 1985). Thus the preschool teacher has a role to play in the process of transforming children's everyday speech to scientific concepts (Vygotsky, 1986**;** Davidov, 1989). Taking children's wonder as starting point is parallel to respect children's perspective (Broström, 2006a; Sommer et al., 2010), that is to respect and enhance a child's own ideas and hypotheses.

In summer during lunchtime some boys spilled some water on the floor. They continued eating and talking, and in the end of lunchtime one of the boys wondered and burst out: "Hey where is the water?", and directed to the preschool teacher: "Have you wiped the floor?" The preschool teacher said: "Oh no, but do you know what happened?" The children became interested, they came up with different answers, but they had no ideas. "I give you a cue" the preschool teacher said: "You remember what happens when we boil the water?" This brought a new dimension to the children and they themselves fund out what was happened. The principle 'Child's perspective, wonder, inquisitiveness and experiences' are in accordance with Driver's (1985) approach 'discovery learning' and also 'inquiry-based science education' which focuses on children's active construct of a hypothesis, clarification of own ideas based on own existing knowledge which results in meaningfulness and independence. Then follow an investigation of the hypothesis. An approach which is similar to Dewey's (1960) science method structure can be compared with the way Eisenkraft (2003) and Bybee (1997) suggest children appropriate science knowledge: Engage, explore, explain, elaborate and evaluate.

Children As Participants –The Child's Democratic Right to Participate in Own Learning

Children contribute to their learning via own activity (Leontjev, 1978; Vygotsky, 1978). More it is their democratic right to be active learners. According to United Nations Convention of the Rights of the Child (1989) it is children's right to be an active participant, but it is also the way children learn. The importance of children's agency for their learning and development is increasingly advocated in early childhood curricula (Carpendale and Lewis,2006). Teachers' views of child agency are associated with children's active interactions and participation in the learning environment and the extent to which they view children as capable and competent to participate in decisions and make their own choices in play and other activities (Berthelsen and Brownlee, 2005). Agency and participation are supported when preschool teachers recognize and build on children's interests and perspectives, when they are responsive to children's ways of thinking and communicating (Johansson and Pramling Samuelsson, 2006), and when they communicate and listen to children to identify and make learning visible (Pramling Samuelsson and Asplund-Carlsson, 2008). Thus the everyday educational (science) practice gives children a chance to be active participants and then being able to construct science knowledge. For example in a preschool children play with water, among other things they splashed water down the slide. Another child turned the direction, but although he splashed the water upwards, it returned to him, and he put forward the question: "Why runs the water always downwards?" This question opened for more questions, wonder and interesting dialogues between children and preschool teachers. And not least new experiments. The preschool teacher listened to the children and participated in the process as co-wondering (medundrende) which supported the children's experimental participation. An open and listening preschool teacher can support children's participation and thus their learning (Thulin, 2010). The notion of the active and participating child is not in contradiction to the participating preschool teacher. Studies of Fennefoss and Jansen (2012) show that preschool teacher's balanced participation and active contribution is a precondition for children's successful learning processes.

Children Learn In Interaction with Preschool Teachers

As earlier mentioned children's learning is under influence of the presence of preschool teacher. The interaction between children and preschool teachers must focus on a shared third, a need for to be together according to something. Thus the didactical category 'content' are of importance, and too to take the concepts contextual intersubjectivity and conceptual intersubjectivity into consideration. It is also a central dimension to strive for development of shared attention, shared intentionality or with Siraj-Blatchford's (2007) word sustained shared thinking. On basis of a didactical situation analyses, and in addition a here-and-now engagement and emphatic approach to the individual child, the preschool teacher is able to take children's interest into consideration, which pave the way for successful preschool teacher arranged activities.

In a science activity the child appropriates and constructs knowledge through interaction with a science competent preschool teacher, who is able to relate science concept to the child's practical experiments: Three four years old children play with water in basin and tried out objects to float and sink. During the play the preschool teacher ask a girl which of the objects can float. "This one" the girl said. "I see it, but why does it float?" "All the red ones float", the girl answered. Then the preschool teacher put some pebble on the top of a boat, and it still float. "Let me try" the girl said, and excited she cried: "Now it sinks" "Yes, you know why?" "Sure there is too much on the top" the girl respond. Through the preschool teacher's interaction and supporting questions the girl realized floating has nothing to do with colors, but something with buoyancy. This episode corresponds with other descriptions (e.g. Pramling and Pramling Samuelsson, 2001). In above example the preschool teacher expresses an active role (Hatch, 2010) in order to support children's science interest and understanding. Nevertheless the preschool teacher grasps the child's wonder or he/she invite the child to study a science phenomenon, so an active preschool teacher role is requested. The preschool teacher shall meet the child's interest at support the emerging reflection. If not many of children's science questions and wondering will die out. This is what happens in below example, where the child based on a present and sensuous experience expresses an interest on the moon, invites the preschool teacher to show interest and help him to understand. A five year old boy pointed at the moon approaching the preschool teacher: "Look at the moon, it is strange." "Well, what do you mean?" "It is half", the boy explained." "Oh yes" the preschool teacher said with a forthcoming voice. The boy replied: "It is because it is in the middle of the day" (Til Nicolay, måske mest korrekt: in broad daylight, but this was not the child's wording).The teacher presumed the child meant there will be full moon tonight, and for that reason she said: "Oh no full moon it takes much more time." The teacher closed the conversation and the child's reflection with this concluding remark, and thus obstructs a continuing process for understanding of thelunar phases.

Professional Preschool Teachers with Personality and Science Competence

Taking the child's perspective and take the child's wonder and questions into consideration are fundamental dimensions. In addition also a presence of an active listening and empathic preschool teacher, who wants and likes to be in interaction with children in science activities are elements for a successful science practice. However preschool teachers need to be science experts themselves. However this is not at all reality. Research shows that preschool teachers do not make use of academic science concepts to describe science phenomenon (Ejby-Ernst, 2012; Thulin, 2011; Shepardson, 2002). In order to bring children in activities which exceed their zone of proximal development, the preschool teacher need to present concept which belongs to the future, that is science concept. As Fleer and Raban (2006) state it is of importance, that preschool teachers are able to identify scientific concept, and if they have scientific knowledge on science they are able to support children's science activities both in planned and spontaneous science activities (Fleer, 2009). The action research project holds both examples of successful activities where preschool teachers make use of their science competences, and where lack of personal science knowledge resulted in the death of promising science activities. The importance of preschool teacher's science competence is obvious, but not enough. The science professionalism has to be connected with an emphatic attitude, ability to take a child's perspective and to follow the child's interest and way of thinking. This includes being able to improvise.

Children Learn in Everyday Life – Forward Panning

In general science education in preschool can be expressed in both planned and spontaneous upcoming activities, in formal and formal and non-formal learning situations (Eshach, 2006), based in backwards- and forward planning (Broström and Frøkjær, 2015). In the present action research an ovrweight of ofspontaneous activities were seen. Some of children's self-organized activities where they touch science aspects (for example got experiences with objects floating and sinking) remained as child activities without participating of preschool teachers. However according to Eshach and Fried (2005) such informal learning activities in the long run can benefit children's formal learning. In the present project a great deal of activities were based in children's wonder and questions where the preschool teachers in a certain extent succeeded to catch and elaborate together with the children. Through children's play and self-organized activities many relevant science possibilities emerge: Some four year old children discover a hole in the house from where air was streaming out. They wonder why, and together with a supporting preschool teacher they realized it was air from the running tumble dryer. From this starting point they covered the hole with plastic bags and played with their self-made balloons. The children showed an interest for air experiments, which could be seen as an invitation for continuing air experiments.

Take children's actual interest as point of departure for science activities is in accordance to research by Jordan (2010) which shows, that children's play holds potential for science experiments. However in order to bring such everyday events in line with science perspectives, preschool teachers must have a fund of science knowledge themselves. One might say that being able spontaneous to relate to children's here-and-now emerging science actions demand science capacity. For that reason some preschool teachers in the action project preferred to plan science activities in advance in order to have time to achieve the necessary science insight as background for planning. This is backwards planning and is in line with a study of Hedges which shows that New Zealand teachers are more inclined to support children's learning in planned situation (Hedges, 2002 in Edwards and Loveridge, 2011).

Grounded on such a secure basis some preschool teachers in the action project also involved children in preplanned and in structured activities as for example chemical experiments, building of volcanos. Opposite practice based on backwards planning most of the preschool teachers in the project in a wider sense made use of forward planning and grasped children's wonder, questions and other forms of initiatives in order to build up a science project: Some five year old boys dig up earthworm and placed them side by side. An observing preschool teacher asked them: "Do you know what they are called?" "Sure 'rain worms" (in Danish). "Sure, but do you know for what reason they are named 'rain worms?" the preschool teacher asked. The one boy replied (sat up a hypothesis): "They love rainy weather". "How comes?" the teacher asked. "You just know." "Let us try it out" the preschool teacher suggested. Then together they made up two different environments. A dry sunny area, and a wet shadowy one. The boys placed the worms in the sunny environment and look carefully after what happens (the experiment). After a (long) while the worms had placed themselves in the wet area. And then one of the boys said: "Exactly what I said" (conclusion). Such examples were very often seen and are predominated over the preplanned science activities. This is also in agreement with the tradition of Danish early childhood education were informal learning methods in an extent size are found. But in both cases preschool teachers make use of similar educational approaches among others they make use of play oriented methods and a psychological methods (opposite a logical method). In the early start of the action research project Feynman's example of 'how Richard's father taught his son' was presented (Feymn,1989, in Eshach, 2006, p. 29). The story is about a boy asking his father about the name of a bird. But instead of to answer directly (and with that close the conversation) the father points out the fact, that the bird pecks its feather all the time, and then they together reflect the question 'why'. They moved from observation the surface to reflect on a fundamental question. The example opens for using a psychological method, e.g. Dewey (1960) who argues to start with what is familiar to the child and then formulation of an authentic problem. Such approaches combined with Driver's (1985) 'discovery learning' and also 'inquiry-based science was presented early in the project to the preschool teachers and probably with a certain impact. Most likely such models describing a move from the first experience to problem formulation and then reflection have probably inspired many preschool teachers to work out theme oriented activities based in projects, as examples themes like: what fish do we see in the sea?; we are fishing crabs; fighting stags; and also long lasting projects themed water, air and light. Such themes emerged often from episodes in everyday life which preschool teachers catch and expand together with the children.

Discussion

The first theme to be discussed is as earlier described the paradox that Danish preschool teachers give a low priority to science education, which is in contrast to children's interest (Davies, 2011; Eshach, 2006) and the societal need for science knowledge. However, nevertheless the action project showed that the involved preschool teachers were engaged in shared science activities with the children. They enjoyed the activities and the children's emerging knowledge, and they saw themselves in a new role: A professional preschool teacher with academic (science) knowledge, who influences children's (science) learning. The action project showed that preschool teachers are willing to create science activities when they are supported and are inspired with science knowledge and educational science methods. So you might think the research by Sacķes (2014) and Edwards and Loveridge (2011) pointing out variable like teachers science education and science subject knowledge are crucial to preschool teachers willingness and ability to set up science activities. And probably you might conclude the other way around, namely lack of subject knowledge might be an influential factor for Danish preschool teacher's presumption that children learn when they are allowed to be in peace and quiet (Broström et al., 2014).Thus it seems to be of importance to support preschool teachers with science subject knowledge and also educational methods in order to incorporate the science dimension in children's everyday life in preschools.

The second theme for discussion is preschool teacher's tendency to support children's misconception or preconception of science phenomenon by a science understanding characterized by an anthropocentric thinking and also their tendency to think the world is created by humans and human beings are center of the world. No doubt science education seeks to contribute to a scientific thinking and children's mastery of science concepts. But such an understanding has to be constructed and appropriated by children themselves. It cannot be passed over from the preschool teacher. For that reason the described four educational principles have to be taken into consideration. First of all pivot for a science Didaktik must be the principle of 'the child's perspective, wonder, inquisitiveness and own experiences'. However, the respect for children's own discovering activities and construction of knowledge, and also the idea of to take children's existing knowledge as a starting point (Ausubel and Robinson, 1971) can easily result in a misunderstanding. Namelya preschool teacher as a passive but interesting observer, who mentally and empathic supports the child's experiments and knowledge construction, but without intervention. The lack of active interaction with the children in order to challenge their knowledge construction might result in misconception of science phenomenon, among others an anthropocentric understanding. So the problem is how to balance on the one side children's wonder, their own construction of knowledge and on the other side a teaching approach giving children a scientific understanding of science phenomenon. In general the answer might be a striving for as many shared activities as possible, where children and preschool teachers make up shared interaction where they discover science phenomenon together. The preschool teachers are responsible for creating an interaction and dialogue characterized by intersubjectivity, joint shared attention (Tomasello, 2008) combined with a leading role and guiding the child's investigative activities in order to make it possible for the child to gain scientific knowledge. However, the preschool teacher must be ready to follow the speed of the child's learning process. That means sometimes the preschool teacher has to accept children's "wrong" and inadequate science understanding. Sometimes the child is not ready to take in new challenges and questions. Nevertheless the preschool teacher thinks it is obviously to present a question or experiment, sometimes the children's interest and activities are focused towards other subjects and tasks. Then the preschool teacher has to wait.

The preschool teacher's effort for making up a balance between on the one hand to support children's wondering, experimental activities and their own construction of knowledge, and on the other hand a guidance and help in order to gain fundamental science knowledge is as important in so-called forward planned activities as backwards planned activities. Backwards planning opens for well reflected science knowledge but there is a risk for carrying through a well-greased process and overlooking children's wonder and own refection. Opposite in death mouse practice or forwards planning where the child's interest is the foreground, there is a risk to drown in the random themes, which actually do not opens for science themes and problems, or the preschool teacher is not able to grasp the immanent science potential in the moment. A sustainable science Didaktik has to take both dimensions into consideration and also experiment with an eye for a possible merger between the two panning strategies. In the forward planning preschool teachers should be more aware of the possibility to integrate their existing science subject knowledge, and in backwards planning preschool teachers should make use of their creative thinking in order to integrate children's here-and-now wondering and initiatives.

Conclusion

The action research project build on three research questions:

Is it possible to create a preschool science Didaktik, which balances a social pedagogy and a critical democratic Didaktik without tendency to schoolification?

- Which educational principles might be possible and necessary for a science Didaktik in preschools?
- What role should the preschool teacher have in order to engage the child in science activities and during the activities?

The action project has more than less shed light on these questions. According to the first question in general the existing Danish social pedagogy preschool tradition and the consistent idea of taking children's wonder and active participation into consideration have been a bulwark against the risk for scoolification. Due to the fact, that forward planning has domineers over backwards planning children's voices have been heard and thus their influence. However this does not automatically lead to a critical democratic Didaktik.

Although children's self-determination and also co-determination in a great extent have been seen, there have been relative few examples of activities characterized by solidarity according to Klafki's understanding. In addition children have only in a limited degree been involved in themes with critical dimensions, e.g. so-called epoch typical themes. The action project has spent more time related to the second research question about educational principles, and thus the involved preschool teachers had a clear focus on production and testing of science educational principles. During the project the preschool teachers have renounced the educational idea that children's learning happens best when they are left alone and gives possibilities to quiet and peace. In contrast they have created and take ownership of the four educational principles, which together call for active children in interaction with active preschool teachers. Thus one might say that the project has constructed sustainable educational principles. According to the third research question about the preschool teacher's role, the project has gained knowledge and experience about the importance of an active preschool teacher which actually is inscribed in the third of the educational principles. The participating preschool teachers have experienced the importance of e empathic, listening andco-wondering (medundrende) preschool teacher, who are able to support children's wondering and inquisitiveness contemporary with leading the child's activity towards a scientific understanding without given fixed answers. In sum together the participating researchers and preschool teachers have taken a step towards the formulation of a Danish science Didaktik. However there is still a need for theoretical studies and practical experiences plus a more visible and sustainable early childhood education policy.

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The science of early brain development can inform investments in early childhood. These basic concepts, established over decades of neuroscience and behavioral research, help illustrate why child developmentâ€”particularly from birth to five yearsâ€”is a foundation for a prosperous and sustainable society.Â Credit: Center on the Developing Child. Policy Implications. The basic principles of neuroscience indicate that early preventive intervention will be more efficient and produce more favorable outcomes than remediation later in life. A balanced approach to emotional, social, cognitive, and language development will best prepare all children for success in school and later in the workplace and community. During early childhood, children actively engage in acquiring fundamental concepts and in learning fundamental process skills. As we watch children in their everyday activities at various stages of development, we can observe them constructing and using concepts such as.Â A major area of interest in science education research is the teaching of science through inquiry. Research findings and the national reforms in science education overwhelmingly support this notion. The U.S. Department of Education and the National Science Foundation (1992) endorse mathematics and science curricula that promote active learning, inquiry, problem solving, cooperative learning, and other instructional methods that motivate students. Early childhood education is not mandated by the United States Department of Education. Elementary and secondary education is all that is legally required for students, though early childhood education is doubtlessly an important and fundamental stage of learning. Working With Young Children. How Can I Become an Early Childhood Educator?Â Working With Young Children. When deciding if early childhood education is right career choice for you, the first and most important question to ask yourself is: Do I like working with children? If you canâ€™t answer yes, then this career may not be best for you. Working with children requires patience, dedication and sensitivity.