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# **ENTANGLEMENT OF SCIENCE TEACHERS' LIVES AND WORK**

**BY  
PEER S. DAUGBJERG**

DISSERTATION SUBMITTED 2013



**AALBORG UNIVERSITET**

# **Entanglement of science teachers' lives and work**



**Peer S. Daugbjerg**  
**PhD Thesis**

**Aalborg University, Department of Learning and Philosophy**  
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Name of the PhD student: Peer S. Daugbjerg

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## Summary

This thesis focuses on science teachers' lived experience, their social position and their teaching. The guiding question for the documented research has been: How is science teachers' work related to their lives? The aim was to situate the voice and body of science teachers in the contemporary era of educational restructuring. The teachers' work and lives in the contemporary school settings are based on the continuity of their experiences and the relations that have formed them. The interaction between critical influences and tensions shapes the personal and professional experiences, and further produces negative or positive outcomes in terms of teachers' sense of commitment, resilience, well-being and capacity to teach. Personal and professional events constitute and shape a teacher's past and present experiences. They may not be conspicuous at first glance, but they somehow affect the way the teacher relates to the children and also how she plans, performs and evaluates her teaching.

At the societal level I have been studying how contemporary changes within educational politics affect the conditions for science teaching in general. The empirical basis for this research was curriculum, administrative orders, political statements, etc. These texts were investigated for discursive intertextuality in the two papers regarding the societal level I include in this thesis. The research done by two fellow PhD students, my supervisor and me shows the impact of global neoliberal educational discourse on primary science teaching in Denmark and finds the implementation of educational reform initiatives not very efficient. The presented research literature and the conducted discourse analysis of educational restructuring establish some of the contemporary social positioning of a Danish primary science teacher. This helps to interpret the individual teacher stories collected during the research on lived experience and teaching practice. Without the analysis of contemporary educational politics in Denmark I would have been unable to address the societal profession level in a way that is relevant for my study of science teachers. The aspect of ownership of reforms gains relevance because they are analysed as science education reforms not as general education reforms.

At the personal level I have intensively studied how personal and professional experiences relate in science teachers' work and teaching. Experiences are often de-

duced from the stories that life history researchers hear from their research participants. But the relation between the actual life, the lived experience and the stories told about these experiences is not straightforward. Feelings, emotions, desires, thoughts, etc. influence the way the experience relates to what actually happens or happened and how it is retold. I define, together with my supervisors, three dimensions of experience, one dimension dealing with the temporal *continuity* of actions and experiences, another one dealing with the educational *settings* of the actions and experiences, and a third dealing with social, material and personal *relations* of the actions and experiences. These dimensions are used to analyse teachers' actions in classrooms and their told narratives on their lives. My research on the personal level consists of five papers. In the first paper two VIA UC colleagues and I use life history research to illustrate the social restructuring of teacher work in a specific rural area. In the second paper I demonstrate how science teachers' experiences are brought forward by the use of narrative inquiry, and argue in favour of this happening. In the third paper I discuss science teachers' resilience and retention in the teaching profession in a general teacher profession research perspective. In the fourth paper my supervisors and I elaborate on the significance of science teachers' bodies and actions in their teaching inspired by post-humanistic theory on embodiment. In the fifth and final paper my co-supervisor and I use research fictions to investigate and communicate the emotion of science teachers in their approach to science subject matter. Without the personal narratives and direct observations of the teachers I would have been unable to address the personal level of the relation between work and life. My shifting theoretical and thereby also analytical approaches provide me – and my shifting co-authors – with different aspects of the relation between a science teacher's life and work, aspects that the continuity, relation and setting dimensions of teachers' experience make it possible to describe.

Life history research provides me with an overarching frame for describing the personal and the societal profession level from different perspectives on the relation between the life and work of science teachers. A first general remark would be that science teachers care about, and are dedicated and committed to, children, science education, their own professional development and nature. They care in a manner that is both dependent and entangled in their personal life history. Like pea plants entangling themselves and their immediate vicinity with their tendrils as they grow; science teacher's commitment is a personal entangled and entangling



growth of peas, made by past and present experiences. Yet another aspect adding to the complexity is that experiences are not stable entities, they dynamically change according to new experiences and to the shifting contexts of retelling experiences. Overall concluding remarks can be broken down into different details according to the audiences of the remarks.

Teachers will relate and have related to my presentation of science teachers' life and work as a mirror that shows them 'so this is what I looks like for an outsider'. They recognize the balance of the complex intensity of everyday teaching described in the observations and their intention to improve the life opportunities for their pupils they tell about in the life stories in the interviews. The narratives also clarify difficulties in maintaining this balance and even sometimes the breakdown of it.

Teacher educators can probably learn from paying attention to the personal life history of their teacher students. Likewise school politicians and managers could learn to make room for the personal life history in their professional development and management of science teachers' work skills and knowledge. It is quite clear how the past and present experience of the participating teacher acquired outside teaching is entangled in their practice in science education. This is a potential frequently overlooked in the pre- and in-service education of science teachers. Of course, the experiences can also be delimiting for a teacher's commitment to parts of the subject matter, but this is all the more reason for addressing these personal experiences and working with them.

Science education researchers are often prescribing, implementing and evaluating changes and improvements in science education. They should, along with school politicians and managers, be aware that any change or reform initiative is entangled in each teacher's personal life history. Teacher narratives reveal how the individual teacher's personal entanglement of life and work is constituted, thereby providing an understanding of the interpretation the individual teacher has of the implementation and/or evaluation in process.

To condense this summary I would say that science teachers' work relates to their lives in an entangling manner that makes it impossible, and even a mistake, to try to separate the two.



## Resumé

Denne PhD-afhandling, *Sammenfiltrering af naturfagslæreres liv og arbejde*, fokuserer på naturfaglæreres livserfaringer, deres sociale position og undervisning. Undersøgelsesspørgsmålet i den bagvedliggende forskning har været: Hvordan er naturfagslæreres arbejde relateret til deres liv? Målet har været at forstå naturfagslæreres udtalelser og handlinger i forhold til deres position i den aktuelle omstrukturering af uddannelsesverdenen. Naturfagslærere lever og arbejder i skolens aktuelle rammer og vilkår ud fra kontinuiteten i deres erfaringer og de relationer som har formet dem. Interaktionen mellem afgørende påvirkninger og spændinger former de personlige og professionelle erfaringer og skaber ydermere negative og positive resultater i form af engagement, robusthed, trivsel og kapacitet til at undervise. Personlige og professionelle begivenheder udgør og former en lærers tidligere og nuværende erfaringer. De er måske ikke umiddelbart iøjnefaldende, men de påvirker alligevel den måde læreren relaterer til elever, samt hvordan hun planlægger, gennemfører og evaluerer hendes undervisning.

På samfundsniveau har jeg studeret, hvordan de aktuelle forandringer indenfor uddannelsespolitik generelt påvirker vilkårene for naturfagsundervisning. Den empiriske basis for denne forskning har været *Fælles Mål* for folkeskolen, samt love og bekendtgørelser for folkeskole og læreruddannelse. Disse dokumenter er analyseret for diskursiv intertekstualitet. Denne forskning er gennemført sammen med to andre PhD studerende og min vejleder, forskningen er dokumenteret i to artikler i denne afhandling. Forskningen påviser hvordan globale neoliberale diskurser har påvirket naturfagsundervisning i den danske folkeskole, samtidig viser vores forskning at reforminitiativer er blevet implementeret med ringe succes. Den behandlede forskningslitteratur og den gennemførte forskning om omstrukturering af uddannelsessektoren demonstrerer aspekter af folkeskolelæreres aktuelle sociale position. Disse aspekter understøtter min fortolkning af de individuelle lærerfortællinger, jeg har indsamlet under min forskning af læreres livserfaringer og undervisningspraksis. Uden analysen af den aktuelle uddannelsespolitik ville jeg ikke kunne have behandlet samfundsniveauet på relevant vis i forhold til mit studie af naturfagslæreres liv og arbejde. Specifikke analyser af skolereformer vedrørende naturfag er vigtigt for at kunne beskrive netop naturfagslæreres ejerskab af uddannelsesreformer.

På det personlige niveau har jeg detaljeret studeret, hvordan personlige og professionelle erfaringer er relateret i naturfagslæreres arbejde herunder undervisning. Erfaringer udledes ofte fra fortællinger som livshistorieforskere hører fra deltagere i deres forskning. Relationen mellem det faktiske liv, livserfaringer og fortællingerne om disse erfaringer er ikke ligefrem. Følelser, stemninger, ønsker, tanker, etc. påvirker hvordan erfaringer forholder sig til det der faktisk skete og sker, og hvordan det genfortælles. Jeg definerer sammen med mine to vejledere tre dimensioner som beskriver erfaringer: en dimension omhandler den tidslige *kontinuitet* af handlinger og erfaringer, en anden dimension omhandler de uddannelsesmæssige *rammer og vilkår* for handlinger og erfaringer, den tredje og sidste dimension omhandler de sociale, materielle og personlige *relationer* i handlinger og erfaringer. Disse dimensioner bruges til at analysere læreres handlinger i klasserummet og deres fortællinger om deres liv. Min forskning indenfor det personlige niveau udgøres af 5 artikler i denne afhandling. I den første tidsskriftartikel præsenterer jeg sammen med to kollegaer fra VIA UC, hvordan social omstrukturering på en egn i Danmark præget af landbrug og fiskeri påvirker læreres livshistorier herunder valg af profession og tilgang til lærerarbejde. I den anden conferenceartikel viser jeg hvordan narrative undersøgelser kan gøre naturfagslæreres erfaringer tilgængelige, og jeg fremhæver behovet en sådan tilgang til studier af naturfagslæreres liv og arbejde. I den tredje conferenceartikel benytter jeg lærerprofessionsforskning til at diskutere, naturfagslæreres robusthed og fastholdelse i lærerprofessionen. I den fjerde tidsskriftartikel undersøger jeg sammen med mine vejledere betydningen af læreres kropslige handlinger og erfaringer i deres naturfagsundervisning ud fra posthumanistisk teori om det levende og det materielle. I den femte og sidste antologiartikel arbejder jeg sammen med min bi-vejleder om, hvordan forskningsfiktioner kan undersøge og formidle læreres følelsesmæssige relationer til naturfag og undervisning i af naturfag. Uden lærernes fortællinger og observation af deres handlinger i klasserummet og udenfor ville jeg ikke have været i stand til at behandle det personlige niveau af relationen mellem naturfagslæreres liv og arbejde. Mine skiftende teoretiske og dermed også analytiske tilgange har givet mig – og mine skiftende medforfattere – indblik i forskellige aspekter af relationen mellem naturfagslæreres liv og arbejde. Aspekter som træder frem gennem analyse af de tre erfaringsdimensioner kontinuitet, relationer og rammer og vilkår.

Livshistorieforskning har givet mig en ramme til at beskrive aspekter af det personlige og det samfundsmæssige niveau med forskellige perspektiver på relationen

mellem en naturfagslærers liv og arbejde. Et generelt aspekt er at naturfagslærere er optagede af og engagerede i deres forhold til eleverne, af deres egen viden om og forståelse af natur, naturvidenskab, naturfagsundervisning og endelig deres egen professionelle udvikling. Naturfagslærerens engagement er som sammenfiltret og sammenfiltrende ærtehal. Hvor ærtehalens sammenfiltrering skabes af ærteplanternes slyngråde, der vikler ærteplanterne sammen og sammen med deres umiddelbare omgivelser; er naturfaglæreres engagement sammenfiltret af tidligere og nuværende erfaringer fra både deres liv og arbejde. Et andet aspekt som bidrager med kompleksitet til ærtehalmen af erfaringer er at erfaringer ikke er stabile, de ændrer sig dynamisk afhængigt af nye erfaringer og skiftende kontekster hvori disse erfaringer genfortælles. Et tredje aspekt er opmærksomhed på hvilket publikum man som forsker ønsker at formidle fortællingerne fra de deltagende lærere til.

Naturfagslærere vil forholde sig og har forholdt sig til min præsentation af naturfagslæreres liv og arbejde, som et spejl der viser, hvordan deres arbejde og undervisning ser ud for en udenforstående. De afvejer den komplekse intensitet af daglig undervisning beskrevet i observationerne med deres intention om at forbedre deres elevers livsmuligheder fortalt i livsfortællingerne i interviewene. Fortællingerne præciserer besværlighederne i at opretholde denne balance og i dens lejlighedsvis sammenbrud.

Læreruddannere kan sandsynligvis lære at vise opmærksomhed til den personlige livsfortælling af deres lærerstuderende. På samme måde kan skolepolitikere og skoleledere lære at skabe rum for den personlige livshistorie i deres udvikling og ledelse af naturfagslæreres arbejdsfærdigheder og –kundskaber. Den præsenterede forskning viser, hvordan de deltagende læreres tidligere og nuværende erfaringer tilegnet udenfor skoleverdenen er sammenfiltret med deres praksis i naturfagsundervisning. Dette udviklingspotentiale er hyppigt overset i såvel grund- som efteruddannelse af naturfagslærere. Erfaringer kan også være begrænsende for en lærers engagement i dele af et naturfags indhold, men dette er blot så meget desto mere grund til at tage udgangspunkt i personlige erfaringer og arbejde med dem.

Naturfagsdidaktikforskere foreskriver, implementerer og evaluerer ofte forandringer og forbedringer i naturfagsundervisning. De kunne med fordel, ganske som skolepolitikere og skoleledere, være opmærksomme på hvordan forandringer og reforminitiativer bliver sammenfiltret med den enkelte lærers personlige livshistorie. Læreres fortællinger afdækker hvordan den enkelte lærers personlige sammen-

filtrering af liv og arbejde er sammensat, hvilket giver en forståelse af den enkelte lærers fortolkning af implementerings- og/eller evalueringsprocessen.

For at sammenfatte dette resumé vil jeg fremhæve at naturfagslæreres arbejde er sammenfiltret med deres liv på en måde som gør det umuligt og endog en fejltagelse at adskille de to.

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But first and foremost the teachers, who so generously gave me access to their classrooms and their life stories.

Finally, but definitely not least, my family – mostly my wife Lisbeth – for watching my back, both in a figurative sense, tolerating my many travelling days and covering the losses back home, and literally watching my back bend over the computer and books.





## Preface

The PhD work that I document in this thesis started in 2007. It started with my own preliminary reflections that led to discussions with different university employees and university managers, my own university college managers and colleagues in the spring of 2007. It took off when, in the early spring of 2008, I made contact with Paola Valero, at Aalborg University. After reading some of my very early writings she immediately said that such work could become an interesting and worthwhile PhD study.

My PhD study has been an evolutionary endeavour where many small and big events have interacted to guide me in my academic work. The most significant events have been:

- 1) My participation in VIA University College's Life History research programme from 2008 to 2010. This work got me started. It pointed to what I could do, and what I should not do. This academic work functioned as a pilot study and a methodological exercise for my own following study. This work formed the empiric basis for three papers, two of which are included in this thesis.
- 2) My participation in a PhD course at Oslo University on 'International organizations and national policy of education', over three days in March–April 2009. This course helped structure my work with the political and societal side of teachers' work. It furthermore consolidated a study group on this formed by Senior Lecturer Jette Schmidt, UCN; Senior Lecturer Martin Sillesen, VIA University College (VIA UC); our supervisor Paola Valero and myself. The work of this group resulted in an ongoing production of papers, one of which is published, and another paper is under review. Both are included in this thesis.
- 3) Meeting Wolff-Michael Roth and Luis Radford on a PhD course at Aalborg University in November 2009. Their talks and the readings at this course on 'Learning-in-practice: Socio-cultural and political theories in engineering, mathematics, and science education' opened the fields of ontology and epis-

temology to me, a field that has been driving my effort to communicate my research findings.

- 4) Participating in the ‘Narrative Research in Progress Conference’ in Anchorage, Alaska in May 2011. This conference opened the field of narrative research to me.
- 5) Meeting and cooperating with Elizabeth de Freitas, who in December 2011 became my co-supervisor. This cooperation opened the field of communicating academic work and research results to me. It helped me finally bring all my work together. This cooperation has resulted in two papers.

The orchestration of this educative journey has been performed by my ever-challenging SUPERvisor Paola Valero. Paola is always likely to ask me questions that make me go back to my data and my sources of research literature and reconsider my approach, my work, and my thinking. Without that challenge my work would not have been so interesting to do – and hopefully to read. It would have been just one more traditional brick in the academic brick wall.

The work done during a PhD study is educating one to become a ‘real’ researcher. The ‘as if’ work done during a PhD study can, be more or less like real research. Within some institutions it is traditional to write and present a monograph. At other institutions it is traditional to produce a series of papers and present them in an anthology. My approach has been to produce papers where the process of writing, receiving reviews and publishing papers in research journals and presenting at international conferences has formed my research qualifications; an education that is very close to the real work conditions – thereby also a slow socialisation into them – of the permanent staff at universities in the present bibliometric publish-or-perish regime of research. Even though much of my data is acquired through the interaction with involved teachers, they are not part of any of the writing processes. All my papers disseminate research results to the general public, i.e. to whom it may interest in the (science) education research community.

Coming from an everyday of educating teachers in Denmark at VIA UC, I had to cross a border into another culture – the contemporary culture of educational research at universities. I have a master’s degree in biology, and have published research papers as part of that study. So I’m not unfamiliar with the university codes of producing academic research papers. Very few of these 25-30-year-old experi-

ences apply today, however, within educational research. I have, though, benefitted from my 17 years as a teacher educator as it gave me some basic knowledge of the concepts and language of contemporary educational research.



## Research background

When I started planning for my PhD work in 2007 science education discourse and politics in Denmark were greatly influenced by international studies such as PISA and TIMSS. These studies showed that science teaching in public schools in Denmark had weaknesses. Measured with the methods of these studies, Danish children performed below average of the mean of the studied countries. This became a concern for Danish parliamentary politicians, and it led to a number of initiatives by the Ministry of Education, e.g. reports like 'Fremtidens Naturfaglige Uddannelser' [The future science educations] (Andersen et al., 2003) and 'Fremtidens Naturfag i Folkeskolen' [The future science in primary and lower secondary school] (Andersen et al., 2006). These reports recommended, among other things, changes in the science education curriculum in primary schools and teacher education, changes that were subsequently developed and implemented. Furthermore, funds were made available from 2007 to 2009 to partially support public school science teachers to take courses and diplomas in science teaching. This education provided science teachers with an opportunity to gain knowledge of contemporary science education research and practice. This new knowledge could potentially lead to changes and improvements in science teaching in public schools, if the schools provided an opportunity for the teachers to apply this newly gained knowledge into teaching practice. An investigation in 2007 documented the need for the education of more science teachers, as science teaching in public schools in science subjects like primary science and geography were shown primarily to be taught by teachers who had not been educated in science teaching (Danmarks Lærerforening, 2007).

In this environment of change and restructuring I started reflecting on how the individual science teacher experienced these changes in their work conditions. The focus on teachers' competencies and their qualifications is fair and reasonable, but: How do the teachers themselves experience their opportunities to do science teaching? Very few investigations in Denmark characterise the teachers' perspective in science teaching (e.g. Sillasen, Valero, & Sørensen, 2010), and none give a detailed analysis of science teachers' past and present experiences in or outside school. Science teachers in the public Danish schools express concern regarding a mismatch between pupils' opportunities for absorption into the subject matter and

the size of the curriculum, which reduces the pupils' options for having an influence on the teaching process. Science teachers also say that they have very limited opportunities to develop their teaching through dialogue with colleagues (Broch & Egelund, 2002). Nordic teachers, despite national nuances, express a common experience in the dilemma of decreasing resources and increasing demands. They find that they are losing control over their work as their workload is increasing, especially through tasks besides the traditional classroom work (Klette, Carlgren, Rasmussen, & Simola, 2002). Despite these findings of increasing workload negatively affecting teaching, the teachers still teach. They could leave the profession and become something other than teachers. Adding to this paradox is a finding from the quoted Nordic study that Nordic teachers understand their essential qualifications as mainly social and personal; they say that their early academic education only gives status to the profession (Klette et al., 2002). It seems that some of the significant experiences that keep teachers teaching come from outside school and teacher education, and are not restricted to their amount of professional knowledge and their mastery of the curriculum.

Realising this I turned to the vast international research literature on the relation between teachers' lives and work (e.g. Day & Gu, 2010; Goodson & Sikes, 2001; Huberman, Jürg & Gronauer, 1993; Lortie, 2002). This literature generally has one shortage seen from a strictly science teaching point of view. It concerns general non-subject-matter-oriented aspects of teaching. Within science education research the opposite situation prevails. A quantitative review of the content of 802 research papers presented in three leading science education research journals during 1998-2002 shows that only 7% of the papers deals with teaching, which covers teacher thinking, behaviour and strategies along with teacher knowledge (Tsai & Wen, 2005). Lee, Wu and Tsai (2009) repeated the quantitative study of Tsai and Wen. They found a doubling of the percentage of paper dealing with teaching during 2003-2007. They further found that none of these articles were among the highly-cited articles in 2003-2007. Contemporary international research into science teachers' professional development is reviewed in the *Handbook of Research on Science Education* edited by Abell and Lederman (2007). These reviews show that the research has its primary focuses on individual teachers' knowledge, attitudes and beliefs about the contents of the curriculum or the science topics to be taught. In all teachers' life history is not yet a very well-explored research topic in science education. A broader understanding of science teachers and of what seems to influ-

ence their decisions as science teachers seems not to be in the scope of interest of existing science education research. Dedicated studies of how science teachers' life and work are affected by experiences inside and outside classrooms as well as during and prior to their teaching career are scarce in the international literature and rarer in a Danish context. Some studies touch aspects of science teachers' experience but they seldom investigate experiences acquired prior to pre-service education and seldom pay significant attention to experiences acquired outside the teaching profession (e.g. Lund Nielsen, 2012). Huberman et al. (1993) do address the significance of subject knowledge in their study, but they do not distinguish between different subjects, so their conclusions are on a general level of teaching subjects. Presumably different life experiences have similar significance to science teachers as other subject matter teachers in their work, but this seems to be under-researched. It seemed to me that there was a gap between teachers' life and work research and science education research. The present study tries to make a small contribution to filling this gap.

Based on the above introductory reflections, my research interest focused on gaining insight into how teachers experience their science teaching work in detail and into how this relates to their life in general. The study of teachers' professional lives can, by staying close to the everyday working lives of the teachers as professionals, find how the rhetoric of teacher and educational reform actually plays out (Goodson & Hargreaves, 1996, p. 22). My study draws on much from research on teachers' lives and work with respect to the mixed use of narrative teacher interviews and contextualising such teacher stories within school and curriculum development through school and classroom observations, and curricular and educational politics analysis. Such broad access has proven fruitful in studies of teachers performed by Goodson (1992) in England, and Goodson and Numan (2003) in Sweden. A broad mixed-method access has also been used in the European large-scale project 'Professional knowledge in education and health: restructuring work and life between state and citizens in Europe' (ProfKnow) (Goodson, 2008; Goodson & Lindblad, 2011; University of Gothenburg, 2010). This project investigated primary and lower secondary school teachers' life and work, as well as the restructuring of the welfare state in seven EU countries – but not Denmark. The ProfKnow project has subscribed to recent decades of research within educational restructuring (Lindblad & Goodson, 2011). The ProfKnow project found some common worklife narratives in all the participating countries. Teachers' lives and work were

affected by more demanding students, increased student diversity, more assertive and demanding parents, and finally loss of status, prestige and respect.

These studies imply that by getting science teachers to tell their professional life story and combining this with observations and relevant policy analysis, it could be possible to get a detailed and valid understanding of science teachers' experience and ways of working in broader terms than what has been documented in existing research on science teachers. My original research question, formulated in the tradition of teacher life and work research, was stated as:

How do science teachers' lives and work interact?

This phrasing sets work and life up as two easily comparable and distinct entities. It has become ever clearer during the research process of talking to teachers, reading research literature and writing papers that this is not the case. Teachers' lives include personal elements as well as work elements (Day & Gu, 2010, p. 33). Teachers' work is a part of their life in its entirety. They are human first, then science teachers. So the relation between work and life is from work within life, to life in its entirety, or in the words of Goodson:

By tracing this person's life over time, it becomes possible to view the changes and underlying forces which influence that person at work – to estimate the part which teaching plays within the overall life of the teachers. (Goodson, 1980, p. 69)

Such a 'within' framing of the relation between work and life, where work is part of the overall life and life is an inseparable part of work and teaching, indicates that it can be misleading to specify anything about the quality of the relation between life and work prior to the research process. This has led me to rephrase my research question into a research problem:

How is science teachers' work related to their lives?

Before continuing, I will give a few delimiting comments about my study that will help clarify how I have studied and investigated this problem. Science teachers are in this study primary and lower secondary school teachers teaching science subjects in Danish public schools. I will return to the structure of science teaching in Danish public schools when I discuss the contemporary restructuring of science education in Denmark. Science teachers' work includes teaching of children, dia-



logue with colleagues, management and parents, supervision of pupils during breaks, correction of assignments, etc. Their lives include every event they have experienced since birth and their perceptions of the contexts in which these experiences occurred. My research interest is in understanding how the individual teacher's work is related to his or her past and present life. My interest can be said to try to establish the centre of gravity for the individual teacher's professional life (Goodson, 2011, p. 80).

I start the thesis with a review that discusses research literature on the relation between the life and work of teachers and distinguishes between researching the relation on a generalised societal profession level and on an individualised personal level. I then address the relation between life and work on a societal level by turning to the contemporary conditions and restructuring within the teaching profession in Denmark. Here I first give a review of research literature within educational restructuring presenting general theoretical considerations. I then turn to the research I have been conducting in this field in order to saturate my understanding of the societal and political context of the personal narrations given by the science teachers. My main research effort has, however, been on the details of teachers' lived personal experience using shifting sociological and ontological approaches such as narrative studies and research fictions. I review and discuss the research literature within lived experience and narrative inquiry presenting general theoretical and methodological considerations. After this I present my applied empirical method for engaging with the science teachers. In my writing and analysis I have used various research approaches as it turned out that one approach alone did not grasp all the nuances of the relation between the life and work of the participating science teachers. The shifting approaches used in the papers should be seen as uneven bits that complement each other like a growth of peas to generate a richer picture of the relation between the life and work of science teachers. I end by summarising my entire work and presenting my overall learning.

## **How teachers' work and life relate**

Many studies have dealt with the relation between the life and work of teachers. They have applied a variety of methods from large-scale psycho-sociological framework studies (Huberman et al., 1993) and large-scale integrated mixed-method studies (Day, Sammons, Stobart, Kington, & Gu, 2007) to individual life history studies (Goodson, 1980, 2010). They provide different insights into how personal, emotional, organisational and intellectual ideas are embedded in a teacher's life as well as work (Lieberman, 2010). The interaction between critical influences and tensions shapes personal and professional identities, and further produces negative or positive outcomes in terms of teachers' sense of commitment, resilience, well-being and capacity to teach (Day & Gu, 2010, pp. 63-64). This indicates that significant events and experiences in the individual teacher's life are present in the classroom and in the teacher's body and mind while she is teaching. Personal and professional events constitute and shape a teacher's past and present experiences. They may not be conspicuous at first glance, but they supposedly somehow affect the way the teacher relates to the children and also how she plans, performs and evaluates her teaching. If we want to understand a teacher's teaching, we have to understand the person as well as the professional the teacher is. This leads to methodological considerations on what investigative approach can bring forward an individual teacher's particular and personal story, and position it in the social phenomenon of the teaching profession.

### **Studies of teachers' lives and work**

This section will review and discuss some of the research within teachers' lives and work. The section will end by pointing out the two research approaches I took up in my subsequent research. I will discuss a variety of research on teachers engaging in different aspects of their life and work. The discussion will include some of the seminal works as well as more recent studies.

Studies of teachers' careers have been conducted by several researchers. Some try to establish qualitatively different phases of teachers' careers (Day & Gu, 2010; Fessler & Christensen, 1992; Huberman, 1993; Sikes, 1985). Others try to reconstruct the learning of teachers over time (Kelchtermans, 2009; Lortie, 1975). Oth-

ers again study how stress can make a career discontinuous or even finish it (Tro- man & Woods, 2009). Characteristic of these studies is that they rarely relate to teachers' lives outside school, they are concerned with the professional work life of the teachers. Other studies do pay attention to the relation between the teachers' personal and professional lives (Day, 2000; Day et al., 2007; Goodson, 2008). Some studies add the past and present social positioning of teachers' work and life to their research approach (Goodson, 1980; Goodson & Numan, 2003; Goodson & Sikes, 2001).

This variety in research approaches and purposes has opened up different under- standings of teachers' work (Day & Gu, 2010, pp. 43-44). A distinction can be made between doing a job to get a pay cheque, having a career for money and ad- vancement, and having a calling/vocation to contribute to the greater good (Selig- man, 2002). This leads Day and Gu (2010, p. 45) to elaborate the career phase thinking into a "notion of professional life phase – rather than career phase – [as it] also helps encapsulate not only the impact of psychological and sociological fac- tors on teachers' work and lives (as does the concept of career), but also that of personal, emotional and organisational factors". Such an all-encapsulating under- standing of how teachers' work is related to teachers' life in its entirety is very in- spiring for my investigation of how teachers' lived experiences relate to their teaching of science subject matter. I will, in the following research literature dis- cussion, focus on the work of three researchers within teachers' lives and life histo- ry: Dan Lortie from the US, Michael Huberman from Switzerland and Ivor Good- son from the UK, as they represent different understandings of the relation between the life and work of teachers.

Lortie (2002, first published in 1975) provides what is often referred to as a signifi- cant alternative conceptualisation of the question of teacher socialisation based on their personal and professional lives (e.g. Goodson, 2003, p. 56; Rasch- Christensen, 2010, p. 32). Lortie states the need for more empirical studies in an often quoted phrase (e.g. Goodson, 2000), "Schooling is long in prescription and short on description", here quoted from the 1975 foreword in the 2002 reprint edi- tion (Lortie, 2002, p. xvii). With his distinction between description and prescrip- tion Lortie wants to address the problematic lack of knowledge of school reality that found the basis of some school change initiatives. Lortie gives a historical overview of teaching in the US; departing from a chronological review he discuss- es teacher recruitment and socialisation, career rewards, teacher meaning and sen-

timents before closing his book with scenarios of the future. Generally he finds teacher education inadequate because teachers learn teaching through their own experience and this learning is individualistic. He discusses the continuing influence of former teachers on teachers' present teaching; he calls it the "apprenticeship-of-observation" (Lortie, 2002, pp. 64-67). Besides the importance of experiences as pupils, Lortie also points to the experience teachers gather as teachers: "teachers said experience was their major means of learning how to teach (ibid., p. 77)" and

It is not what "we, the colleagues" know and share which is paramount, but rather what *I* have learned through experience. From this perspective, socialization into teaching is largely *self-socialization*; one's personal predispositions are not only relevant but, in fact, stand at the core of becoming a teacher. (ibid., p. 79, italics in original)

This makes teachers seem conservative to Lortie: "teachers are like practitioners in other fields – they are reluctant to try new approaches unless they feel sure they can make them work and avoid damaging their reputations" (Lortie, 2002, p. 234.); their use of their own experience as pupils becomes an "ally of continuity rather than of change" (ibid., p. 67). He presents an explanation for this finding: "teachers have a built-in resistance to change because they believe that their work environment has never permitted them to show what they can really do" (ibid., p. 235). For teachers to engage their experiential socialisation in teaching prior to their careers teacher education could make teacher students scrutinise their previous experience in classrooms using autobiographies and "microfilmed lessons by various teachers might help to stimulate recall. Novels and biographies could also evoke recollection" (ibid., p. 231). Lortie's work on teacher socialisation provides good descriptions of teachers' entry into and development within the teaching profession seen from the teachers' perspective, but the relation to pupils, colleagues and schools as organisations is not uncovered. Lortie states a wish for future studies:

Although individual teachers and teacher-researchers could provide a steady stream of useful insights, the occupation will also need large-scale projects directed toward the assessment of novel instructional strategies, organizational changes, political movements and the like. (ibid., p. 243)

One such large-scale study is reported from Switzerland by Huberman in his seminal work on teachers' lives (Day and Gu, 2010, p. 1). The findings are based on

interviews with 160 middle and secondary school teachers and were first published in French in 1989 and then in English in 1993. Huberman's premise is that the individual life cycle of a teacher's career is best understood using a mixture of psychological and psycho-sociological frameworks (Huberman et al., 1993, pp. 2-3). He makes a note on how he sees the relation between the social and the psychological approach: "... the arbitrary organisation of social life creates social expectations that are internalised and acted on, as if they were psychological factors" (ibid., p.17). He formulates eight categories and research questions to investigate this relation including topics such as changes in teaching style, content or disenchantment, turning bitter or remaining serene. He looks for how teachers' progress can be understood as passing through uniform phases or processes. He focuses on the pedagogical career of classroom teachers to "explore the trajectory of individuals in organizations" (ibid., p.4). The trajectory is stated in a schematic and speculative phase model that evokes "central tendencies and general junctures, notably to the leitmotifs of different phases and the ordering of these phases" (ibid., p. 12). The model for stages in a teacher career is tested and refined while being aware of the danger of sacrificing too many essential particularities (ibid., p. 13). Huberman describes four rules of methodological conduct: 1) avoid over-determination of a single factor, 2) obtain key relationships between representations and actions of individuals facing particular contexts, 3) listen carefully to the person who is doing the talking, and 4) the degree of generalisations is solved by identifying subsets or 'families'(ibid., pp. 19-20).

Among beginning teachers in particular, Huberman finds painful descriptions of socialisation through the internalisation of a new institutional role. His findings, like Lortie's, connect socialisation to conservatism among teachers: "one of the effects of socialisation that is frequently mentioned as routinization: an acquired occupational life-style that is progressively sclerotic, conventional and conservative over time" (Huberman et al., 1993, pp. 259-260). However, due to his research of teachers in their context and their organisations, Huberman is capable of suggesting that teachers get professional satisfaction through "enduring commitment, good relations with pupils, good colleagues and balance between school and home life/personal interest" (ibid., p. 249). Huberman continues: "Only those who retain their curiosity and openness by focusing on more concrete activities and experiences in their own classrooms seem to end their careers with a feeling of professional satisfaction" (ibid., p. 250). Huberman's findings point to changes in the in-

teraction between the life and work of teachers as their career progresses. The initial exploration phase is characterised by easy and/or painful beginnings when relating to pupils and superiors; the stories told are euphoric and/or depressive. In the following phase a stabilisation occurs with a durable commitment to teaching; the stories told are generally positive. The following phase shows diversity in career trajectories: some pursue administrative responsibilities; others are continuously committed to classroom teaching. The next phase – for some the final phase – is characterised by self-doubt leading to a feeling of routine or even real crisis. Crisis can lead to career change. If the self-esteem problems are overcome, then the teachers become less engaged and more relaxed; serenity settles on the teacher. Researchers other than Huberman have been devoted to finding stages in teachers' careers (Rolls & Plauborg, 2009). Rolls and Plauborg point to major contributions presented by Huberman et al. (1993) in Switzerland, Fessler and Christensen (1992) in the US, and Sikes (1985) and Day et al. (2007) in the UK. Rolls and Plauborg (2009) synthesise the teacher career phases developed by Huberman, Sikes, Fessler, and Day into three phases: entering the profession and the first years (newly qualified), established within the profession (making a commitment) and the final years (disengagement). Such phases provide an overview of the expected relations with teaching that a researcher can encounter when researching the life story of teachers. But the career trajectory phases leave out individual variations for the benefit of clarity. Furthermore, the development of the actual teaching practice, its preparation and execution are also largely neglected in the studies of teachers' career trajectories (Rolls & Plauborg, 2009, p. 25). This means that teacher career trajectory studies provide life and work research with a scaffold for engaging with individual teachers, but not with a blueprint for their lives.

I opened this review with Lortie's call for more description and less prescription. The reviewed research has provided many descriptions, so research has addressed Lortie's call. However, a quarter of a century later Goodson calls for a counterculture to the auspicious belief in curriculum as prescription as held by politicians and administrators. Goodson thereby opens for researching the effects of political power and influence on the life and work of teachers. He finds that "in addressing the crisis of prescription and reform it becomes imperative that we find new ways to sponsor the teacher's voice" (Goodson, 2000, p. 17). Goodson does not see significant improvements in the inclusion of research descriptions in the development of political changes and reforms in school. Goodson furthermore acknowledges Lor-

tie's work as a significant alternative conceptualisation of the question of teacher socialisation and finds in it a strong argument for doing "far more life history work covering the pattern of socialisation of teachers over the full span of their work and life in teaching" (Goodson, 2003, p. 56). As Goodson uses the phrase "pattern of socialisation" one could get the idea that he was pledging for more stage model or career phase studies. Goodson's work is, however, more concerned with the individual teacher's relation to her own personal life and professional work than with the individual teacher's relation to generalised career phases or stages. In one of his early writings he proclaimed his quest to be, addressing the teaching profession from the personal perspective: "*In understanding something so intensely personal as teaching it is critical we know about the person the teacher is. Our paucity of knowledge in this area is a manifest indictment of the range of our sociological imagination*" (Goodson, 1980, p. 69, italics in original). So "pattern of socialisation" should be read as personal pattern of socialisation.

In 1992, Ivor Goodson edited a book with the title *Studying Teachers' Lives*. In the opening chapter he calls the topic of the book "an emergent field of inquiry". He starts by describing the development of British research on teachers. He points to how the conservative renaissance of the 1980s in the UK affected educational research (Goodson, 1992, p.5). This led to a decline in studies on relations between teachers' lives and careers and the context of their work. He states the intention of the book is to accept:

... the problematic nature of the enterprise [study of teacher life stories] but does not take the view that we should withdraw from the field and thereby leave conduct of life story work to those who do not accept or explore such problematics. Rather it argues for facing squarely the dilemmas of studying people's lives; to build both methodological procedures and value systems which will respect those lives and collaborative patterns which will widen and deepen understandings. (ibid., pp. 6-7)

Goodson has been following this line of studies for the past 30 years. He sums up some of his research in 2000 using his own previous publications: "I argued that researchers had not confronted the complexity of the schoolteacher as an active agent making his or her own history", referring to the above quoted 1980 paper (Goodson, 2000, p. 15). He also argues that "the issue is to develop a modality of educational research which speaks both of and to the teacher" (Goodson, 1991 in

Goodson, 2000, p. 19). Teachers make personal choices that influence their career and thereby schooling in general. Personal biography and historical background say more about teachers' careers than singular events like a single observation of classroom teaching (Goodson, 1980). The publish or perish regime of academia creates a risk of the researcher exploiting the teacher in order to secure the researcher's career (Goodson, 2000). He therefore recommends that "teachers' life studies should, where possible, provide not only a narrative of action, but also a history or genealogy of context" (ibid., p. 22), and continues "developing genuine collaboration in studying teachers' lives is a viable trading point between life story giver and research taker" (ibid., p. 23). Goodson furthermore points to the significance of collaboration between researcher and teacher in life history studies: "The teacher becomes less a teller of stories and more of a general investigator; the external researcher is more than a listener and elicitor of stories and is actively involved in textual and contextual construction" (Goodson, 1992, p. 244). Goodson uses MacIntyre (1981) to accentuate how "the story of my life is always embedded in the story of those communities from which I derive my identity" (Goodson, 2000 p. 23). This way life stories of teachers relate to a broader social and political history of teaching but one which is sensitive to their individual lives and experiences (Goodson, 2000, p. 24; Goodson, 2003, p. 25). The stories teachers tell are the starting point but they need to be historically and socially located (Goodson, 2003, pp. 25-26). The narration reinforces and rewrites the domination in the political discourses of power and teaching when it is contextualised (Goodson, 2003, pp. 31-32).

## **My lead from the existing research literature**

This review of studies on teachers' life and work is far from exhaustive, but presents the approaches that have proven fruitful in my research. Lortie gives an empirically well-consolidated description of teaching in the US in the 1960s as a profession based on tradition and experience. His approach and results have had a significant impact on later researchers in the field. Huberman's large-scale study on teachers' careers shows how teachers' routine and commitment change with seniority, leading him to suggest a raised awareness of teachers' life cycles in their career. This notion of typical and general changes in teachers' careers is also brought forward by Day and Gu in their work. Goodson, however, raises questions about the way much life history research has been conducted and argues persistent-



ly for keeping the person the teacher is in focus. He never talks of life cycles or stages in a teacher's career. Goodson firmly believes, along with Day and Gu (2010), in the value of rich historical, social and personal descriptions as the best way to understand teaching as a very personal profession.

To follow this lead from Goodson and others I have been studying the relation between life and work at the societal level and at the personal level. The lived life and the told story are founded in a social relation that involves two levels in the society (Antoft & Thomsen, 2005, p. 158). At the societal level I have been studying how contemporary changes within educational politics affects the conditions for teaching in general. At the personal level I have intensively been studying how personal and professional experiences relate in science teachers' work and teaching. My work at these two levels is presented in the following. I continue by presenting the work I have done with peers to analyse the quality and significance of recent educational reforms in Denmark. This work presents parts of the setting for the personal and professional experiences of science teachers in Denmark.

## Educational restructuring

Transformation in patterns of governance, deregulation, marketisation, consumerism and the introduction of management principles derived from the world of business into the public management and planning of education is often labelled 'educational restructuring' (Lindblad & Goodson, 2011). Teachers willingly or unwillingly become advocates for the restructuring of the welfare state through their professional work as civil servants. Nordic teachers see their main tasks as teachers as: teaching, upbringing, social tasks, organisational responsibilities and cooperation with parents (Klette et al., 2002). These tasks have changed and increased in workload. The teachers experience pupils and parents as being more demanding as part of the above-mentioned general changes in society among other things has decreased the status of the teaching profession. The teachers also have to meet increasing demands from legislation and school administration regarding a more detailed curriculum, more extensive documentation and never-ending cutbacks in the school budgets. The conditions for working as a teacher are increasingly complicated and the teachers have to defend the work they perform under these conditions in order to keep up their self-esteem (Priour, 2010; Priour & Jensen, 2010; Robertson, 2000).

The changes in the welfare state are driven, in Denmark and other countries in the world, by rhetoric on flexible workforce, harmonisation and globalisation. This rhetoric is based on a neo-liberal ideology, which according to Beach (2005, p. 10) is characterised by five denominators:

- Market economy, where economic decisions are considered to be voluntary.
- Monetarist economic policy, where the economy is being stimulated by manipulating the money supply.
- Privatisation of state-owned industries and services.
- Low taxation to stimulate individual freedom.
- Control of expansion of State expenditure in the welfare State and local government.

This changes the welfare state into an economic redistribution establishment for economically effective delivery of services to individual citizen-clients. It furthermore introduces logic, notions and concepts of business economics into the welfare state. The civil servants in such a welfare state have to be flexible and adaptable at the same time towards changes in the market for welfare benefits. The autonomy of the civil servants is regulated by the legislation issued by politicians and the financial support they get from the same political authorities. The financial support is more and more managed by the means and concepts of business economics. Due to constant international comparison in the globalised economy the autonomy is slowly but surely being reduced through increasing control mechanisms and more external influence on teachers' work (Carlgren, Klette & Simola, 2002). The market model of schooling operates like a shopping mall with supermarkets and boutiques where the majority of consumers buy standardised school products and different minorities shop more selectively and buy their school products in small boutiques (Robertson, 2000). The market primarily harmonises the school products in relation to globally transferable qualifications in reading, science, mathematics and English.

This rhetoric and harmonisation affect the civil servants such as teachers through professionalisation and increasing centralised management of the professions. The professionalisation of teachers is a long and extensive process which in Denmark reached a peak in 2000 when the teachers' union (DLF) published their 'Professional Ideals' (Danmarks Lærereforening, 2002). The debate is still running (e.g. Krogh-Jespersen, 2005); it tries to give the teaching profession an ethical, political and societal status from where to reclaim the lost esteem of the teaching profession. The teachers' union summarised this in 2005 as a profession strategy that contrasts with a traditional employee strategy (see Table 1).

This extrovert profession strategy puts more responsibility on the teacher to fulfil the expectations of the citizens and the State. The union wants to reclaim some of the lost esteem with this strategy.

<b>Employee Strategy</b>	<b>Profession Strategy</b>
If we aren't paid for the task, we don't do it	We must have conditions that support our work
Threats	Quality management
Reactive	Proactive
Control of the work	Professional accountability
Confidence	Liberty of action
Security	Flexibility
Justice	Respect from partners
The work consists of parts that are performed within the given conditions	We have the responsibility to prioritise and solve the task

*Table 1: The Danish Teachers' Union Profession Strategy (Danmarks Lærereforening, 2005).*

The increase in centralised management of the teachers' practice can be illustrated by the process of describing the subject matter content in Danish primary schools. In order to ease testing in the public schools, the aims and purposes of school subjects have undergone three revisions over a 10-year period – new aims issued in 2002, 2004 and 2009. The tendency has been that the aims have become more detailed and explicit, which then enables better opportunities to evaluate and measure the individual student outcome of the teaching. There are now stated aims for the 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup> and 9<sup>th</sup> year for every subject in Danish schools and additional aims for some subjects for the 8<sup>th</sup> and 10<sup>th</sup> year. These detailed aims are part of an increased focus on evaluation and testing in primary and lower secondary Danish schools. Danish pupils take a national internetbased test every year in different subjects (see Table 2).

The schooling in Denmark ends with seven final exams in the 9<sup>th</sup> year. Five of them are compulsory: two in Danish, one in mathematics, one in English (oral examination) and one in physics/chemistry. Two are chosen by lot, one within sci-

ence, either biology or geography, and one in humanities, either English (written examination), religious knowledge, history, social science, German or French. This extensive testing of the pupils at the end of their public schooling adds to the national test during schooling to establish a coherent and detailed monitoring of the pupils' learning outcome of participation in public schooling in Denmark.

Subject/Year	2.	3.	4.	5.	6.	7.	8.
Danish/reading	x		x		x		x
Mathematics		x			x		
English						x	
Geography							x
Biology							x
Physics/Chemistry							x
Danish as secondary language				x		x	

Table 2: National tests – subjects and years (Skolestyrelsen, 2013).

These aims, final exams and tests describe the outcome of public welfare school education very detailed to the citizens. The parents can more easily see what to expect from the schooling of their children. This way of describing the intention of schooling through subject matter content and tests reflects the neo-liberal ideas of better management and accountability in the welfare state. Biesta (2007) discusses the relation between means and aims in education. He finds that very detailed aims can control but not develop education. The problem is that even if means and aims are optimised in accordance with a given standard, it is very unlikely that they will be appropriate seen from a holistic analysis of the entire complexity in a teaching situation. Such detailed aims don't improve the professional behaviour of the teachers; the reduced room for professional action can inhibit the implementation of reforms in the educational system. The considerable effort put into continuous

revisions of the aims demonstrates the reduction of the autonomy of the teacher through increasingly detailed descriptions of the public service of education.

This brief literature review indicates that a basic understanding of the general mechanisms involved in changes in schooling is essential for interpreting the teachers' work and teaching conditions. Global trends of increased national competition raise demands for qualification of the workforce in the individual countries (OECD, 1989; Rychen & Salganik, 2003). This has resulted in Denmark in an increasingly more detailed school curriculum that the teachers have to follow, and the teachers also have to prepare the children for the accompanying national tests and exams. This also makes it easier for the parents to follow and control their children's learning in the school. Such consumer orientation and marketisation of schooling are often interpreted as signs of complying with global neo-liberal discourse on the purpose of teaching and schooling (Bourdieu & Gustavsson, 1998; Ranson, 2003).

## **Analysis of educational politics and reforms**

In literature, discussing the impact of the neo-liberal discourse in education (Ingersoll & Smith, 2004; Van Zoest & Bohl, 2005), three particular neo-liberal processes and their related practices are highlighted:

*Individualisation* as the process that creates individuals as movable units in a competitive, flexible and global labour force.

*Development of individuals' competencies* as a process whereby individuals acquire market value through the development of skills and knowledge that can be treated as a commodity.

*Development of individual accountability* as a process establishing a clear relationship between individuals and the responsibility for their actions.

These three processes are important tools in the neo-liberal philosophy of governmentality, that is, of setting in action practices and their associated discourses to regulate human behaviour in society (Schmidt, Daugbjerg, Sillasen, & Valero, under review). Restructuring studies can be done in many different ways either by analysis of political documents (Beach, 2011) and more general societal trends (Robertson, 2000), or analysis of questionnaire data from civil servants (Sohlberg,

Czaplicka, & Lindblad, 2011) or analysis of narrative data (Müller et al., 2011), or by using a mixture of all four methods (Day & Gu, 2010; Day et al., 2007). I have been studying restructuring in cooperation with fellow PhD students and my supervisor using political documents, legislation and departmental orders. This work took off in November 2008 from a notion on restructuring of teaching in the Nordic countries as defined by Klette et al. (2000, 2002). The further discussions included discussions on sustainability in educational change as defined by Hargreaves and Fink (2006). Our main sources of inspiration for understanding the relations between global politics and national educational decision-making processes have been the work of Fullan (e.g. 2007), Darling-Hammond (e.g. 2005), Fairclough (2001) and Robertson (2000).

We have been using the three processes of neo-liberal educational discourse to analyse the quality of educational reforms within science education in Denmark (Schmidt et al., under review). The present organisation of science teaching in Danish public schools is a basis for understanding the former and present restructuring. The context we investigated was the Danish public schools. In Denmark, the pupils follow the same cohort of peers from year 0 (kindergarten class) until year 9. During these 10 years of schooling the pupils meet four different science subjects. From year 1 to 6 they have a primary science subject called 'Natur/teknik' (nature/technique) and from year 7 to 9 they have biology, geography and physics/chemistry as three independent science subjects. A science teacher in Denmark can teach one or several of these subjects depending on the local school organisation and their pre-service and in-service education. All four subjects are taught at the Danish teacher colleges, furthermore a number of teachers take exams in these subjects as part of in-service education programmes. In Denmark, teachers teach different subjects and different years (ibid.).

The work in this study group has resulted in one paper under review in English and one published paper in Danish; both are included in this thesis (see paper overview). The paper under review discusses competence development, accountability development and individualisation as driving factors in recent changes in the science curriculum in primary schools in Denmark. This paper investigates the relations between global neo-liberal trends and science education in Denmark; the title is 'The neoliberal utopia and science education in Denmark – From education for citizenship to education for work life' (Schmidt, Daugbjerg, Sillasen, & Valero, under review). The paper presents an analysis of the political framing of science

education in Denmark when a liberal-conservative government was in power from 2001 to 2011, and a new set of reforms of the educational system were put into operation at political (national), implementation (municipality/school) and operational (classroom) levels. What proved fruitful was to look for discursive resonances of intertextuality between different levels of the societal organisation of education (ibid.). Such an approach:

[A]cknowledges, in the first place, that we are not supposing a cause-effect relationship between them [different levels in the educational system], because the complexity of how social and discursive practices are formed cannot be conceptualised in terms of mechanical systems... In the second place, looking for discursive resonances opens for identifying the ideas that repeatedly appear in texts, as well as the conditions that make their repeated appearance in other linked texts and historical contexts possible. In other words, the analysis of discursive resonance is possible because we assume intertextuality to be a characteristic of discourse and discursive practices... This type of analysis allows us to link discourses that apparently seem not to be connected such as, in the case of this paper, neoliberal discourses and particular changes in science education policy (Schmidt et al., under review).

Using critical discourse analysis the article builds an argument about how the new reforms – e.g. individual pupil study plans – have brought fundamental changes in the role of education within society, changes that resonate with a global neo-liberal discourse of education. The analysis illustrates how neo-liberal ideas about individualisation, competencies and accountability have penetrated science educational policy and the curricular aims of primary science. Finally, the paper discusses whether the neo-liberal trend in science educational reforms is viable for the future and whether alternatives could and should be formulated.

The published paper discusses in detail three different reform initiatives within science education in Denmark. The translated title is ‘Qualities of reforms in science education in Denmark – Teachers’ resources and roles in reform processes’ (Sil-lasen, Daugbjerg, Schmidt, & Valero, 2010). The three reform initiatives analysed are: reform of the national central aims, targeted funding of in-service teacher education programmes and reform of pre-service science teacher education. The analysis focuses on teachers’ opportunities and constraints to invest resources in implementing the reform initiatives. The analysis indicates that teachers have had



various degrees of opportunities to implement and take ownership of the reforms. This situation has created an imbalance between teachers' and other actors' investments in resources, which reduces the quality of the two reforms closest to the teachers. The targeted funding has not attracted as many teachers as expected due to an inappropriate co-funding structure, and the reform of the national central aims was developed without a significant influence from any teacher representatives.

## **Restructuring affects teachers' sense of autonomy**

Robertson (2000, p. 137 ff.) discusses the empowerment and autonomy of teachers. She finds that the rhetoric of teacher empowerment and autonomy is part of the neo-liberal agenda that describes teacher practice in terms of skills, outcomes and control. She refers to research which mentions, among others things, that teachers should determine the curriculum and the manner of instruction if they are to be empowered genuinely. The introduction of detailed national curricular aims in schools put certain strains on the deregulated and empowered point of decision – i.e. the school and its teachers (Klette et al., 2002). The increased management through individual study plans and frequent adjustments of subject matter aims and tests calls for increased autonomy from the teachers in order not to render the children helpless in the increasing demands on them. Carlgren et al. (2002, p. 150) report that Danish teachers seem most irritated among the Nordic teachers in relation to changes but also seem to shake off the new demands and keep to teaching in a more traditional sense. Their study indicates that the tradition of fairly autonomic teachers in Denmark and other Nordic countries empowers the teachers to professionally reformulate demands issued by the central school authorities in order to maintain focus on the benefit of the children. I see this as a supertanker syndrome of Danish schools: it is hard to change direction towards the better as well as the worse.

The evident impact of global neo-liberal educational discourse on primary science teaching in Denmark and the implementation of educational reform initiatives meet autonomous and reform-sceptical Danish teachers in the schools. Perhaps this is part of the explanation of the not very efficient implementation of the investigated reform initiatives, apart from the teachers' limited ownership of the reforms. This is not directly investigated in detail in my restructuring studies, so it remains just a

speculation. I will, however, return to the relation between the reforms and the individual teachers' response to them when I summarize my overall learning from this thesis. In any case, the presented literature and the conducted research on educational restructuring establish some of the contemporary social positioning of a Danish primary science teacher which helps me interpret the individual teacher stories collected during my research on lived experience and teaching practice (Goodson & Sikes, 2001).

## Lived experience

A recurring theme in much life history research literature is the importance of understanding lived experience (Day & Gu, 2010; Goodson & Sikes, 2001; Müller et al., 2011). Experiences are often deduced from the stories that life history researchers hear from their research participants. But the relation between the actual life, the lived experience and the stories told about these experiences is not straightforward. Feelings, emotions, desires, thoughts, etc. influence the way the experience relates to what actually happens and what has happened and how it is retold (Plattner & Bruner, 1984). This calls for reflections on what experience is and how it can contribute to an understanding of the relation between present life and work. Such reflections are included in the paper under review that I co-author on the ontology of science teachers' experiences, titled 'Mapping the entangled ontology of science teachers' lived experience' (Daugbjerg, de Freitas, & Valero, under review). I will in the following pages summarise these reflections as they are a central part of my overall argument for choosing the narrative approach.

Daugbjerg et al. (under review) start by referring to Roth about how teacher experience is always acquired through presence in "*this* classroom at *this* time and with *these* students" (Roth, 2002, p. 21 italics in original). They see that this indicates that teacher experiences are gained in specific teaching situations. Personal experiences can be characterised by temporal, situational and interactional principles (Dewey, 1938), principles that can be aligned along inward, outward, backward and forward directions of experience (Clandinin and Connelly, 1994, p. 417).

The inward direction relates to feelings and moral dispositions. The outward direction relates to the social environment. The backward and forward directions relate to time. Clandinin and Connelly (1994) condense these 4 directions to 2 dimensions, one dealing with inward-outward and one dealing with backward-forward, then they add a third dimension space, which deals with the landscape of inquiry. Based on the work of Clandinin and Connelly, we redefine Dewey's principles of experience as three dimensions. We see one dimension dealing with the temporal continuity of actions and experiences, another one dealing with the educational settings of the actions and experiences and a third dealing with the social, material and personal relations of the actions and experiences. The three dimensions provide our overall

analytical framework for the interpretation of teachers' lived experiences and their living bodies in the classroom. (Daugbjerg, et al., under review)

Daugbjerg et al. (under review) use these three dimensions to open up a discussion of experience that addresses matter and the material world as an essential part of the lived experience of living bodies. The body is a pivot point of this relation as it mediates the impressions between the objective social cultural context and the internal individual mind (Carr, 1986; Hwang & Roth, 2011). Humans' power to act knowledgeably in their familiar world and settings is inseparably intertwined with their everyday experiences (Hwang & Roth, 2011, p.2). The fundamental conditions of teacher experiences arise from an irreducible unit of being in the world and everyday knowing (Roth, 2002).

Relations are experienced most intensively in the present, in the immediate now of communicating with a person, or sensing an emotion, or enjoying a landscape, or participating in an event. All these moments of presence in relations and settings are somehow continuously seasoned into general experiences that can be activated when a similar relation or setting is encountered (Daugbjerg, et al., under review).

Daugbjerg et al. (under review) find that the entanglement between and embodiment of continuity, setting and relation point to an understanding of experience, where the body is integral to sense making as discussed by Hwang and Roth (2011), and the surrounding matter is integral to the body's sense making as discussed by Barad (2003). Barad opens up a shift to seeing relations as originary, rather than secondary (Daugbjerg, et al., under review). Barad uses the term 'intra-action' to specify how entities relating – the relata – are included in the relation, whereas interaction sees the relata as excluded from the relation. This opens up a different thinking about how the life and work of teachers relate and how experience influences this relation (ibid.). Teachers' experiences are contextualised to the teachers' living bodies based on their bodily engagement in managing classrooms, illustrating scientific principles, setting up experiments or investigations, guiding field trips, dealing with emotional relations, hunting, fishing, picking berries, gardening, bringing up their own children, feeding their own pets, etc. Teachers' living bodies are their life experience, their current motor functions and senses. It is this entanglement of feelings, actions, knowledge and experiences that the teacher uses when (s)he teaches the subject matter of biology or other science subjects to the pupils (Daugbjerg, et al., under review).

Earlier I quoted the definition of three dimensions of experience given by Daugbjerg et al. (under review). Writing this thesis in English make me add a small reflection to the temporal continuity dimension on a double-time notion implied in the concept experience. Relations and settings are experienced and perceived in the present; this present and immediate perception of experience translates to the Danish word 'oplevelse' and the German word 'erlebung'. All these moments of presence are, however, somehow seasoned into general experiences that can be activated when a similar relation or setting occurs; this retrospective perspective of experience translates to the Danish word 'erfaring' and the German word 'erfahrung'. The English word 'experience' take in past as well as present aspects of experience. This calls for an awareness of whether the teachers are describing present or past experiences.

## **Experience and narrative inquiry**

The above reflections on experience frames how the apparent retrospective approach of collecting narratives on experiences can inform research about present modes of action. Narrative inquiry is very context- and relation-sensitive; this is both an advantage and a disadvantage. The advantage of the ability to bring forward the particular is based exactly on this sensitivity, but seen from a methodological point of view the sensitivity also complicates the use of the method. Horsdal (2011) discusses this in great detail; she points to the fundamental fact that both the interviewee and the interpreter are situated, relational and contextual. This calls for awareness of how the point in time, the particular research project, the atmosphere of the encounter between interviewer and interviewee might influence the analysis. She points further to a point that is of great relevance for teacher-educators such as me researching teachers: "collective, cultural narratives influence the basic assumptions and implicit understandings of the researcher" (ibid., p. 107). Knowledge of teaching as a profession might dull your sensitivity towards specificities in a narrative you are being recounted. Horsdal continues: "life story narratives do not open a window to life itself and to factual events but represent situated interpretations of life and experience" (ibid., p. 208). This argument can be debated because what is 'life itself'? Is it all the events and relations that have occurred chronologically during the lifespan of the interviewee? Then these, of course, cannot be retold in a life story interview. But if "life itself" is constituted by significant experiences, then the situated retelling of these experiences is per-

haps not a clear glass window but at least a pair of glasses to see the life and actions in it through.

In my research on how teachers' work is related to their life, the earlier discussed relation between mind, body and experience provides me with a language to talk about how past experiences are present in teachers' present teaching. The perception of general changes in the teaching profession is filtered through personal past and present experiences. So even though large-scale studies, such as those made by Lortie, Huberman, and Day and Gu discussed in the review on the life and work of teachers, provide an overview their generalisations somehow wipe out the person the individual teacher is. This is a somewhat naive critique of an inherent characteristic of large-scale studies, but in my research looking for the significance of personal experiences in teaching it is a fundamental difference. Goodson seldom induces any generalisation regarding teaching from his many investigations. I interpret this as a fundamental theoretical standpoint. Goodson is not a spokesman for prescribing teachers what to do. Generalisations from educational research are often deduced into prescription for teaching practice. Goodson's avoidance of stating generalisations on teaching keeps him clear of sponsoring prescriptions regarding teaching, whereas he strongly promotes the use of person-oriented life history research. Goodson provides a life history approach, which makes the individual teacher the primary informant regarding experiences and conditions for teaching.

The emphasis upon teachers' stories and narratives encouragingly signifies a new turn in presenting teachers. It is a turn that deserves to be taken very seriously, for we have to be sure that we are turning in the right direction. Like all new genres, stories and narratives are Janus-faced: they may move us forward into new insights or backwards into constrained consciousness – and sometimes. (Goodson, 2003, p. 24)

With these words of caution, I will now try to unpack narrative inquiry as an approach that supersedes the immediate thrill of collecting exciting stories. One characteristic of human activity is language (Bakhtin, 1986) and language is as diverse as other human activities with relation to differences in and understanding of places, practices and artefacts. Bakhtin's seminal work on speech genres (*ibid.*, pp. 60-61) points to three significant elements of any utterance: thematic content, style and compositional structure. He finds that these structures can be found in any human utterance in spite of their heterogeneity. Thematic content relates to the gen-

eral story the utterance is referring to or is part of. Analysis of the compositional structure reveals how the utterance relates to existing genres and shows personal and/or language styles. Bakhtin emphasises the uniqueness of a speech utterance, “for speech can exist in reality only in the form of concrete utterances of individual speaking people, speech subjects” (ibid., p.71), but he also acknowledges the importance of speech partners: “These relations are possible only among utterances of different speech subjects; they presuppose other (with respect to the speaker) participants in speech communication” (ibid., p.72). He further states: “The utterance is filled with dialogical overtones, and they must be taken into account in order to understand fully the style of the utterance” (ibid., p.92); and he adds: “thus addressivity, the quality of turning to someone, is a constitutive feature of the utterance; without it the utterance does not and cannot exist” (ibid., p.99). This means in relation to teachers’ narrative that the listener to whom the narrative is given shall be taken into consideration as well as the content the utterance may refer to.

This point to a problem that Goodson and Sikes (2001) discuss: “What have you got when you’ve got a life story?” They elaborate their concern: “Clearly, neither a life story nor a life history is anything other than a representation of the life they concern” (ibid., p.40). Goodson and Sikes (2001, p. 46) quote teachers as saying “I don’t know if this is the sort of thing you’re interested in” and they conclude that the teachers are “seeking information that they are telling the right version of their story, the version that they believe the researcher wants to hear”. In this case it is obvious, according to Bakhtin, that the content of the teachers’ narration is influenced by the interview situation. Goodson and Sikes in any case conclude: “we have to accept that it is as close as we possibly get” (ibid., p. 56). Narratives are personal interpretations of events and personal understandings of a lived life, and are as such always valid for the life story teller (Antoft & Thomsen, 2005, p. 167). Goodson and Sikes (2001) acknowledge the importance of including social considerations in life history research: “Social positioning influences the stories we are able, and that we wish, to tell. This, in itself, is useful analytical information for life historians.” Two things can be learned from adding Bakhtin’s notion of the narrative to Goodson and Sikes’ notion of life story. One is the importance of a rich understanding of the social and societal position of the teacher and the teaching profession in general, where I earlier presented my own work with the contemporary changes in primary science education in Denmark. The findings were that teachers are not directly involved in the design of the reform processes and there-

fore their ownership is very scarce. The second learning is that Bakhtin's addressivity notion points to the need for more profound awareness of teachers' basis for and way of telling their life story. Goodson and Sikes mention this problem, "... which takes us back to the issue of narrative forms, what is available to us and how such forms can end up shaping perceptions and experiences" (Goodson & Sikes, 2001, p. 47).

This calls for further elaborations of the understanding of narratives as retold embodied and lived experiences. Clandinin and Connelly are strong advocates for narrative research as the best way to understand experiences:

... with narrative as our vantage point, we have a point of reference, a life and a ground to stand on for imaging what experience is and for imagining how it might be studied and represented in researchers' texts. (Clandinin & Connelly, 2000, p. xxvi)

Goodson (2003, p. 59) makes a point on the significance of life experience and background in teaching "to the degree that we invest our 'self' in our teaching, experience and background therefore shape our practice", and he continues "his/her [the teacher's] latent identities and cultures impact on views of teaching and on practice". The teacher receives new experiences from many artefacts, people and practices, some of them being school- and thereby work-related but not all. Experience is always placed in a unique historical, cultural and institutional setting. Bourdieu (e.g. 2005) gives with his notion of habitus a language of the relation between existing dispositions and new experiences. Roth (2002) summarises his development of Bourdieu's theoretical framework:

Habitus is not static and closed but an open system of disposition undergoing a continuous experience-dependent transformation embodying its own history and experiential trajectory. These experiences either reinforce or modify existing structures of habitus such that it will sustain more viable practices. (Roth, 2002, p. 46)

The relation between present experience and past experience is thus significant in narrative inquiry and working with life stories. Trajectory and situation relate to and influence the way experiences as phenomena are retold.

Narrative inquiry, the study of experience as story, then, is first and foremost a way of thinking about experience. Narrative inquiry as a methodology entails a view of the phenomena. To use narrative in-



quiry methodology is to adopt a particular narrative view of experience as phenomena under study. (Clandinin & Connelly, 2006, p. 477)

Narrative researchers are distinguished by the fact they “usually embrace the assumption that the story is one if not the fundamental unit that accounts for human experience” (Pinnager & Daynes, 2007, p. 5). Riessman supports this close linkage between understanding experience and narrative inquiry: “Narrative analysis allows for systematic study of personal experience and meaning: how events have been constructed by active subjects” (Riessman, 1993, p. 70). To do so, “Narrative analysis takes as its object of investigation the story itself” (ibid., p. 1). Riessman also outlines aims and methods in narrative analysis:

The purpose is to see how respondents in interviews impose order on the flow of experience to make sense of events and actions in their lives. The methodological approach examines the informants’ story and analyses how it is put together, the linguistic and cultural resources it draws on, and how it persuades a listener of authenticity. (ibid., p. 2)

Turning back to the words of caution by Goodson on narrative research the above discussion has focused on what narrative inquiry might provide of understandings of science teachers’ experience of life and work. Characteristic of the formerly presented life history researchers is that they base their findings on analysis of narratives in accordance with a traditional qualitative research approach of looking for themes to clarify and justify across a number of cases. Such an approach leaves little room for the story of the individual teachers’ experience, voice and actions to gain value in the larger context. It seems therefore worthwhile to use a narrative inquiry-based approach in order to let the individual teacher stand out more significantly in both the presentation and the analysis of the research. Such a narrative inquiry-based approach must start by acknowledging that teachers’ experience can be accessed through their actions and voices. Experiences from previously used voices and actions are the experiences that form the topical actions and voices of science teachers. The benefit of bringing the experiences forward is that teachers’ practice is based partly in professional or educational work settings, partly in everyday life settings.

## **Narratives and life stories**

It is not only in the process of study but also in the process of communicating that the characteristics of narrative inquiry need clarification. Coulter and Smith (2009) discuss the difference between narrative inquiry and other qualitative research with regard to communication:

Narrative researchers use literary devices such as we have described to develop time- and process-oriented accounts. They are less likely than qualitative researchers to use discursive logic to frame their descriptions of the social worlds of their participants. They do not usually state explicitly the themes they have discovered, or reveal the methods they have used, preferring to let the narratives stand on their own literary merits. ... In contrast, qualitative researchers are more likely to mingle discursive arguments with descriptions, case studies and vignettes (Coulter & Smith, 2009, p. 587).

Clandinin and Murphy (2009) criticise Coulter and Smith (2009) for reducing narrative inquiry to literary analysis and production. Clandinin and Murphy (2009, p. 600) argue that the research text is composed of the experiences that are co-constructed with the participants in field text such as interviews. They further stress that the research text talks to a wider scholarly and public audience, but it always keeps the relation to the research participant in mind. The research author should not choose the aesthetics of the story over the relation to the research participant. I will return to this discussion of aesthetics and communications of life story data shortly.

I will now take up other aspects of retelling life stories, the time and place aspects. In order to create the life story, Horsdal points to the need to distinguish between narrated time and story time:

The comparison between the narrated sequence and the constructed chronology enables a clarification of the order or the telling. A clarification of the order of narrated experiences assists the conceptualisation of the narrator's configuration. We notice flashbacks, flash-forwards and ellipses in the narrated life story (Horsdal, 2011, pp. 90-91).

Horsdal further discusses the importance of awareness of the communities presented in the narration, the use of pronouns, the use of names and metaphors, and the

fact that the Western narrators in particular try to make meaning out of the narrative they are telling. Horsdal also points to the ethical demand of restricting the urge to analyse and communicate everything:

Although I might miss a good point in my analysis of some applied research by obeying the simple rule of respecting each interviewee, this is far better than to risk having abused some way or another the openness and confidence of the narrators. (ibid., p. 99)

Such ethical considerations are important to remember in the process of performing interviews, making observations, transcribing, analysing and communicating the interaction with the research participants. Horsdal (ibid., p. 108) distinguishes her approach from that of a psychological characterisation of a person's life story: "The focus in my approach is not the individual person – how she or he really is beyond the surface – but how the narrator tries to make sense of lived experience through her narration." She further establishes a difference with fiction:

The story is an attempt to negotiate the meaning of what happened; and what is told about this in the narrative may have very different implications for the narrator outside and after the construction of the life story narrative than would be the case with an invented fiction. (ibid., p. 109)

This means that the told narrative is an interpretation of the lived life and hence the created life story is an interpretation of the told narrative. But the life story is not in itself a psychological profile and it is not a fiction. Life story is a distinct genre that brings experiences forward in order to understand the conditions for life and work.

The existence of a boundary between fiction and life story narratives as stipulated by Horsdal and Clandinin and Murphy above has been challenged by other narrative researchers. This is a significant problem within communicating narrative research: "as we see, the representational crisis arises from the central dilemma of trying to capture the lived experience of scholars and of the teachers within a text" (Goodson, 2003, p. 22). I have taken up the personal narrative approach of Goodson in my own research, but tried to work intensively with the communication of such research, as I see Goodson's reluctance towards issuing statements regarding teaching as limiting for the dissemination of life history research outcomes. This problem has been addressed by researchers that explore research fictions as a genre

to supplement the classical text-string logical academic genre (Clough, 2002; de Freitas, 2003, 2008).

Fiction is a sort of “experimental epistemology” (Fluck, 2003) that is capable of articulating imaginary elements that cannot be articulated in any other way (De Freitas, 2003).

Fiction multiplies possible interpretations without privileging one dominant reading of an experience or event. Fictions thereby open retold lived experiences granting them body and valour to challenge the facelessness of classical academic writing (Clough, 2002; de Freitas, 2003; de Freitas & Paton, 2009).

In particular, the capacity of story for “validating the interconnectedness of the past, the present, the future, the personal and the professional in an educator’s life” (Beattie, 1995, p. 54) is immense and powerful. (Clough, 2002, p. 99)

Assigning power to the particular story of the individual teacher is called for by several educational researchers (Clough, 2002; Goodson, 1980; Pinnegar & Daynes, 2007, p.21). Power is never without responsibility, so the development of research fictions has ethical implications and interpretations all the way from invitation to interview and to final published research text.

In my particular study there is a chain of interpretation that is done through interviewing, transcription, coding, making participants anonymous and translating quotes into English. Every step leads in the direction of fictionalising the representation of the participating teachers, a process not unlike that of processing primary questionnaire data into secondary summarised means and standard deviations, and performing statistical tests. In such a process the individual respondent’s reply is also lost in order to make a clearer representation of the collected data. Primary data in my research are direct quotations, with secondary data being summarised or fictionalised narratives.

Fictionalisation of the individual participant contributions, however, does not solve another problem within life history research: the problem of using life as told to develop life as lived and experienced into an actual life history (Daugbjerg, 2010; Goodson, 1992, p. 236). Goodson elaborates on this problem: “The danger with a focus on personal and practical knowledge is that it can rupture the links to theoretical and contextual knowledge” (2003, p. 52); he adds:

By focusing on the personal and practical, teacher data and stories are encouraged, which foregoes the chance to speak of other ways, other people, other times and other forms of being a teacher. The focus of research methods solely on the personal and practical is then an act of methodological abdication, of the right to speak on matters of social and political construction. By speaking in this voice about personal and practical matters, the researcher and the teacher both lose voice in the moment of speaking. For the voice that has been encouraged and granted space in the public domain, in the realm of the personal and practical, is the voice of technical competency, the voice of the isolated classroom practitioner. (ibid., pp. 53-54)

Goodson refers to this as the need to “develop understandings of the social and political construction” (ibid., p. 54). He further elaborates that “life history studies of teachers’ life and work as a social construction provide a valuable lens for observing contemporary moves to restructure and reform schooling”.

Bringing all these reflections on narrative and experience together leaves me with narrative inquiry as a strong method for bringing forward the past, present, professional and personal experiences of science teachers. These experiences will help me examine the relation between the work and life of science teachers. The method also has limitations as the personal orientation reduces the options for traditional academic generalisations and thematisations on a large scale, but the use of research fictions opens up another powerful communication and investigation of research-based personal experiences other than thematised generalisations.

## **The method used in my empirical narrative research**

A basic principle in narrative research is that each participant must be understood and treated on his or her own terms. This enables a deeper analysis of, among other things, hidden emotional experiences, experiences that hold central turning points and dilemmas of a human life story (Antoft & Thomsen, 2005, p. 158). Much information on the significance of told events and experiences can be learned from the pace and density of a narrative (Antoft & Thomsen, 2005, p. 167). Slow pace is often associated with dense description of experiences and events of great importance to the life storyteller. Narrative conventions of specific societies, as in my case the teaching profession, contextualise a given narrative. Interpretation of the narratives and the experiences behind them is performed in an existing culture

where text, manuscript and genre are given cultural resources (Antoft & Thomsen, 2005, p. 165). This constrains and enables (Giddens, 1993) the analysis and interpretation of narratives at the same time. The narratives can be subjected to narrative analysis as if they were written literary text (e.g. Herman & Vervaeck, 2005), which provides information on the relation between the elements in the text, the relation of the characters in the text, etc. A textual analysis risks the participant being left behind as a faceless research object, as discussed above. The given narratives can be combined to create many different versions of the person's valid life story, but always representing the person as a subject in a text (Antoft & Thomsen, 2005, p. 165). So in order to contextualise my science teachers' narratives in the teacher profession and add a perspective on science teaching to their narratives, I had to do more than interview them. Traianou emphasises the importance of studying teachers' actual teaching practice:

[...] the assessment of an individual's knowledge should be based on how this person performs, and not on what this person says about his/her own performance or what he/she can and cannot do in artificial situations. (2007, p.40)

She can be read as though she finds the use of interviews misleading or even unnecessary. Rather she puts her finger on the need to study teachers as closely as you can get to real situations. Thus, rather than simply recounting verbatim the teachers' own accounts of their practice, nor confining one's study to their performance in teaching situations, you should apply a research method that brings together diverse observational data and presents teachers in all their complexity. Furthermore, Goodson lists six sources of life history data (1992, pp. 243-244): 1) life experience and background, 2) life style, 3) life cycle, 4) career stages, 5) critical incidents, and finally 6) 'life histories' of schools, subjects and the teaching profession that all provide vital contextual background. So in order to have a rich account of a teacher's professional life you have to have interviews, observations and some contextual data regarding the school and local area where they live and work. Such a method has been tried out by Goodson and Norrie (2011) and Brickhouse and Bodner (1992). Goodson and Norrie focused on "educational restructuring and the work lives and professional knowledge of primary teachers in England" (2011, p.11). Their analysis of work life narratives was based on: "two life-history interviews and observations (of two to three days)... First interviews were unstructured and second interviews explored emerging themes."

My own narrative and life history research has been conducted in two phases. The first short phase was my participations in a larger life history research programme at VIA UC on several welfare professions, where the approach was given by the purpose of the programme. In the life history research programme the data collection was solely based on teacher life story interviews; I will describe this method in detail when I present the paper from this investigation. Based on my experiences from my participation in the research programme I designed my own research approach for the longer second phase. In this phase I first did a semi-structured interview with each teacher. The interviews covered childhood, parents, schooling, teenage years, high school education, and leisure time activities, choice of teacher education, teaching experience, and next developmental initiative. The interview was followed by observations of the teachers for two to four entire workdays at their schools (see Table 3 for overview). A second interview was based on themes and questions that appeared from a preliminary analysis of the first interview and the observations. This personalized interview guide and the transcripts of the first interview and the observations notes were send to the participating teachers prior to the second interview. The second interview started by a conversation on these transcripts to give the participating teachers opportunity to reflect and comment on these transcripts. Likewise transcripts of the second interview were send to the participating teachers for comments and corrections. To further saturate my understanding of the teachers' work and teaching I collected various teacher-produced materials during the observations. In addition, I have been gathering first-year inscription data from two of the teacher colleges the teachers graduated from.

The two phases are not sharply separated as I have used data from the research programme in the second phase as well. Furthermore, the research purpose and approach of the research programme do not totally coincide with my stated research problem and approach. So I have a variety of data sources and research approaches as background for the included papers on life history and narrative research.

### **Research interest and ethical attitude**

Before presenting the participating teachers in more detail I will provide some reflections on the ethical aspects of my cooperation with the participating teachers. These reflections will coincide with and repeat some of the methodological considerations in the included papers, but I will try here to present a coherent overview. I will depart from my research interest stated earlier as this has been guiding my re-

search effort and interaction with the participating teachers throughout my work. My research interest is to understand how individual teachers' work is related to their past and present lives. In order to do so I have to engage with teacher to have them tell me about their present and past professional and personal lives. I'm trying to create coherent stories of the participating teachers by looking at the past as well as the present and their professional as well as their personal lives. This means that a coherent presentation of each teacher is of the utmost importance.

In my research approach I'm much inspired by Anglo-American research as presented earlier. In this research literature (e.g. Clandinin and Connelly, 2000; Josselson 2007; Riessman, 2008) there is much concern with the official institutional approval of a given research project. This is not as much the case in Denmark. Horsdal (2011) never addresses this aspect of institutional approval in her summary of her more than 20 years of doing life history research in Denmark. Likewise I have not been met with a demand to have my research approach approved at an institutional board by the doctoral school as it is a social science research project (Kvale & Brinkman, 2009, p. 83). This does not clear me of considering ethical aspects of my research, rather it places this entire ethical responsibility right back at me. I cannot lean on any institutional approval acquitting me of part of the responsibility for respecting and honouring my participating teachers. I'm the only one accountable for doings and undoings in my research. I have had to develop my own ethical attitude as I went along with developing and conducting my research. The notion of ethical attitude is developed by Josselson (2007, p. 538) as "a stance that involves thinking through these matters and deciding how best to honor and protect those who participate in one's studies while still maintaining standards for responsible scholarship". She contrast this with following a cookbook saying exactly what to do, rather than developing an ethical attitude which includes balancing contradictory goods and taken responsibility in order to minimize harm. By addressing the ethics of narrative inquiry as an attitude she acknowledges that is a mixture of opinions, feelings and behaviour. Since any narrative inquiry is contextualised and dependent on the participants and the researcher(s), any standardised guidelines will misfit the actual ongoing interaction between researcher and participants in a specific narrative inquiry.

All the following considerations is my own dealing with ethical responsibilities prior to engaging with the participating teachers as well as taking care of relational aspects that occurred and had to be dealt with. As narrative research is open-ended



you can never know what kind of information you will be confronted with and will have to be dealing with. This also true in my case, I have heard stories and seen actions that I will never use in a public arena, especially as my research interest has been to understand teachers professional doings in the light of their entire past and present life. I cannot upscale singular incidents or singular utterances for the sake sensation. This would compromise not only the participants but also me as a researcher. The joint interest of my participating teachers and me is that published stories of the teachers present them in a coherent way.

The interaction with the participating teachers has been mine and mine alone, except for the first interviews with four of the teachers in the first phase – the life history research programme at VIA UC. This means that all the decisions and actions regarding handling of contacts, transcripts, paper manuscripts, etc. illustrate the responsibility I have taken on to develop and perform an ethical attitude in my relation to the participating teachers. Any research relationship involves dilemmas, but this is especially so in narrative research investigating concrete life and work of real living persons. On the one hand it is the responsibility of the researcher to respect the dignity, privacy, and well-being of the participants and the other hand the researcher also has scholarly obligations of accuracy, authenticity, and interpretation towards the research community (Josselson, 2007). This dilemma can never be solved (Malcolm, 1990 in Josselson, 2007), but has to be lived out in a narrative research practice. I have all the way felt it important that the teachers were fully informed about the purpose of my ongoing research and that they had opportunity to follow the research process from the first contact to the submitted papers. In the following I will present how I behaved in the different phases of research in order to spell out my ethical attitude throughout my conducted research. My ethical considerations refer to the phases in my research of contacting, interviewing, observing, re-interviewing, coding, analysing, and writing the included papers. Such a movement through research phases is described by Clandinin and Connelly (2000) as taking the participating teachers narratives and actions from the field to field texts and further to research texts. In this process the presentation of the participating teachers becomes more and more loaded with concepts and notions about teachers and teaching taken from research literature leaving less and less room for the participating teachers' original voice.

### *First contact*

The teachers for my research in the second phase were chosen based on basically two criteria: they had to be active science – primary biology – teachers and they had to have at least five full years of teaching experience. I set the demand for at least five years of experience as I wanted the teachers to be over the induction period and the first ‘hard’ years of teaching (Bayer & Brinkkjær, 2003; Luft, 2003). Despite the small sample I had to make exceptions. I would have preferred to focus only on biology teachers. This teaching subject is somewhat overlooked in Danish science education research, where the focus is mainly on chemistry and physics or primary science. When I started to contact schools and teachers, I realised that not every teacher was interested in telling their life story to a stranger. Other teachers were not interested in having a stranger in their classroom observing their teaching. They said among other things that their practice was not interesting or exemplary to investigate. This means that the teachers who ended up participating in my research were those who accepted to have their classroom practice and life opened up and exposed to the ears, eyes and pen of a stranger. I’m unable to say whether this makes my group of participating teachers typical for science teachers in Denmark in general as I have no reference on age, sex, and seniority, etc. distribution of Danish science teachers. Furthermore some of the headmasters did not distinguish between biology and the other science subjects, so I ended up with a group of participants with a larger diversity regarding teaching subject as well as seniority than intended. Four of the teachers from the life history research programme had never taught any science subject, so they are not included in the second phase of my narrative research. Three teachers – Linda, Jesper and Helle – were not teaching biology during my observation period, but had done so previously. Another teacher – Ruth – had less than five full years of teaching experience after her graduation, but she had been teaching biology at different schools alongside her prolonged teacher education. So by extending my criteria for the selection of teachers, I ended up with 10 teachers in the second phase of my narrative research. These 10 teachers were all teaching 4<sup>th</sup> to 10<sup>th</sup> year science subjects in primary and lower secondary schools in Denmark. In this process of choosing participating teachers it was important for me that their participation was genuinely voluntary, so I took no for an answer and never asked a second time any teachers who rejected my initial invitation. Even though a more focused group of participants could have improved the composition of experience and subject coverage of my participating teachers. On the other hand a more diverse group of participants can assure that as well innova-

tive as conservative teachers are present in a spectrum of informants (Goodson, 2008). I have privileged the participants' consent at the expense of possible focus. I did this based on an opinion that it was important to secure the participants' voluntary openness towards me as a researcher.

### Orientering om forskning i Naturfagslæreres livshistorier

Peer S. Daugbjerg – aug. 2010

Forskningen danner grundlag for en Ph D uddannelse, som forventes afsluttet august 2012. Forskningen vil belyse naturfagslæreres baggrunde og motiver for valg af lærerarbejde generelt og naturfagsundervisning i særdeleshed.

Naturfagslærere medvirker i 2 individuelle interview og observation i 2-3 arbejdsdage.

- Det første interview omhandler opvækst, forældre, søskende, skolegang, fritidsinteresser, ungdomsuddannelse og vej ind i og inde i lærerarbejdet.

- Observationerne har fokus på dokumentation af naturfagslæreres arbejdsdag, dvs. undervisning, møder, forberedelse og tilsyn med samlinger, etc.

- Det sidste interview finder sted når Peer S. Daugbjerg har analyseret det første interview og observationerne. Dette sidste interview vil bl.a. udrede uklarheder i livsforløb, men vil primært stille skarpt på baggrunde og motiver for valg af lærerarbejde generelt og naturfagsundervisning i særdeleshed.

De deltagende lærere for mulighed for at gennemgå udskrifter af interviews og observationer inden disse analyseres med henblik at rette misforståelser og udelade personfølsomme informationer.

Peer S. Daugbjerg har det fulde ansvar for anvendelse og tolkning af interview og observationer i publikationer og har alle intellektuelle rettigheder til disse publikationer.

Alle citater vil være fuldt anonymiserede.

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Peer S. Daugbjerg  
(Interviewer)

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Lærer (Informant)

*Text box 1: Information sheet in Danish given to the participating teachers in the second phase of my research.*

### *First meeting and interview*

Upon having acceptance from the participating teachers I made appointments with them regarding the first interview. Prior to turning on the audio recorder I discussed my research process and purpose with the participating teachers giving them a final possibility to withdraw from the research. I furthermore presented the participating teachers to an information sheet regarding my research (see text box 1). The information sheet specifies the involvement of the teachers as one introductory interview, my observation of them for 2-3 workdays followed by a final interview. The information sheet furthermore specifies that the teachers would be given opportunity to correct and comment transcripts of interviews and observations in order to leave out information that the teachers found sensitive. Indeed this part of the participation agreement was used by one teacher in the life history research programme at VIA UC. The teacher asked me to remove information about the person's hobby, since it would comprise the anonymity because others who knew the locality would be able to recognize the person. In contrast, another teacher had no problem with having his publicly known devotion to ornithology exposed and included in his alias character Eric.

As indicated on the information sheet it was optional for the participating teachers to make a signed version of the information sheet, so that it could work as signed letter of consent. None of the participating teachers found it necessary to do that. Based on the fact that none of the participating teachers were forced to participate, I took their decline to sign the information sheet as a sign of them trusting me to respect them and not over-interpret any analysis of their spoken words. The explanation of the research purpose apparently had left them confident of me coping with the responsibility of handling their life stories and teaching without harming them in the following process (Goodson, 2008). I was fully aware that the lack of signature left me as well as them without a juridical and/or institutional protection in case of a potential conflict occurred. I decided not to insist that the participating teachers signed the information sheet as a letter of consent in order not to force a juridical language of signatures as being more significant than spoken words into the zone of confidentiality I had created with the participating teachers. It is also arguable what the value of signed consent is worth as much of what will happen in a narrative research process is unforeseeable, so you anyway have to apply an ethics of care rather than one of rights (Josselson, 2007, p.540).

### *Observations*

After the first interview I visited the participating teachers to follow their work for whole workdays including all their breaks, playground duties, all lessons including non-science lessons, etc. During these days I kept a time-structured logbook on all the teachers' interactions with pupils, colleagues, managers as well as their actions during teaching. I deliberately choose not to use video recordings of their teaching as this media creates a distance between the observer and the observed by inserting a video-camera in the process of observation. Without having to attend to video camera it was easier for me to focus on the teachers actions and talk in the classroom, staffroom, hallways, playgrounds, etc.

During the observation days I further developed the relation to the teachers, but also build a relation to their pupils and colleagues as I interacted with them during breaks and lessons. During group work in the lessons I mostly circulated with the teacher to follow his or her talks with the pupils, but I also spend time helping pupils who asked me. This way I was partly participating as an assisting teacher in the lessons, investing myself in the teachers' primary activity supporting the children's learning. During the observation days I focused on the different and varied work functions and routines a teacher performs during a workday, but the interaction and small talk with the teacher during the day also included bits and pieces about their teaching career and life.

The ethics of observing teachers teaching is complex because it involves relations to the observed teacher as well as to the pupils present in the classroom or participating in the field excursion. The observing researcher is a stranger that affects the behavior pupils as well as the teacher. So to minimize the stranger effect in the classrooms I engaged myself as an assisting teacher if the pupils contacted me as such. Some of teachers commented my dialogue with the pupils by saying: 'Oh it's nice to have assisting teacher present today.' I felt it unproblematic as I previously have been teaching upper secondary science in Denmark and thereby I knew the specific cultural pattern and behavior required in the given setting (Christensen, 2002). Christensen (p. 301-302) develops on Gold's four idealized observer roles and calls a behavior as mine for participatory observation. Without prior knowledge to the cultural pattern participatory observation can lead to misinterpretation of the observed field (Kruuse, 2007). I felt that my behavior developed the mutual trust between me and the participating teachers. Furthermore it gave me access to pupil's comments on the teacher and the teaching. Comments that I used

to saturate my understanding of the teacher, but I never used the comments for more detailed scrutiny. In my opinion this is a way to live out an acceptable behavior that level out the distance between the observing researcher and the observed teacher.

#### *Final interview*

During the observation period I transcribed the first interview and the observation notes of each teacher. I made a preliminary analysis of these transcriptions to find significant events in the participating teachers' lives that I would like to have developed further in the final interview; and/or significant actions or relations from the observations that I needed to have elaborated in the final interview in order to understand the context of these relations and/or actions. Based on this analysis I developed individualized question guides to each of the participating teachers for the final interview. I sent this question guide along with the complete transcripts of the first interview and the observations notes to the participating teachers. The final interview started by a discussion of these transcripts, so that the teachers had a chance to comment on them. They made different types of comments and corrections to the transcript. One example of their comments is included the paper 'Mapping the entangled ontology of science teachers' lived experience'. Here Eric addresses how he understands my observation of his classroom dialogue on muscles in the arm.

During the interviews I also experienced that the participating teachers wanted me to turn off the audio recorder as they were to tell me something that were meant for me, but not for my research. Obviously I turned the audio recorder off, and made no notes of what they told during these moments of confidentiality. I interpret that they wanted to tell me something as a person, but not me as a researcher, as a sign of the confidential relationship that I was able to create to the teachers. They could as well have omitted to tell me this confidential information.

I transcribed the final interviews and sent them to the participating teachers to comment and correct. I received only replies with consent. This is not unusual in life history research (Goodson, 2008).

#### *Analysis of transcripts - moving from field text towards research text.*

I felt and still feel very grateful towards the teacher who so willingly opened their lives and classrooms to me. To honor this debt of gratitude I have been regarding the Danish language transcripts of interviews as well as observations as a joint

property of me and the participating teachers. They had full right to add, delete and correct any part in the transcripts.

The transcripts form my basis for the analysis of trying to find themes, cases, events, that could form a basis for a research publication that shed light on my research interest. This process was my effort all along; I did not burden the participating teacher with this, as the amount of work they would have to put into it would far exceed what was presented on the information sheet. Furthermore based on my research approach and stated research problem I had specific notions and concepts that I was applying in the analysis. I will not go in detail with these now, as they follow in more detail later especially in the individual papers. My point here is that this application of pre-chosen concepts is my responsibility as researcher and I could naturally try to get the participating teachers to legitimize my choices, but I feel they would somehow be used as an excuse to promote my agenda rather than contributing with or to their own agenda.

During this analytical work I had a continuous dialogue with my supervisors, who eventually became my coauthors on 2 of my papers. The task was to produce papers that would communicate my work to the academic community (Josselson, 2007, p.548). We decided that the papers were to be written in English. This decision further brings the transcripts and their analysis away from the participating teachers as the original Danish interview and observation transcripts have to be translated to English. In this process I only used narratives where I felt to have a saturated understanding of the teachers' narratives and actions. The saturation made it possible for me to translate to English and still present the original experience of the participating teachers in the rhythm and spirit they told it in (Åsberg, 2012).

*Writing and submitting papers - working with research texts.*

Writing in English and collaborating with a non-Danish speaking supervisor (see page 48) made my responsibility even clearer. The confidentiality with the participating teachers was between me and them, not between them and an entire group of researchers. So I had to take on the full responsibility for the interpretation and selection of the data to be translated into English – as stated in the information sheet in text box 1. Any translation is a further interpretation and application of concepts, notions and language from international research literature adds a further interpretive layer to the original Danish localized teacher lives I'm trying to under-

stand. This interpretive authority belongs to the researcher (Josselson, 2007, p.557).

When the papers were submitted to journals or conferences I sent the submitted versions to the teachers included in the papers. I made it clear that they were welcome to add, delete or correct any part of the translated quotes and observations as well as to comment the interpretations and the analysis presented in the papers. I only received very few comments; none of them were concerned with a misrepresentation of the participating teachers. Several issues can be taken up based on the experience that normally very few teachers react (Goodson, 2008). Teachers normally have distanced themselves in time to the teacher they were when interviews and observations took place (Josselson, 2007, p 559-560; Riessman, 2008, p. 198). Furthermore I have alienated the presentation of the Danish participating teacher by translating their actions and utterances into English and by applying an international research language to the interpretation of their actions and utterances. One could argue that I ought to have retranslated the papers to Danish and arranged a session with each teacher where I could have explained how his or her utterances and actions has contributed to my reflections and the writings of me and my coauthors on the relation between teachers lives and work. This would have been a laborious task for me, though it would possibly have been very educative. I would also have exceeded the time consumption the teachers were expected to contribute with according to the information sheet (text box 1). I have omitted such a detailed and final validation of my research texts for mainly two different reasons. One is that I didn't want to disturb the teachers unnecessary by obliging them to participate in a session where they could respond to my interpretation of their work, in order to assure that I did not intimidate them in my presentation of them. The primary beneficiary of such a meeting would be me getting legitimacy; it would not take away the responsibility of me being the interpreter in the research text. Of course a teacher could prevent me from publishing intimidating or disagreeable text about him or her. However, the teachers had opportunity to prevent publication, when I presented them with the manuscripts by email. Another reason is that the research literature on narrative research is ambiguous in this matter. The importance of building a relation of confidentiality with the participants and there through learn their borders between private, personal and professional themes in their lives and work is central in narrative inquiry (Goodson, 2008; Josselson, 2007, Kvale & Brinkmann, 2009). Such a mutual confidentiality was especially



built during my observation days, and has led me to leave out utterances and actions of the participating teachers from my analysis, that I feel would leave the teachers intimidated and harmed if exposed to the public. So I felt fairly confident when I send the manuscripts to the participating that they would find themselves out of harm's way when reading the manuscripts.

My research interest is to understand how individual teachers' work is related to their past and present lives. To learn about this I have been listening to their stories on choice of teaching, especially on their choice of science teaching, and how such earlier choices and stories are present in their teaching today. This approach could be criticized as I'm only humoring the participating teachers, so be it, my research design was not focusing on revealing unfavorable characteristics of the participating teachers; but rather to create a space where they would experience that their professional life story was taken seriously and used for reflection on the teachers work. Rather than using their voices to validate my findings and reflections I have been trying to amplify their voices by applying a spectrum of research notions, genres and concepts in the different papers (Riessman, 2008, p. 223).

Clandinin and Connelly (2000) and Josselson (2007) discuss the issue of the extent to which narrative research texts belong to participants or to the researcher. They argue that, despite taking a starting point in information provided by the participants, at one point the text becomes the responsibility of the researcher. The used utterances and actions in the papers are still a joint ownership between participants and researcher that emerged in the life history interview talks. The academic interpretation of the utterances and actions is however mine and my co-authors as researchers.

#### *Ethical attitude*

The above presentation of my choices and the arguments behind them is what I did in this line of research. A research that is as much an educative journey as it is an academic conquest of new and never previously seen research findings. I have been balancing the dilemmas of caring for the trust of the participants placed in me and maximizing my own educative outcome of the research to the best of my ability. I feel I have been exercising the kind of wakefulness that Clandinin and Connelly (2000, p. 184) call for, where I continuously has been reflecting on ways to engage with my participating teachers, that keep them out of harm's way and holds me accountable for the interpretations and publications of their lives and actions.

The choices I have made and the opinions I have formed are based the research literature I have used in this section on ethical consideration and how I interpreted that the presented notions, concepts, and approaches could help me to investigate my exact research interest. Based on these opinions and feelings I have behaved as described above exercising an ethical attitude, where I have considered the dilemmas of learning from and not harming the participating teachers in my work (Josselson, 2007, p. 560). I fully acknowledge my responsibility and accountability towards as well the participating teachers as the research community, in my effort to do research that tries to see the teachers as whole persons, where life as well as work history is present in their teaching.

### **The participating teachers**

I present the involvement of each of the teachers in my research in table 3. Three of them have double aliases. In the Life History Research Programme they were ascribed Danish aliases, aliases that I later changed to more internationally appropriate aliases. This was done to ease the presentation of my research to international audiences at international conferences; today I'm not sure that it was a necessary change. Another note to be mentioned is the fact that the first interviews with Knud, Tine, Marie and Anne/Diana were conducted by my colleague at Teacher Education in Nørre Nisum, VIA UC Senior Lecturer Kurt Lyhne. All interviews were audio-recorded and transcribed.

<b>Teacher alias</b>	<b>School alias</b>	<b>Interview 1 date</b>	<b>Observation dates</b>	<b>Interview 2 date</b>	<b>Comment</b>
Knud	Small town A, school 1	16-02-2009	-	-	Not teaching science
Tine	Small town A, school 1	22-02-2009	-	-	Not teaching science
Marie	Small town A, school 1	22-02-2009	-	-	Not teaching science
Jesper/Lars	Village school	20-02-2009	-	05-03-2009	
Helle/Karen	Village school	05-02-2009	-	20-02-2009	
Lise	Village school	16-01-2009	-	03-02-2009	Not teaching science
Tina	Town D school	08-09-2011	05-10-2010, 08-10-2010, 10-01-2011	02-02-2011	
Anne/Diana	Small town A, school 1	03-03-2009	07-09-2010, 09-09-2010	03-02-2011	
Frank	Small town A, school 2	19-08-2010	10-09-2010, 14-09-2010	03-02-2011	
Linda	Small town A, school 2	18-08-2010	13-09-2010, 16-09-2010	03-02-2011	
Ruth	Small town B school	02-09-2010	15-09-2010, 01-10-2010	02-02-2011	
Jane	Small town A, school 2	31-08-2010	17-09-2010, 20-09-2010, 05-11-2010	07-02-2011	
Erik	Town D school	01-09-2010	29-09-2010, 06-12-2010	09-02-2011	
Simon	Town C school	22-09-2010	30-09-2010, 07-10-2010, 26-10-2010, 14-12-2010	11-02-2011	

*Table 3: Overview of dialogue with participating teachers.*

The participating teachers showed a rich variety of background prior to entering teacher education and subsequently teaching. They furthermore spanned 21 years in birth age and 31 years in seniority, so they represented a rich variety of experiences in personal and professional life (see Table 4).

<b>Teacher alias</b>	<b>Gender</b>	<b>Birth year</b>	<b>High school or similar finished</b>	<b>Other education or employment prior to teaching education</b>	<b>Start of teacher education</b>	<b>Graduation as teacher</b>
Knud	♂	1969	1996	Fisherman	1996	2000
Tine	♀	1957	2000	Bank Clerk	2001	2005
Marie	♀	1956	1975	Folk High School	1976	1980
Jesper/Lars	♂	1956	1976	Clerk	1982	1986
Helle/Karen	♀	1966	1986	Industrial worker	2001	2005
Lise	♀	1971	1991	Nursery assistant	1994	1998
Tina	♀	1975	1995	Kitchen assistant, video shop manager	1997	2001
Anne/Diana	♀	1970	1990	Shop assistant	1992	1996
Frank	♂	1973	1997	Farmer, nursery assistant	1999	2004
Linda	♀	1956	1994	China painter, shop owner	1994	1998
Ruth	♀	1972	1992	Nursery assistant, occupational therapist Left teaching early in 2011	2002	2009
Jane	♀	1954	1974		1974	1978
Erik	♂	1957	1977		1977	1981
Simon	♂	1971	1990	Laboratory worker	1997	2001

*Table 4: Overview of the biographic data for the teachers.*

The participating teachers came from schools and towns of different sizes (Table 5). The schools represent different settings regarding pupil and parents social background, different degrees of mixed ethnicity, differences in rural and urban background, etc.

Town	Inhabitants	Pupils at school
A	7,000	School 1: 550 School 2: 420
B	10,500	460
C	105,000	490
D	25,000	640
Village	550	170

*Table 5: Overview of schools and the town they are placed in.*

### **Analytical focus points and coding**

My initial coding was grounded on the work by Day et al. (2007, p.40) and Day and Gu (2010, p. 51). They used eight categories to look for variations in teachers' life and work:

- Leadership
- Colleagues
- Pupil relations
- Pupil behaviour
- Personal events
- Work life balance
- Professional development
- Educational policies

I decided to approach my data with these categories. One reason was that they were quite similar to the ones used in the life history research programme of VIA UC, but more importantly, they were in accordance with significant themes teachers express regarding their work as found by Klette et al. (2002) and Müller et al. (2011).

The analysis and coding of the transcripts, observations and collected material were performed using the NVivo 8 qualitative analysis software. I created a casebook with all my teachers in. I used this casebook to note biographical data on my

participating teachers (Richards, 2008). Parts of these data are presented in Table 4; besides the presented data I also noted parents and spouse occupation, age and gender of siblings and own children, etc. The casebook option in NVivo 8 is dynamic, so I was able to build up an attribute coding as I repetitively worked through the material (Saldaña, 2009). I could return to all my participants to note information regarding an added attribute.

The coding framework is constructed in accordance with the recommendations by Saldaña (2009) and Richards (2008) using a mixture of free nodes and tree nodes in NVivo 8. I defined the eight categories of Day and co-workers as tree nodes before analysing the material. I made my first coding based on these eight categories, using what Saldaña calls a theoretical coding approach. This gave me an overview of my participating teachers' relation to these categories. This overview formed the basis for the second interview with my participating science teachers. The second interviews did not, however, confine themselves within these eight categories; other teacher-specific aspects were discussed as well.

I realised that a coding with a prescriptive theoretical basis might lead to accepting stereotypes (Saldaña, 2009, p. 165), which would be counterproductive for my search for the person in the professional science teacher. I learned that restricting myself to these eight categories made it difficult for me to handle "the complex and often contradictory mechanisms" of life histories as Goodson (2008, p. 89) points out. I therefore decided to develop and refine my coding with inspiration from what Saldaña calls 'longitudinal coding' (2009, p. 173). However, I did not follow my teachers over a long period of time. Instead I based my codes regarding turning points, the increase or decrease in commitment to teaching, etc. on the narratives I was presented with by my participating science teachers and my observation of them teaching. So in the terminology of coding presented by Saldaña I have adapted a longitudinal coding approach to bring forward the personal as well as the professional side of my participating teachers. In this process I further developed the tree nodes, but restricted them to aspects of the science teachers' work life. During this process I started to use the free node option in NVivo 8 for more personal life-related data. I went through the participants' contributions repetitively to analyse interviews, observations and collected material from the perspective of the paper in question. This in the end resulted in 22 work-related free nodes and 21 personal life tree nodes.

The five most coded work-related nodes (tree nodes) turned out to be:

- View of science (105 references, 40 sources),
- Colleagues (82 references, 24 sources),
- Pupil relations (80 references, 28 sources),
- Professional development (53 references, 21 sources)
- Approach to teaching (49 references, 18 sources)

The five most coded personal life-related nodes (free nodes) turned out to be:

- Choice of science as teaching subject (50 references, 19 sources)
- Spouse (17 references, 13 sources)
- Choice of other major teaching subjects from teacher education (17 references, 12 sources)
- Employment prior to teaching (16 references, 11 sources)
- Own children (16 references, 12 sources)

In different papers the emphasis has been on shifting perspectives on the relation between personal and professional life and work. This shifting focus of analysis has been decisive for the continued analysis, reinterpretation and representation of the life histories of the teachers. In reflection I would say that the work within VIA UC's life history research programme taught me the strength and limitations of using a strictly theoretical coding approach. The limitations led me to use the overview given by the attribute coding to select teachers whose life history had characteristic events that have influenced their approach to teaching science and analyse their interviews and observations more intensively with a longitudinal approach. It was in this process that the free node coding of personal aspects flourished as they made it possible for me to approach and interpret my data with shifting frames. These personal aspects were especially significant for the structuring of the paper on embodiment and the paper using research fictions and how they combine the personal and the professional.

## **Narrative inquiry of science teachers' life and work experiences**

As explained above, my analysis of the teachers' life stories has been continuously developing. I have continuously reinterpreted my data as my analysis led me to new significant understandings of the relation between the life and work of science

teachers in Denmark. I have been trying to create as rich a growth of peas possible of the relation between the life and work of the participating science teachers. This has been tried out by working with analytical approaches and writings that bring forward work and other life experiences in the teachers' teaching. The papers bring this forward in different ways and to varying degrees, and they reflect the above two presented phases in my work with narrative inquiry and lived experience, of which the final phase with my own research design is the most elaborate. First I present my participation in a life history research programme and one Danish published journal paper written in this context. I then present the writings from phase two which consist of two published international conference papers and finally two under review international papers.

### **Teacher work under social restructuring**

The first research approach I present was also my introduction to do more systematic academic work within teacher profession research through my participation in VIA University College's research programme on life histories of welfare professionals. This work was led by Professor Annick Prieur, Aalborg University, Denmark and Research Director Søren Gytz Olesen, VIA University College, Denmark. During my participation in the project we had lectures by Emer. Professor Staf Callewaert on working with reflexive sociology in accordance with the work of Pierre Bourdieu and by Professor Susan Robertson, Bristol University, UK on political studies of the welfare professions.

The research programme worked with empirical methodology and an interpretative approach primarily inspired by Pierre Bourdieu. In particular, his deductive sociological framing of the relation between individual and social structure was defining for the way the research was conducted (Prieur, 2010). The framing social structure of teaching is in this line of thinking a field where the struggles of recognition and distribution of power and resources are performed. The individual positions herself in this field through education and career choices (Prieur, 2010). Life histories of individual actors can inform researchers about the relation between, e.g., schools and the individual biography. The biography or life history will provide stories of the dispositions of the individual, in a Bourdieu framework described as habitus and forms of capital. In this relation Ivor Goodson's research contributed to the approach of the research programme with his dedication to understanding the personal motives and social mobility of welfare professionals through their life



history (Priour, 2010). The main difference between Bourdieu and Goodson is that Bourdieu sees life histories as illustrations of facts already known to the sociologist, whereas Goodson with Muel-Dreyfus (1983) and others inductively let patterns or significant narrations emerge from a series of life histories. They all, however, emphasise the inclusion of existing vital necessities and social history in the interpretation of the actual presented life history.

In the specific study on teachers that I and my colleague Senior Lecturer Kurt Lyhne performed within the research programme, we based our analytical approach on the work of Muel-Dreyfus (1983) on teachers and social workers (Daugbjerg, Lyhne, & Olesen, 2010). She puts emphasis on understanding the local and family dispositions of personal choice of education and profession. She finds an emerging harmony between people and their profession as an effect of social-historical activity: "...people chose their profession and the profession makes them its chosen ones" (Muel-Dreyfus, 1983, p. 9 – my translation). Muel-Dreyfus sees this as a sociological process, whereas Huberman adds a psychological dimension to this: "... the arbitrary organisation of social life creates social expectations that are internalised and acted on, as if they were psychological factors" (1983, p. 17). The point to take up from each of them is that a profession as a social organisation has expectations towards a newcomer that somehow have to be met and dealt with if that person wants to be selected by the profession and cope with the demands of the profession.

My work in the research programme was conducted together with my colleague Senior Lecturer Kurt Lyhne to study teachers' lives and work in the rural area of North-Western Jutland in Denmark, where we ourselves live and work. The local study was based on life story interviews with three teachers from a school in a village and four from school 1 in small town A. The teachers were chosen to represent different generations and thereby also different teacher education legislations and departmental orders. The interviews were conducted using an interview guide with questions regarding: 'Yourself and your education', focusing on childhood, youth, parents and choice of teaching profession; 'Tasks', focusing on the everyday work at a school; 'Demands', focusing on the expectations and demands to a teacher today; 'Competences', focusing on what is felt important to be able to do and on own in-service education; 'Changes', focusing on experienced changes in the profession, and on own changes within the teaching profession; and finally 'Work/private life', focusing on the balance between work, family and time for

recreation. The work by Kurt Lyhne and me resulted in two papers published in a special issue of the Danish journal *Social Kritik*, both of which were co-authored by research director Søren Gytz Olesen in order to establish coherence with the rest of the papers from the research programme in this special issue. The paper on the empirical study of the teachers in a rural area under social restructuring is included in this thesis (see paper overview). The translated title is ‘Teacher work under social restructuring’ (Daugbjerg, et al., 2010).

It was in the rural area grounding of the study that Muel-Dreyfus helped us to keep focused on given historical, economic, social and cultural conditions of teachers’ choice of and choices within teaching as a profession. The local rural area has experienced radical changes in the labour market, leading young people to choose different careers to their parents, and people to be more or less forced to change career. It was this phenomenon of general social restructuring that was guiding the coding and analysis in this particular study. We used a theoretically based coding to specify how our participating teachers had dealt with temporal and structural ordering of their specific life conditions (Charmaz, 2006). The participants’ paths in the social landscape helped us to understand why people become teachers and how they experience and express their teaching work (Daugbjerg et al., 2010, p. 111). Our results were to some extent in accordance with the findings of Lortie (2002) that teachers educate and work close to their birthplace. Thereby they represent to a large extent the same local culture and history as the children’s parents. Only one out of the seven teachers we interviewed was born more than 50 km away from where she is now teaching, and only one (not the same teacher) was educated more than 50 km from where she was teaching. Our research showed, however, that each of the life stories and lived experiences was particular and personal despite the common socio-geographical background. The paper on the study that I did within the VIA UC life history research programme includes primarily a contextualisation of teaching as a profession and career in the actual local area (Daugbjerg et al., 2010). The social positioning of the life histories is made to the local labour market in general terms and not so much to the specific teachers’ actual work and teaching. This shortcoming is inherited through the deductive Bourdieu sociological framework of the programme, where the emphasis was on showing the constraints in the teachers’ career options more than on their opportunities within teaching. However, the collected and presented interviews clearly demonstrate how a mixture of sociological, psychological, personal, emotional and organ-

isational factors influence how teachers experience their present teaching conditions as suggested by Day and Gu (2010).

The main research objective of the life history programme was to search for connections between choice of education and career among welfare professionals in the region where VIA University College is located. Of course, the structure and restructuring of the local labour market influence the experiences the teacher can have growing up, educating, working, etc., but the teachers' work at their schools and other activities in everyday life also form their experiences. The presented life stories indicate the strength of approaching how teachers' work is related to their lives through the personal and particular experiences of the individual teacher. The results thus support the person-oriented research approach recommended by Goodson, if the research interest is to uncover a relation between personal past and present experiences and present teaching.

To further develop my understanding of the potentials of narrative inquiry I used the material from the life history research programme to refine my research approach and use of narrative inquiry.

### **Understanding teacher practice using their own narratives**

Under this heading I gave a presentation at the International Organisation for Science and Technology Education (IOSTE) conference in Bled, Slovenia in June 2010. The accompanying published conference paper is included in this thesis (Daugbjerg, 2010). This paper marks the transition from my first work within life history and narrative inquiry to a more science teaching inclusive analysis. I analysed the seven teachers from the Life History research programme focusing on the science teachers among them to understand the potentials and problems in using narrative inquiry. I have summarised the abstract and the conclusion here in order to establish a basis for extracting my learning from working with this presentation and conference paper.

This paper is especially based on how my teachers talk about their relationship with pupils and science teaching. The paper discusses ways of understanding teachers' practice in educational settings. An educational setting consists of cultural, social and historical elements that all influence the teacher's practice and how she experiences this practice. It is argued that teaching science and technology is a socially conditioned practice. The teachers' practice is formed by their previous

education and teaching experience but also influenced by their private life. This way of looking at teacher knowledge and experience requires attention to teachers' perception of these aspects. Teachers seldom talk about their knowledge of teaching, but they willingly recount their experiences of being a teacher. This conference paper argues that teachers' narratives and life history can give an insight into teachers' experience, knowledge and practice. The notion of habitus is used to merge the former experience with the actual practice. The paper discusses pitfalls and stepping stones in the process of using narratives to understand teachers' experiences and knowledge. Important stepping stones are few questions, teachers' written contributions, careful analysis and supplementary collection of observations. Important pitfalls are ideologism, psychologism, and exclusion of teachers' perspective and lack of distance to practice. Pitfalls and stepping stones are illustrated in relation to narratives from the teachers participating in the life history research programme (Daugbjerg, 2010).

Working with this conference paper I realised that to understand teachers we need to know their life history and how they have experienced it. This is the basis for their present teaching and for their potential to develop their teaching. The history of teachers is more than is normally assessed by looking at their knowledge of pedagogy and subject matter. I do not reject the notion that assessing teacher knowledge can contribute to understanding their practice, but I was affirmed in my understanding that using narratives can unveil personal understandings that are closer to everyday teacher practice.

In order to follow this personal approach to science teachers' practice I dug deeper into work by Christopher Day and Quing Gu based on their investigation 'Variation in Teachers' Work, Lives and Effectiveness' (VITAE) performed in the UK (Day et al., 2006, 2007). In this work they identify how teachers' commitment and motivation affect their teaching. I used their notion of commitment and motivation in my first writings in phase two of my narrative research, because I wanted to clarify my understanding of why science teachers work as teachers and why they teach science.

### **Science teachers' narratives on motivation and commitment**

Under this heading I gave a presentation at the European Science Education Research Association (ESERA) conference in Lyon, France in September 2011. The accompanying published conference paper is included in this thesis (Daugbjerg,

2011). In this paper I was for the first time analysing data from the second phase of my work with life history and narrative inquiry. Details regarding the data types are provided earlier in the section on the method I used. In this paper I especially analyse the teacher approach to teaching and their upbringing. The following paragraphs summarise the abstract and the conclusion of the ESERA conference paper in order to establish a basis for extracting my learning from working with this presentation and conference paper.

The individual science teacher's recruitment to the teaching profession is based on personal motivation, as well as the individual science teacher's retention is based on continued motivation and commitment to science teaching. Narratives constitute a way to learn more about the individual teacher's motivation and commitment. Narratives from the 10 science teachers that I have had contact with form the basis of the paper. The paper focuses on two of these teachers. Their dedication towards science teaching differs. Tina was recruited into science teaching through inspiring teachers in primary and high school and a desire to do good for others; this motivated her to choose teacher education and specifically biology as a major teaching subject. After nine years of teaching she is retained in teaching by her commitment to treating the children as whole human beings. Jane was recruited into science teaching by an interest in outdoor life; this motivated her to choose teacher education and biology as a major teaching subject. After 32 years of teaching she is retained in teaching by a commitment to developing outdoor science education (Daugbjerg, 2011).

Several of the teachers that I have met have changed to the teaching profession after years of other work. These teachers all have a sharp focus on the main work function in the teacher practice – teaching. Their work practice has changed from their former careers to the teaching profession, and in this change their former experiences have been supplemented with new experiences. They consolidate their present practice by giving clear statements on central aspects of the teaching practice. Given the opportunity to talk about their experiences with the teaching profession they all do this in a committed manner. These career changers tell a story of how teacher education is no longer the frequent first choice of education; this brings different types of experiences of relevance to science teaching into teacher education (Table 4 on the biography of participants). Recruitment to science teacher education could benefit from engaging in initial dedication and prior experiences in order to challenge and develop student teachers' interests and perspectives be-

yond their immediate motivation for science teaching. Retention in science teaching can be accomplished through the development of opportunities that support the science teachers' specific commitment. Commitment through participation in ongoing changes at their school is typical of all the teachers as arguments for staying in teaching; not all of these, though, are related directly to science teaching (Daugbjerg, 2011).

I participated with more or less the same as the above presentation at the American Education Research Association (AERA), Narrative Study Interest Group conference in Anchorage, Alaska in May 2011. The conference had no podium presentations and produced no proceedings. Meeting the richness of the North American narrative research tradition seriously influenced my understanding of what could be done by using narrative inquiry but also by using narratives in communicating this type of research.

Despite the strength of the approach used by Day and Gu and their co-workers in characterising teachers' commitment and motivation, I realised that I would not be able to justly encapsulate the relation between the life and work of the teachers that I have met using only commitment and motivation as explanatory components. This led me on to more reflections on the ontology and embodiment of the lived experience of science teachers, reflections that made me focus more on the expressed and observed social and relational aspects of the teachers' work. I therefore returned to my data to look more carefully for personally specific experiences supporting the individual teacher's teaching practice.

### **Science teachers' lived experience**

The reflections and renewed analysis are developed in the paper under review titled 'Mapping the entangled ontology of science teachers' lived experience' that I co-authored with my two supervisors. This paper is based especially on classroom observations, the teachers' relation to professional development combined with the teachers' present and previous experiences with nature, science and health-related issues. I here insert a summary of the abstract and the conclusion in order to present the discussion addressed in the paper (Daugbjerg, de Freitas, & Valero, under review).

In this paper we investigate the connection between teachers' lived experience and their embodiment of teaching. The analysis is guided by reflections on the relation-

al ontology of Barad (2003, 2007) and the studies of embodiment and bodily communication by Hwang and Roth (2011). This makes it possible for us to map teacher embodiment in the entanglement of their actions and experience. The understanding of experience is, as stated earlier, developed from the work of Dewey (1938) who in his writing on experience and education develops three principles – continuity, interaction and situation – that are involved in experiencing. Using his understanding and the work of Clandinin and Connelly (1994, 2000) we define continuity, relation and setting as three dimensions of experience (Daugbjerg, et al., under review). This means that bodies and settings are mutually entailed in the present relation, and furthermore that the past as well as the present of these bodies and settings – their continuity – is also part of the present relation. We analyse this entanglement of lived experience and embodied teaching using the three proposed dimensions of experience: continuity, relation and setting. We focus our attention on two questions: 1) how science teachers refer to the lived and living body in teaching and learning, and 2) how science teachers tap into past experiences of body when they teach about living organisms (Daugbjerg, et al., under review).

Analysing interviews with and observations of Danish primary and lower secondary school science teachers, we look for how their lived experiences become entangled with their content knowledge and their classroom practice. A common characteristic of the analysed teachers is that they all embody a continuity between their past lived experiences and present teaching actions. We find that embodied demonstrations of scientific concepts and explanations in the classroom settings and 29 years of teaching experience appear entangled and entangle in the mediation of biological phenomena. Furthermore, that the same teacher separates his own spare-time commitment towards nature conservancy from his everyday science teaching practice, indicating a primarily mediating intra-action in the observed science teaching. We meet another teacher whose embodied joy of natural settings and 32 years of teaching practice entangle with a spreading enthusiasm to include pupils in investigating natural phenomena, indicating a relation to science teaching involving empathy towards nature. We analyse the teaching and life story of a third teacher and see how embodied ethical considerations in different educational settings entangle with a holistic approach to teaching sex and health education, indicating a relation to science teaching involving empathy towards the pupils (Daugbjerg, et al., under review).

The teachers' knowing about teaching science subjects is visible in their bodily actions and in the way they include references to bodily actions when they talk about their teaching. The teachers becoming the science teachers they appear as in the observations and interviews include embodied experiences and actions. In understanding the entanglement of the roles of body and experience in teachers' actions, Barad helps us to keep focus on all three dimensions of experience including their entanglement in our analysis. The above analysis illustrates how the teachers' actions are an entanglement of their knowledge and experience of nature, natural phenomena and teaching as well as the way they gained this knowledge and experience (Daugbjerg, de Freitas, & Valero, under review). Our results thus indicate that the reflections by Radford (2008) that pupils' learning is about being as well as doing in those cases is also applicable to teachers' teaching. Furthermore, it seems that the findings by Hwang and Roth (2011) on the significance of actions and experiences in understanding students' learning is also applicable to understanding teachers' teaching. Barad's (2003, 2007) philosophical reflections on the entangled nature of being, becoming and knowing remind us to be cautious when looking for decisive single-factor explanations of observed teachers' actions. Without due respect to the entanglement of continuity, setting and relation for a given teacher in a given teaching situation, we are likely to misinterpret the observed actions and experiences behind them (Daugbjerg, et al., under review).

This paper illustrates the possibilities of analysis that narrative inquiry can open to develop a deeper understanding of the entangled relation of lived experience and embodiment in teachers' past and present life and work. This was one of the potentials of narrative research that was opened for me during the AERA Narrative conference. Another potential I encountered during this conference was the use of narrative as a communicative as well as an investigative approach to research.

### **Research fictions**

I took on the challenge of working with research fictions in the paper 'Listening to nature: Life histories of Danish biology teachers', which I co-author with my co-supervisor Associate Professor Elizabeth de Freitas (Daugbjerg & de Freitas, under review). My several years of teaching have given me some notion of the strength of fictional retelling of events and lives; but my basic education as a biologist, majoring in agricultural ecology, has not provided me with any academic background for engaging with this genre. So the theoretical foundation and framing of the ap-



proach was done under the close guidance of Elizabeth de Freitas. This paper is especially based on teachers' view of science and nature as well as their choice of science as a teaching subject. I here present a summary of the paper under review.

In the paper we discuss particular theoretical and methodological aspects of life history research and narrative inquiry, and argue for the relevance of this kind of research in exposing the socio-cultural framing of teachers' experiences in schools. We then argue that research fictions (Clough, 2002) serve as powerful narrative tools for highlighting particular thematic elements found in life history data. Based on life history narratives told by my 10 Danish science teachers, we offer two corresponding research fictions that explore how emotions pictured as listening to nature influence their choice of the teaching profession and of biology as a teaching subject (Daugbjerg & de Freitas, under review).

Research fictions provide a tool to expose doubt, care, stamina, etc. in a biology teacher's life and work. They present an amalgam of interview transcripts, observations and symbolic equivalents for the sake of clear communication of the complexity of teachers' lives and work. The complexity entails a work vs. home life balance, a passion for nature and animals especially, grounded learning experiences of core biological knowledge and a recurring commitment to centre and celebrate pupils' experiences with nature and animals. A sustained commitment is based on many reasons and the apparent lack of one can be offset by an excess of other reasons (Daugbjerg & de Freitas, under review).

The presented research fictions illustrate how listening to nature through outdoor life and a positive relation with animals is a significant reason for choosing biology as a teaching subject. Fictions can represent emotions and inner dialogue in ways that are not available to classic academic writing and place them into temporal, spatial and social contexts. Our work with research fictions indicates that it is possible to shed light on the ways in which teachers' past and present experiences and emotions entangle in complex ways (Daugbjerg & de Freitas, under review).

## **Entanglement of science teachers' work and life**

I sat out to investigate the relation between the life and work of science teachers in Denmark. I visualised my primary research interest with the words of Goodson (2010) as an attempt to “establish the centre of gravity for the individual teacher’s professional life”. In order to do this I chose to include science teachers past as well as their present in my research. I based this choice on the basic notion of life history research that you cannot understand a person’s present without understanding his or her past (Goodson, 2003; Goodson & Sikes, 2001). This led me to carefully consider how to understand a person’s past through their retold experiences (Clandinin & Connelly, 1994). This made me enter the vast research area of narrative inquiry (Clandinin & Connelly, 2000; Riesman, 1993). Within this research I chose especially to focus on two perspectives at the personal level: 1) the lived experience of science teachers and how it appears in the bodily communication of these science teachers, and 2) the fictionalised investigation and retelling of such lived experiences. The lived experience was investigated to provide an understanding of the relation between the life and work of a science teacher. The relation could best be described in the words of Barad (2003, 2007) as an entanglement. By working with research fictions I was able to include science teachers’ inner voices and emotional relations to nature in this entanglement.

An underlying theme in my work has been the science teachers’ options for ownership and commitment to educational reform initiatives (Schmidt et al., under review; Sillasen et al., 2010) in their everyday teaching (Daugbjerg, 2011; Daugbjerg & de Freitas, under review; Daugbjerg, de Freitas, & Valero, under review). Governmentally issued reforms regarding curriculum or professional development are, on a societal profession level, not in themselves successes as we show by the lower than expected utilisation of the professional development funding options (Sillasen et al., 2010).

In this closing chapter of my thesis I will bring forward how the participating teachers specifically address the underlying theme of educational restructuring in their work and life narratives. This combines my research effort within the generalised societal profession level and the individualised personal level. This chapter is as such not a conventional concluding chapter as I include new research literature

as well as otherwise unpublished utterances from the teachers. The intention is to give a coherent narrative combining the individual papers into a more complete response to my stated research problem. I finish this chapter by pointing to what other actors in the educational field might learn from reading my papers and thesis.

## **Educational restructuring in the narratives of teachers' life and work**

Curricular changes and accompanying demands for individual study plans can be characterised as examples of the increasingly neo-liberal constitution of science education in Denmark (Schmidt et al., under review). It is, however, characteristic of my participating teachers that they redefine the individual study plans into their own planning tools.

I'm one the few who argues hard for the individual study plans; if I'm going to use the individual study plans as a progressive tool with the pupils, then they have to be handed out in September/October. What good do they do in May when I'm going to take 6 weeks' holiday? That is not right. I hand them out in the autumn and use them as a tool in the pupil status conversations and the parent status conversations.  
(Helle/Karen, 43 years of age, 4 years as a teacher)

Diana tells a similar story about her use of the individual study plans. They thereby redefine the prescribed procedures for the individual pupils' study plans in order to make the work with them agree with their understanding of good relations with the pupils.

The participating teachers' concern is how the pupils can benefit from the educational restructuring initiatives. This means that they reflect and act upon how they can adapt the concrete initiatives into operative measures that support their own teaching and the learning of the pupils. The teachers therefore rephrase the curricular aims:

I have made a pupil edition of the national curriculum, simply rewritten it in respect of the content, where I took it section by section and rewrote it so that it is understandable for children, and this I have done for the aims for biology at year 8, and after that we did it for geography as well and for Natur/teknik [primary science] year 4 and 6

as well. I think that it has worked very well. (Erik, 53 years of age, 29 as a teacher)

Erik has distributed this local curriculum to his colleagues as part of his role as subject matter coordinator of science education at his school. He calls himself a subject matter lighthouse [fagligt fyrtårn].

The participating teachers thereby circumvent the changes in the national regulations and redefine them in order to make them manageable in their everyday teaching. We as researchers might find that the changes are in accordance with a general neo-liberal impact on educational politics. This is not, however, the concern of the participating teachers. The participating teachers act in accordance with the findings of Carlgren et al. (2002), that Danish teachers in general are reluctant to accept change and try to keep on teaching and working as they find best for the children. The participating teachers also express their commitment towards the pupils and the pupils' experience of school.

The most important thing for me is that the pupils function. (.) Like socially in relation to each other and function in relation to the conditions we have here, someone can be fine with one another but when I give some conditions or another does it, then they don't function (...) and that I think is the biggest task to make them function here and make them function with the other pupils and function together with other adults. (Diana, 40 years of age, 14 years as a teacher)

This commitment towards the pupils and their well-being is common for several of the participating teachers as seen in Tina's story in Daugbjerg (2011) and Beth's story in Daugbjerg and de Freitas (under review). Teacher research has solidly established pupil relations as one of the most significant concerns for teachers (Day & Gu, 2010; Day et al., 2007; Klette et al., 2002; Müller et al., 2011). Social and relational aspects of teaching are clearly of significance for the way science teachers perform their teaching.

Another general dedicating factor for the participating teachers is the teaching and communication of different aspects and topics of science subjects as seen in Daugbjerg (2011) and Daugbjerg and de Freitas (under review). This committing relation to the subject matter is not as well described as the pupil relation. However, Daugbjerg and de Freitas (under review) discuss results from German research (Urhahne, 2006) on aspects of dedication towards specific elements of biology

teaching. It can be dedications towards specific biology topics as seen in Tina's and/or dedication towards outdoor teaching as seen in Jane's story in Daugbjerg (2011) and in Daugbjerg, de Freitas, and Valero (under review). But this dedication has a flip side as some of the participating teachers acknowledge a lesser interest in other science topics.

I don't find it exciting how fish breathe (.) I really don't (.) and I think birds are boring.

But it doesn't mean that you can just skip and say well I don't want to talk about lakes today, really, I do maintain a decent professional level, but I think the children can feel that I also don't think it is very exciting. (Tina, 35 years of age, 9 years as a teacher)

Dedication or disinterest in science subject matter is clearly a significant aspect of teacher retention and commitment for in-service science teachers. Daugbjerg (2011) refers to Day et al. (2007) for their two types of retention: a physical retention and a maintained commitment and motivation. Day et al. (2007) find that commitment has major implications for teacher effectiveness as measured by pupil test scores. Looking at Tina's story in the above quote and Jane's story in Daugbjerg (2011), they seem to support the conclusions of Urhahne (2006) that detailed studies of the individual teachers' interests reveal significant differences in commitment towards science teaching and even towards specific parts of the science curriculum. I have not had access to the pupil test scores of my participating teachers, so I have no evidence of the effect of the teachers' commitment on the pupils' learning achievements. But my observations of the teachers' teaching clearly show varying degrees of enthusiasm depending on teaching subject and topic.

However, the relation towards science topics and subjects is not the only factor deciding why science teachers have become teachers at all. There are other aspects that dedicate them to choosing teaching as a career. Daugbjerg (2011) quotes Persson (2009) for distinguishing four types of motivation: walking in the footsteps of a master, working with your hobby, investing in teacher education, and avoiding beers and mopeds. Daugbjerg (2011) finds that Tina is following a master and that Jane is pursuing options for working with her dedication to wildlife and nature. In my material I also have cases of teachers investing in teacher education to get away from a socially unsatisfying situation. Helle/Karen tells a story of choosing teacher education as a way of returning to the labour market after a work

injury (Daugbjerg, Lyhne, & Olsen, 2010). Jesper/Lars tells a story of changing from a boring clerk job to teacher education because teaching to him was a good profession: “It [teaching] to me was something positive and exciting.” General changes in the structure of a local labour market can further inspire one to choose teaching as a career as discussed by Daugbjerg, et al. (2010). Whether you come to be at ease in the teaching profession depends on many factors, one being finding subject matter niches like Jane and Tina (Daugbjerg, 2011). You might then begin to feel chosen by the profession (Muel-Dreyfus, 1983).

It is in findings such as the above that narrative inquiry reveals and describes everyday teaching in great detail that opens up an understanding of the significance of teachers’ life history in their science teaching. In Daugbjerg (2010) I combine reflections on habitus of teachers brought forward by Kosonen and Houtsonen (2007) and Roth (2002) to say that:

This way [applying habitus] of looking at teachers’ knowledge requires attention to their perception and appreciation of their own experience and knowledge and how they see this in relation to colleagues and pupils.

This notion of the significance of teachers’ past experiences in their present teaching is developed further in Daugbjerg, de Freitas, and Valero (under review). This paper takes up the understanding of experience based on Clandinin and Connelly (2000) brought forward by me in Daugbjerg (2010) and supports it with the work of Dewey (1938). Based on this research literature experience can be understood through three dimensions: continuity, setting and relation. The understanding is further developed with the use of Hwang and Roth (2011) and their emphasis on the significance of everyday experience and bodily communication in science education. As science education typically deals with human relations to the material world, Daugbjerg, de Freitas, and Valero (under review) also establish a theoretical framework for grasping the relation between the human and material. This framework is developed using the relational ontology of Barad, which sees relation as an iterative entangling process that includes the matter that is being related into the relation (Daugbjerg, et al., under review). Barad (2003) calls this type of relation ‘intra-action’ to signify the inclusiveness of the relation. The theoretical considerations in the paper:

... provide[s] a frame to investigate the entanglement between teachers' lived experience and embodied teaching. This frame brings together their subject matter, their life history, their pupils, but also other materialities within the school setting, like the physical aspect of classrooms, desks, chairs, blackboards, textbooks, etc., and also the organisational relations that bind colleagues, management, and other administrative bodies together. This expansive and inclusive approach is used in this paper to help unpack the complexities of science teaching. (Daugbjerg, et al., under review)

In the analysis we find examples of how science teachers use their past experience of teaching, their own commitment towards nature and their own embodied ethical considerations in a way where the settings, continuity and relations of past experiences are entangled in their present teaching (Daugbjerg, et al., under review).

While the above-referred learnings mostly address past experience and reflections on the influence of past experiences on present teaching, experiences as a concept in the English language also hold an element of the present perception and sensation of events. This more emotional aspect of experience is addressed in the paper entitled 'Listening to nature: Life histories of Danish biology teachers' (Daugbjerg & de Freitas, under review). This paper uses research fictions to highlight particular emotionally significant narratives found in the life history data. Contemporary teacher research acknowledges the emotional as well as the intellectual side of teaching:

However, teachers need to be committed and resilient in order to sustain their sense of effectiveness in what are emotionally as well as intellectually demanding and often changing work contexts. These are associated with their sense of positive and negative professional identity. (Day, 2011)

In order to address the lived experience of teachers, Clough (2002) uses research fictions as they provide him with a medium for dealing with "analytical justice at the same time as experiential truth". Daugbjerg and de Freitas (under review) take up this approach of combining raw data, real details and (where necessary) symbolic equivalents (Clough, 2002, p. 9). Our paper presents two different research fictions. Beth is a teacher committed to science teaching through devotion towards nature and outdoor life. The character of Beth builds mostly on the life story narratives of Jane, but there is added a primary sensation and inner voice that are in ac-

cordance with her close relation to nature. It is these present primary experiences that would be difficult to address if we only used the presented narratives. David is a teacher in doubt of his continued career; he is especially committed to biology teaching through a passion for animals of all sorts. The character of David builds on several of the participating teachers but the doubt aspect especially is taken from Ruth and Simon, and the animal passion is from Frank and Simon. In the fiction of David it is the present doubt aspect that would be difficult to address if we only used presented narratives from one teacher. Together the two research fictions illustrate how listening to nature through either outdoor life or a dedication to animals is a significant emotional reason for choosing and presently working with biology as a teaching subject (Daugbjerg & de Freitas, under review).

Seen as a coherent narrative the papers move from analysis of educational restructuring over descriptive life history approach to a fictional emotional perspective, where the individualised personal teacher experiences becomes more and more prominent. This zooming closer and closer in on the teacher as individual has been my attempt to saturate a contemporary presentation of how teachers' lives are entangled with their work and the conditions for their teaching.

### **My own learning and experience and others potential learning**

My use of different research approaches has contributed with different aspects of the societal professional level and the individualised personal level that I have been focusing on.

Without the combination of personal narratives and direct observations of the teachers I would have been unable to address the personal level of the relation between work and life. My shifting theoretical and thereby also analytical approaches provide me – and my shifting co-authors – with different aspects of the relation between a science teacher's life and work, aspects that the close and varied understanding of each teacher makes it possible to describe.

Without the analysis of contemporary educational politics in Denmark I would have been unable to address the societal profession level in a way that is relevant for my study of science teachers. The aspects of ownership of reforms gains relevance because they are analysed as science education reforms not as general education reforms.



Life history research provides me with an overarching frame for joining the personal and the societal profession level into different perspectives on the relation between the life and work of science teachers. A general remark would be that science teachers care about, and are dedicated and committed to children, science education, their own professional development and nature in a personal-life-history-dependent and entangling manner. Science teachers' centre of gravity is not as such a centre but rather a personal entangled and entangling growth of peas, made up of past and present experiences. Yet another aspect adding to the complexity is that the experiences – the individual pea plants in the growth of peas – are not stable entities, they dynamically change according to new experiences and to the shifting contexts of retelling experiences.

Besides these general methodological and theoretical learnings within the research trade I will sum up my contextual findings regarding the entanglement of science teachers' lives and work in Denmark by breaking them down into different details according to the audiences of the remarks.

Teachers will relate and have related to my presentation of science teachers' life and work as a mirror that shows them 'so this is what I looks like for an outsider'. They recognize the balance of the complex intensity of everyday teaching described in the observations and their intention to improve the life opportunities for their pupils they tell about in the life stories in the interviews. From this recognition teachers can learn, that they are sharing joint experiences of contemporary educational restructuring, and that colleagues might contribute with elements to cope with parts of the restructuring. The narratives also clarify difficulties in maintaining the balance between life and work and even sometimes the breakdown of it.

Teacher educators can probably learn from paying attention to the personal life history of their teacher students; likewise school politicians and managers could learn to make room for personal life histories in their professional development and management of science teachers' work skills and knowledge. It is quite clear how the past and present experience of the participating teachers acquired outside teaching is entangled in their practice in science education. This is a potential frequently overlooked in pre- as well as in in-service education of science teachers. The experiences can also be delimiting for a teacher's commitment to parts of the subject matter, but this is all the more reason for addressing these personal experiences and working with them.

Science education researchers are often prescribing, implementing and evaluating changes and improvements in science education. They should, along with school politicians and managers, be aware that any change or reform initiative is entangled in each teacher's personal life history. Teacher narratives reveal how the individual teacher's personal entanglement of life and work is constituted, thereby providing an understanding of the interpretation the individual teacher has of the implementation and/or evaluation in process.

To boil the essence of my conclusion down to a few words I will paraphrase a North American proverb:

You can try to keep the professional work clear of the personal life of a science teacher, but you can't keep the personal life clear of the professional work of a science teacher.

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# Paper overview

## Papers on educational restructuring - the societal level:

Paper 1: Sillasen, M. K., Daugbjerg, P. S., Schmidt, J., and Valero, P. (2011). Kvaliteter ved reformer af Naturfags-undervisning i Danmark – læreres ressourcer og roller i reformprocesser [Qualities of reforms in science education in Denmark – Teachers’ resources and roles in reform processes]. *Mona*, 2011, 1, pp. 39-56.

Analysis of reforms directed at improving science education in Danish primary and lower secondary school. Authorship: Martin K. Sillasen, VIA UC (30%), Peer S. Daugbjerg, VIA UC (30%), Jette Schmidt, UCN (30%), and Paola Valero, AAU (10%).

Paper 2: Schmidt, J., Daugbjerg, P. S., Sillasen, M. K., and Valero, P. (under review). The neo-liberal utopia and science education in Denmark – From education for citizenship to education for work life.

A study of the politics guiding Danish science education reforms. Submitted December 2011 to a book on ‘The networks of mathematics and science education practices. Studies of philosophy, society, culture and politics’. Authorship: Martin K. Sillasen, VIA UC (30%), Peer S. Daugbjerg, VIA UC (30%), Jette Schmidt, UCN (30%), and Paola Valero, AAU (10%).

## Papers on lived experience – the personal level:

Paper 3: Daugbjerg, P. S., Lyhne, K., and Olesen, S. G. (2010). Lærerarbejde under social omstrukturering [Teacher work under social restructuring], *Social Kritik*, 124, pp. 99-112.

Paper from VIA UC Life History Research programme, teacher life stories on choice of profession. Authorship: Peer S. Daugbjerg (50%), Kurt Lyhne (30%), Søren Gytz Olesen (20%), all VIA University College.

Paper 4: Daugbjerg, P. S. (2010). Understanding teacher practice using their own narratives. Proceedings from International Organization for Science and Technolo-

gy Education. Symposium (14; 2010; Bled). *Socio-cultural and human values in science and technology education*, pp. 332-342

Discussion of the use of teachers' life story narratives in science education research. Empirical material from VIA UC Life History Research programme.

Paper 5: Daugbjerg, P. S. (2011). Science teachers narratives on motivation and commitment – a story about recruitment and retention. Proceedings from ESERA 2011; *Part 13: In-service science teacher education*. Co-editors: Jouni Viiri and Digna Couso. 2012, pp. 59-63.

Analysis of two biology teachers' motivation and commitment to teaching biology. Empirical material from second phase of my research.

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Under review at Cultural Studies of Science Education. Study of the interplay between teachers' living body and lived experience in biology teaching. Empirical material from phase two of my research. Authorship: Peer S. Daugbjerg (70%), Elizabeth de Freitas, Associate Professor, Adelphi University, New York, USA (20%), Paola Valero, AAU, (10%).

Paper 7: Daugbjerg, P. S. and de Freitas, E. (under review). Listening to nature: Life histories of Danish biology teachers.

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# Kvaliteter ved reformer af naturfagsundervisning i Danmark

– læreres ressourcer og roller i reformprocesser



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**Abstract.** *Artiklen analyserer kvaliteten af tre reforminitiativer rettet mod folkeskolens naturfag: revisioner af naturfagenes målsætninger i folkeskolen, tilskud til folkeskolelæreres naturfagsdidaktiske efteruddannelse og ændringer i grunduddannelsen til folkeskolelærere i naturfag. Reforminitiativerne analyseres ud fra læreres muligheder for at investere ressourcer i reformerne. Analysen viser at lærerne har haft varierende grad af indflydelse på implementeringen i skolens hverdag. Dette har skabt en ubalance mellem lærernes og andre aktørers roller og investering af ressourcer, og dermed forringes kvaliteten af reformernes implementering.*

## Introduktion

I Danmark har de seneste bølger i kvalitetsudviklingen af uddannelsessystemet været drevet af et politisk ønske om at landet skal klare sig godt i en globaliseret, markedsorienteret verden hvor viden er en handelsvare, og et højt uddannelsesniveau i befolkningen er vigtigt for at kunne sikre velfærden langt ud i fremtiden (regeringen, 2006). Denne politiske diskurs støttes af nye offentlige ledelsesprincipper for at sikre professionel ansvarlighed og effektivitet i velfærdsydelse. Disse ledelsesprincipper indfører økonomiske motiver og strategier i diskursen om velfærdsstatens kvaliteter (Beach, 2008, s. 272-273). Men en økonomisk forståelse af kvalitet peger kun på en af dimensionerne til at beskrive og vurdere reformer af uddannelsessystemet. Suc-

## FAKTABOKS OM GRUNDLAGET FOR DE POLITISKE INITIATIVERS TILBLIVELSE

Fra 2001 til 2008 har en række rapporter fra ekspertudvalg tematiseret de problemstillinger der knytter sig til at styrke naturfagsundervisningen i folkeskolen og læreruddannelsen. Først kom Evalueringsinstituttets evaluering af fysik (Danmarks Evalueringsinstitut, PLS Rambøll Management & Dansk Markedsanalyse, 2001) som fremhævede mange skolers svage naturfaglige kultur og behovet for fagdidaktisk opgradering af lærerne. Rapporten *Fysik og kemi – naturvidenskab for alle* (Arbejdsgruppen for Fysik og Kemi, 2002) analyserede fysik og kemi i hele uddannelsessystemet og anbefalede at satse på naturfag for alle, dvs. en breddestrategi frem for en elitestrategi, kombineret med en kompetenceorientering af fagene og en fagdidaktisk satsning. *Fremtidens naturfaglige uddannelser* (Andersen, Busch, Horst & Troelsen, 2003) samlede op på disse rapporter. For naturfagene i folkeskolen anbefalede rapporten at faglige lærerteam får større ansvar, at der udvikles lokale læseplaner i natur/teknik, at der etableres et efteruddannelsesprogram for lærere, og at naturfagene i 7.-9. klasse koordineres bedre og gøres til prøvefag. Derefter fulgte rapporten *Fremtidens naturfag i folkeskolen* (FNIF) (Andersen et al., 2006) som specifikt kom med anbefalinger rettet mod naturfagsundervisningen i folkeskolen. Senest har rapporten *Et fælles løft* (NTS) (Andersen et al., 2008) budt på en samlet strategi som ud over naturvidenskabelige og tekniske uddannelser også omfatter sundhedsfaglige uddannelser.

Det bemærkelsesværdige ved denne serie af rapporter er tætheden hvormed de er fremkommet, og at anbefalingerne i rapporterne i store træk ligner hinanden. Specielt er der stort sammenfald mellem hovedanbefalinger fra de to sidste rapporter, FNIF og NTS, vedrørende naturfag i læreruddannelsen, lærernes efter- og videreuddannelse og naturfagenes målsætninger opstillet synoptisk. Se tabel 1.

cesfulde reformer balancerer mellem de økonomiske/teknokratiske, de politiske og de kulturelle/pædagogiske krav til forbedringer af uddannelsessystemet (House & McQuillan, 2005).

Denne inkluderende forståelse af kvalitet er i overensstemmelse med nyere fortolkninger af kvalitetsbegrebet der ikke kun refererer til egenskaber ved et produkt, men også til egenskaber ved de tilknyttede processer og procedurer (Dahler-Larsen, 2008). Fokus på processer og produkter bidrager til at anerkende de mange aktørers forskellige handlemuligheder for at opnå kvalitet (Darling-Hammond, 2005). Med andre ord bør en diskurs om kvalitet i uddannelsessystemet sidestille økonomiske,



**Tabel 1.** FNIF- og NTS-rapporterne opstillet synoptisk.

Hovedanbefalinger i FNIF-rapporten (2006)	Hovedanbefalinger i NTS-rapporten (2008)
De fire naturfaglige linjefag i læreruddannelsen skal alle være på mindst 1 årsværk og have et fælles naturfagsdidaktisk modul og højere adgangskrav.	Folkeskolelæreruddannelsen i naturfagene forbedres gennem en <b>ligestilling af linjefagene</b> og indførelse af et <b>fælles didaktisk modul</b> . Der indføres et <b>nyt alment obligatorisk NTS-fag</b> med fokus på områdets betydning i samfundet.
Der skal etableres et nationalt efter- og videreuddannelsesprogram til sikring og udvikling af lærernes fagspecifikke og fagdidaktiske kompetencer.	Et <b>efteruddannelsesprogram for grundskolelærere</b> etableres i dialog med relevante aktører med fire hovedindsatser: (1) natur/teknik-linjefagsopkvalificering for at sikre faglige forudsætninger for at gennemføre undervisningen, (2) skolebaserede udviklingsforløb for at sikre reel udvikling af undervisningen, (3) efteruddannelse af ikke-naturfagslærere for at alle lærere kan bidrage til elevernes almene naturfaglige dannelse, og (4) pædagogisk diplomuddannelse i naturfagsdidaktik for at sikre tilstrækkelig mange lærere med kompetence som lokal naturfagsressourceperson.
Målbeskrivelserne for naturfagene skal præciseres og samtænkes for at sikre progression og bedre synergi mellem naturfagene. Grundlaget for på længere sigt at etablere en fælles ramme (Science) for naturfagsområdet i hele folkeskolen skal undersøges.	<b>Målbeskrivelserne for NTS-fagene (inkl. matematik) nytænkes og samtænkes</b> med brug af samme kompetenceorienterede begrebsapparat så der skabes en <b>rød tråd</b> gennem hele uddannelsesforløbet fra grundskole over ungdomsuddannelserne til videregående uddannelser. For grundskolen arbejdes der på sigt i retning af en fælles ramme ("Science") for det naturfaglige område.

værdimæssige og pædagogiske perspektiver og handlinger. I Danmark diskuteres behovet for at balancere den økonomiske rationalitet i kvalitetsudvikling med en diskurs om læreres didaktiske og professionelle råderum i deres arbejde og undervisning (Moos et al, 2005). Systematisk forskning i USA og Canada om skoleforandring peger på betydningen af læreres arbejde i uddannelsesreformer: "Ændringer i uddannelser afhænger af hvad lærere gør og tænker – det er så enkelt og komplekst" (Fullan, 2007, s. 127) (forfatterens oversættelse). Det er velkendt at lærere er nøgleaktører i reformprocesser (OECD, 2005; Lieberman & Mace, 2010).

De generelle overvejelser om kvalitet af reformer gør sig også gældende når spørgs-

målet om ændring og forbedring af skolens naturfag kommer i fokus. Det afgørende for reformers betydning for kvaliteten af naturfagsundervisningen i skolen er, hvordan de påvirker naturfagslæreres handlinger og tænkning.

Vi vil i denne artikel præsentere en analyse af tre uddannelsespolitiske reforminitiativer rettet mod naturfagene i folkeskolen og læreruddannelsen. Analysen fokuserer på om reforminitiativerne har levet op til de politiske intentioner set ud fra lærernes handlemuligheder. De tre initiativer vi analyserer, er:

1. Ændringer i naturfagenes målsætninger
2. Tilskudsmuligheder til læreres naturfagsdidaktiske efteruddannelse
3. Ændringer af læreruddannelsens naturfaglige linjefag.

Analysen tager udgangspunkt i disse tre initiativer fordi de er centrale elementer i regeringens intention om at reformere skolens naturfagsundervisning (Undervisningsministeriet, 2008). De er også fremhævet af naturfagsdidaktiske ekspertudvalg gentagne gange siden år 2000.

## Aktører og ressourcer som kategorier til analyse af kvalitet

Indledningsvis er det nødvendigt at understrege en vigtig pointe: Vi baserer vores kvalitetsbegreb på international og dansk uddannelsesforskning om implementering af reformer. Denne forskning baserer sig ikke på samme kvalitetsforståelse som understøtter de uddannelsespolitiske beslutninger, eksemplificeret her ved daværende statsminister Anders Fogh Rasmussens udtalelse om at indførelsen af slut- og trinmål i Folkeskolen: "... giver forældrene et redskab til at komme efter skolen, hvis børnene ikke lærer nok." (Larsen, 2003, s. 301). Dette citat illustrerer hvorledes den politiske opfattelse af kvalitet i uddannelsesreformer er domineret af et ønske om kontrolbarhed af undervisningens resultater.

Kvalitetsbegrebet kan således være præget af såvel ønsker om kontrol som ønsker om udvikling af de pædagogiske processer. Derfor vælger vi en operationel forståelse af kvalitet der fokuserer på *aktørernes* – specielt lærernes – rolle og mulighed for at investere *ressourcer* i implementeringen af reforminitiativerne i deres daglige arbejde. I dette afsnit udfoldes aktører og ressourcer som kategorier for at bygge et begrebsapparat til at tydeliggøre reforminitiativernes betydning for de involverede aktørers professionelle arbejde med naturfagsundervisning.

### *Aktører – hvem handler?*

Vi bruger Dolins (2005) inddeling af aktørniveauer i uddannelsessystemet som udgangspunkt for vores forståelse af aktørers roller i uddannelsesreformer (se tabel 2).

**Tabel 2.** Model for aktørniveauer i uddannelsessystemet (Dolin, 2005).

Niveau	Elementer	Aktører
MAKRO Intentioner	Uddannelsespolitik Læseplansudvikling	Regering, interesseorganisationer Ministerium, forskere, interessenter i øvrigt Kommuner
MESO Implementering og institutionalisering	Skolekultur, værdigrundlag Naturfagsmiljøet Fortolkning i praksis	Ledelse Fagkolleger Lærere i samarbejde
MIKRO Realisering	Undervisnings- og lærings- situationer	Lærer og elever i relationelle situationer

Der er to vigtige idéer ved denne model i relation til uddannelsesreformer. For det første at uddannelsesreformer ikke bevæger sig i én bestemt retning i uddannelsessystemet. Lærere, skoleledelser, kommunale forvaltninger og statslige myndigheder er alle aktører i uddannelsessystemet der kan initiere reformer (Müller et al., 2011). Initiativet i reformprocesser kan tilhøre forskellige aktører på forskellige niveauer i uddannelsessystemet. For det andet at aktørernes forskellige placering i uddannelsessystemet har betydning for deres muligheder for at påvirke og have indflydelse på forandringer. Det betyder at omsætningen af intentioner til handling i reformprocesser er drevet af aktørers muligheder for at fortolke, forhandle og gennemføre reformer ud fra deres position i uddannelsessystemet (Darling-Hammond, 2005).

Pointen i disse idéer er at initiativet i reformprocesser kan tilhøre specifikke aktører i uddannelsessystemet, men at aktørernes mulighed for at handle afhænger af deres position i uddannelsessystemet. Ifølge Darling-Hammond er der i uddannelsesforskningen to forskellige teorier om hvordan uddannelsesreformer kan implementeres. Den ene teori fokuserer på stram *central* styring (makroniveaustyring og -initiering, jf. Dolin) gennem bl.a. præcise mål og kvalitetssikringsstrukturer. Denne teori bygger på en antagelse om at lærere og ledere grundlæggende mangler fokus og engagement i forhold til at forbedre undervisningens kvalitet. Den anden teori lægger vægt på *lokalt* at øge læreres viden og ændre skoler til lærende organisationer som kan udvælge og bruge de mest effektive metoder i undervisningen (lokalt genereret udvikling på mesoniveau, jf. Dolin) (Darling-Hammond, 2005, s. 365-366).

Et eksempel på en *centralt initieret* reformproces er den der foregik i USA fra slutningen af 50'erne og op gennem 60'erne efter Sputnikchokket (Darling-Hammond, 2005; Robertson, 2000). I denne reformproces blev nye læseplaner udviklet af de bedste videnskabelige eksperter inden for hvert naturvidenskabeligt fag. Læseplanerne blev

transformeret til undervisningsplaner og afprøvet på et lille antal modelskoler. Erfaringerne fra denne implementeringsstrategi var at det var meget svært at overtage undervisningsplaner udviklet på modelskoler og implementere dem på andre skoler. Et eksempel på en *lokalt genereret* udviklingsproces er spredningen af udeskolepædagogikken fra lokale ildsjæle til kommunale indsatsområder (se Udeskole.dk, 2010). Denne form for uddannelsesreform er sjælden.

Oftere ser man en blanding af de to typer i det man kan kalde en *centralt stimuleret lokal udvikling*.

En uddannelsesreform der er karakteriseret ved *centralt stimuleret lokal udvikling*, har en større chance for at blive succesfuldt implementeret end fx en *centralt initieret* eller *lokalt genereret* reform fordi den indeholder elementer af en *balanceret* beslutningsproces og opgavefordeling mellem nationale og lokale institutioner i uddannelsessystemet (Darling-Hammond, 2005, s. 366). Denne type blandede reformer giver muligheder for:

1. at lærere kan tilpasse reformers indhold til deres elevers aktuelle læringsbehov
2. at lokale skolemyndigheder kan iværksætte initiativer der støtter kapacitetsudvikling på den enkelte skole og vidensdeling mellem skoler – kapacitetsudvikling forstås som ansvarliggørelse af skoler og lærere for elevers læring under hensyntagen til den enkelte elev og lokalsamfundets skiftende behov
3. at nationale skolemyndigheder kan etablere systemer til kvalitetskontrol, fordeling af ressourcer og vidensdeling om god undervisningspraksis (Darling-Hammond, 2005).

Projektet “Danske Science Kommuner” er et eksempel på en udviklingsproces som omfatter mange af disse ønskelige elementer (Dansk Naturvidenskabsformidling, 2010). I dette projekt har 25 kommuner været involveret. De konkrete initiativer i projektet omfatter fx formuleringen af en kommunal naturfagsstrategi som skal bidrage til skolernes kapacitetsudvikling, samt etablering af naturfagsbestyrelser som skal bidrage til at styrke samarbejdet mellem forskellige aktører med det formål at støtte den samlede udvikling af naturfagsundervisningen i hver kommune.

Darling-Hammond og Dolin beskriver aktørers forskellige muligheder for at handle i reformprocesser. Kvaliteten af en uddannelsesreform kan derfor afdækkes gennem en analyse af *aktører* og deres tildelte roller i reformen.

I analysen bruger vi konklusionerne fra undersøgelsen *Elementer af god skolepraksis* (Mehlbye & Ringsmose, 2004) sammen med Darling-Hammonds kriterier for en balanceret opgavefordeling i reformer til at vurdere om reforminitiativerne bidrager til at øge kvaliteten af lærernes arbejde. Mehlbye & Ringsmose (2004) konkluderer at en skole med bl.a. en samarbejdende lærergruppe og en synlig, tydelig og dialogorienteret

ledelse er bedst til at støtte elevernes læring. Andre studier af elevers læringsudbytte i skolen (fx Nordenbo et al., 2008; Fullan, 2007) beskriver hvordan lærere bedst kan bidrage til elevernes læringsudbytte i skolen. Med afsæt i disse resultater vil vi analysere reforminitiativerne ud fra lærernes roller i reformerne.

### *Ressourcer – hvad handler aktørerne med?*

Aktørers muligheder for at indfri reforminitiativernes intentioner afhænger bl.a. af om aktørerne har de nødvendige økonomiske og menneskelige ressourcer til at varetage deres del af reformen. Intentionen med en uddannelsesreform er typisk at investere økonomiske ressourcer i at forbedre skolens produktionsapparat så eleverne får et større udbytte af undervisningen (Hargreaves & Fink, 2006). Den danske regering ønsker at øge kommunernes fleksibilitet for ressourceanvendelse for at forbedre elevernes udbytte af undervisningen (regeringen, 2002, s. 20). Den aktuelle politiske debat i Danmark drejer sig om hvordan det offentlige system forvalter skatteydernes penge på en økonomisk forsvarlig måde (Lehmann, 2010). Dette kan sammenholdt med det øgede fokus på målsætning i skolen (se afsnittet om målsætninger) tolkes som en markedsorienteret uddannelsespolitik der sætter brugerne (eleverne og deres familier) i centrum, og hvor skolerne gennem en kontraktpolitik er ansvarlige for en bestemt ydelse over for brugerne af skolen (Robertson, 2000; Hermann, 2007). Denne opfattelse af skolen som leverandør af en ydelse defineret ud fra bestemte kvalitetsparametre der er nærmere beskrevet i en formaliseret kontrakt, har ændret skolerne økonomiske og ledelsesmæssige råderum. Hvor økonomiske bevillinger til skolerne tidligere var funderet i en bredt formuleret mål- og rammestyring, er de nu med indførelsen af kontraktpolitikens formalisering og ansvarliggørelse i højere grad bundet op på pulje- og projektbevillinger som udløses til skolerne hvis deres aktiviteter opfylder statsligt udstukne retningslinjer (Hermann, 2007, s. 160-162). Det betyder at skolelederne og lærerne lokalt pålægges et ansvar for at bruge ressourcerne på en økonomisk forsvarlig måde så de er i stand til at opfylde de krav som er formuleret i den statslige eller kommunale skolepolitik.

Fokuseringen på kvalitetssikring gennem økonomisk incitamentsstyring er kun én af flere dimensioner som kan anvendes til at analysere uddannelsesreformer. Uddannelsesreformers succes afhænger også af om der stilles krav til udvikling af pædagogiske/kulturelle dimensioner i reformen (House & McQuillan, 2005). Det kan fx være udvikling af lærernes og skoleledernes professionelle kompetencer så de kan bidrage til at øge den enkelte skoles kapacitet til at implementere uddannelsesreformer i den daglige praksis. Reformprocesser kan på forskellig vis aktivere disse kompetencer ved at benytte dem til at iværksætte pædagogiske udviklingsprocesser. I det systematiske review *Lærerkompetencer og elevernes læring i førskole og skole* (Nordenbo et al., 2008) konkluderes det at lærerne 1) skal besidde kompetencer til at indgå i sociale relationer

med eleverne, 2) skal besidde kompetencen til at lede hele klassen og 3) skal besidde en didaktisk kompetence i almindelighed og i relation til specifikke undervisningsfag. Ifølge Nordenbo et al. bidrager disse tre lærerkompetencer først og fremmest til eleveres læringsudbytte.

Nordenbo et al.s præcisering af lærerkompetencer kombineret med Hermans udredning af skolers økonomiske råderum muliggør en nuancering af de ressourcer skoler råder over i en reformproces. Vi sammenfatter lærernes kompetencer og skolers økonomi til *ressourcer* som den anden kategori i vores analyse. Med dette skelner vi mellem lærerne som aktører og lærernes kompetencer som en ressource. Vi vil jf. diskussionen om aktører som analysekategori fokusere på læreres mulighed for at investere ressourcer i implementering af reformer i form af arbejdstid, kompetencer og råderum.

## Analyse af tre uddannelsespolitiske initiativer

Vi vil undersøge kvaliteten af reformer primært ud fra deres evne til at understøtte læreres muligheder for lokalt at bearbejde reforminitiativets betydning for deres egen undervisning og elevers læring. Vi er mindre optagede af reformernes politiske kontrolkvaliteter. Vi har valgt at analysere tre reforminitiativer som på forskellig vis kan påvirke lærerne i deres daglige undervisning. Ændringer i naturfagenes målsætninger kan indvirke direkte på lærernes daglige undervisning. Tilskudsmuligheder til læreres naturfagsdidaktiske efteruddannelse kan indvirke på de efteruddannede læreres formelle kompetence i deres daglige undervisning. Ændringer i læreruddannelsen påvirker kommende læreres formelle kompetence i deres fremtidige daglige undervisning.

### *Naturfagenes målsætninger*

Andersen et al. (2006 og 2008) anbefaler at der skabes en progression i målsætningerne der strækker sig fra skolestart til afslutningen af ungdomsuddannelserne – se faktaboks for detaljer. Disse anbefalinger understøtter en politisk proces der har været i gang siden år 2000. Først blev Klare Mål indført i 2002 med baggrund i bl.a. forsøgsprogrammet *Folkeskolen år 2000* (Mehlbye, 2001). Med folkeskoleforliget i 2004 ændredes de til Fælles Mål, der udgør bindende trin- og slutmål for folkeskolen (Hermann, 2007, s. 132-140). Dernæst blev Fælles Mål erstattet af Fælles Mål II i 2009. Revideringen af Fælles Mål til Fælles Mål II var udtryk for en opfattelse af at de samlede naturfaglige ressourcer i grundskolen blev udnyttet for dårligt (Andersen et al., 2008). Andersen et al. (2006) påpegede et behov for at skabe et incitament til at styrke samarbejdet mellem biologi, fysik/kemi og geografi. Det er nu til stede fordi flere af trinmålene er enslydende for naturfagene. Det øgede fokus på samarbejde og progres-

sionen mellem naturfagene skal være med til at skabe en stærkere naturfaglig kultur for lærerne på skolen som helhed så elevernes samlede udbytte af undervisningen øges (Andersen et al., 2008).

Revisionerne af målsætningerne kan opfattes forskelligt alt efter det aktørperspektiv man anlægger på reformen. På den ene side er tydeliggørelsen af undervisningsmålene for naturfagene udtryk for et politisk ønske om øget ansvarliggørelse af lærere over for brugerne af skolen (Hermann, 2007, s. 160). De politiske intentioner med mere præcise undervisningsmål er at styrke fagligheden i folkeskolen for at gøre Danmark konkurrencedygtigt i en globaliseret, markedsorienteret verden (regeringen, 2002).

På den anden side har kæden af revisioner øget detaljeringen af målbeskrivelserne, hvilket har betydet at lærerne oplever en begrænsning i deres muligheder for at fortolke fagenes indhold og målsætninger. Risikoen ved detailstyring af undervisningens målsætninger er at mange lærere oplever at deres professionelle autonomi begrænses. (Hermann, 2007, s. 146).

Revisionen af målsætningerne siden år 2000 eksemplificerer en sammenhængende række af initiativer som isoleret set ikke har kostet noget økonomisk, men som har indskrænket læreres og lederes professionelle autonomi. Undersøgelser peger også på at der kan indtræde en reformtræthed blandt lærere hvis de udsættes for hyppige revisioner af deres daglige arbejde (Müller et al., 2011).

Sammenfattende har undervisningsministeren i overensstemmelse med ekspertanbefalingerne og Folketingets beslutning præciseret målbeskrivelserne for naturfagsundervisningen i folkeskolen. Det tydeliggør Folkeskolens forpligtigelse over for såvel skoleledere og lærere som forældre og elever. Men på den anden side har undervisningsmålene i Fælles Mål II en detaljeringsgrad som indskrænker læreres frihedsgrader til at fortolke og omsætte målene til undervisning tilpasset deres elevers behov. Dette er u hensigtsmæssigt da læreres mulighed for lokalt at formulere mål for undervisningen er afgørende for elevers læring (Mehlbye & Ringsmose, 2004). Målene for undervisningen er blevet beskrevet mere og mere detaljeret i løbet af de sidste ti år, men betydningen for børnenes læring er uvis.

### *Lærernes efter- og videreuddannelse*

Lærernes behov for fagdidaktisk opkvalificering er veldokumenteret. Flere undersøgelser har gennem de senere år påpeget at andelen af lærere med linjefagsuddannelse i biologi, geografi og natur/teknik er særlig lav (KL, Finansministeriet & Undervisningsministeriet, 2006; Danmarks Lærerforening, 2007). Andersen et al. (2006 og 2008) anbefaler at der etableres et nationalt efter- og videreuddannelsesprogram med fokus på både fagspecifikke og fagdidaktiske kompetencer – se faktaboks for de specifikke hovedindsatsområder.

Anbefalingen blev fulgt op af et politisk initiativ til styrkelse af naturfagsdidaktikken i folkeskolen gennem et økonomisk støtteprogram til læreres deltagelse i linjefagsuddannelse inden for natur/teknik, biologi og geografi samt til den pædagogiske diplomuddannelse til naturfagsvejleder (Undervisningsministeriet, 2007a). Initiativet relaterede sig både til skolens økonomiske ressourcer og til lærernes kompetencer. Hensigten var at øge kompetencerne blandt folkeskolens naturfagslærere med henblik på at styrke den naturfaglige undervisning.

Den endelige udmøntning af støtten fulgte anbefalingerne i en rapport fra Kommunernes Landsforening, Finansministeriet og Undervisningsministeriet fra 2006, således at støtten blev givet til deltagerbetaling og taxametertilskud (KL et al., 2006). Kommunerne skulle selv finansiere lærernes arbejdstid – dvs. løn under uddannelsen. Støtten blev givet i 2007-2009, dog således at påbegyndte forløb kunne afsluttes senere end 2009 og stadig opnå støtte. Det var intentionen at ordningen skulle skabe et incitament for den enkelte kommune og skole til at efter- og videreuddanne flere lærere i naturfag ved at stat og kommune delte udgiften. Ordningen kan ses som et direkte samspil mellem det makroskopiske og mesoskopiske niveau i uddannelsessystemet med henblik på at styrke den enkelte medarbejders kompetencer.

Undervisningsministeriet udbød i puljen "Styrkelse af folkeskolen" 99,5 mio. kr. til refusion til kommunerne til efteruddannelse af folkeskolelærere inden for naturfag, matematik og engelsk (Undervisningsministeriet, 2007a). Af denne pulje blev der reelt kun brugt 24,5 mio. kr. (J. Holme, Undervisningsministeriet, personlig kommunikation, 11. oktober 2010). Disse bruttobeløb siger ikke noget om efteruddannelsesaktiviteten inden for naturfag. Undervisningsministeriet undersøgte i 2007 hvor mange lærere kommunerne forventede at efteruddanne med støtte fra puljen "Styrkelse af folkeskolen". 83 ud af landets 99 kommuner indgav svar. Disse er gengivet i 2. og 3. kolonne i tabel 3 (Undervisningsministeriet, 2007b). Den forventede aktivitet inden for naturfagsdidaktik svarer til en refusion til kommunerne på 63 mio. kr. Undervisningsministeriet undersøgte i 2010 hvor mange lærere der reelt var blevet efteruddannet med støtte fra puljen. Disse data er gengivet i 4. kolonne i tabel 3 (J. Holme, Undervisningsministeriet, personlig kommunikation, 11. oktober 2010). Tabellen viser at kun halvdelen af det forventede antal lærere gennemførte en naturfagsdidaktisk opkvalificering.

Den politiske intention med dette initiativ var, i overensstemmelse med ekspertudvalgenes anbefalinger, at øge lærernes formelle faglige kompetencer for at undervise. Støtteordningen var eksemplarisk set i forhold til Darling-Hammonds anbefaling om statslig stimulering fra makroniveau til støtte af lokal udvikling af lærerkompetencer på mesoniveau. Forskellen mellem det forventede og det reelle antal efter- og videreuddannede lærere tyder på at tilskudsordningen havde visse indbyggede svagheder. Tilskudsordningen var tidsbegrænset til tre år, så den store tålmodighed har man ikke haft på det politiske makroniveau.



**Tabel 3.** Antal forventede og reelt efteruddannede lærere inden for naturfagsdidaktik.

Vurderede kommunen at der var behov for at linjefagsuddanne lærere eller lærere som vejledere med støtte fra puljen?	Ja/nej	Antal lærere som de 83 kommuner pr. december 2007 forventede at uddanne i 2007-2009 i de nævnte fag med støtte fra puljen	Antal lærere som reelt blev efter- og videreuddannet i naturfagene med støtte fra puljen i 2007-2009, opgjort i februar 2010
Natur/teknik (linjefag)	74/9	895	533
Geografi (linjefag)	58/25	289	278 <sup>1</sup>
Biologi (linjefag)		267	
Naturfag (vejleder)	53/30	280	72 <sup>2</sup>
I alt		1.731	883

Arbejdsgruppen om efteruddannelse (KL et al., 2006, s. 9) refererer til "... oplysninger fra DPU ..." om at det er påvist at linjefagsuddannede lærere giver bedre elevresultater. Rapporten gengiver ikke disse oplysninger og diskuterer dem heller ikke. Arbejdsgruppen anbefaler efterfølgende formelle efteruddannelsesstilbud i form af linjefag og pædagogisk diplomuddannelse, hvilket også er det der er gennemført, jf. tabel 3.

Virksomheden af denne formelle kompetenceudvikling på naturfagsundervisningen i skolerne er ikke undersøgt. En undersøgelse af læreres deltagelse i pædagogiske diplomuddannelser tyder på ringe virkning på sigt på undervisningen (Appel & Daugbjerg, 2010). Et af problemerne er hvordan den nye viden skal indgå i samarbejdet mellem lærere på den enkelte skole. I denne implementeringsproces er skoleledelsens opbakning afgørende for at få lærernes nye kompetencer bragt i spil i forhold til den daglige undervisning. Mehlbye & Ringsmose (2004) påpeger at sparring og dialog mellem ledelse og lærere og mellem lærere er afgørende for elevernes læring. Det er p.t. undersøgt hvordan de gennemførte uddannelsesforløb har påvirket lærernes samarbejde og daglige undervisning.

Landspolitisk ønskede man at afhjælpe et dokumenteret behov for kompetenceudvikling inden for naturfagene. Den begrænsede udnyttelse af efteruddannelsesinitiativet har ikke skabt det kompetenceløft man kunne have opnået ved forbrug af alle

1 Dette tal indeholder både dem der er efteruddannet i biologi og i geografi. Tallene fra Undervisningsministeriet viser ikke hvor mange lærere der er videreuddannet i linjefagene hver for sig.

2 Dette tal dækker over at der er lærere der har gennemført 431 moduler på naturfagsvejlederuddannelsen, svarende til at cirka 72 lærere har fuldført diplomuddannelsen på i alt seks moduler.

de oprindeligt afsatte midler. Staten står tilbage med uforbrugte midler: Pr. februar 2010 er der forbrugt 24,6 mio. kr. til refusion til kommunerne af den samlede pulje på oprindeligt 99,5 mio. kr. Lærere og lokale skoleledelser har ikke haft mulighed for at påvirke brugen af de afsatte midler. Midlerne kunne kun bruges til deltagerbetaling og arbejdstid til efteruddannelse (KL et al., 2006). Det var kun muligt at få del i støtten i perioden 2007-2009. Det er uklart hvilke af de diskuterede forhold der har haft størst betydning for den ringe udnyttelse af efteruddannelsespuljen. Det er også uundersøgt hvilken betydning deltagelse har haft for den enkelte lærer i den daglige undervisning.

### *Læreruddannelsen*

En samlet evaluering af læreruddannelsen i 2003 konkluderede at den i store træk var velfungerende med hensyn til at uddanne lærere til grundskolen, at strukturen med tre-fire linjefagsvalg burde bevares for at sikre linjefagsdækningen i folkeskolen, men at den fagdidaktiske dimension burde styrkes med tydeligere reference til dansk og udenlandsk forskning (Danmarks Evalueringsinstitut, 2003). Denne evaluering fandt ikke et behov for en revision af linjefagsstrukturen, men derimod et behov for en kvalificering af fagdidaktikken i linjefagene. Problemet inden for læreruddannelsen var således ikke strukturelt, men indholdsmæssigt. Specifikt for naturfagene anbefalede Andersen et al. (2006) at de fire naturfag i læreruddannelsen forbedredes ved at indføre et fælles naturfagsdidaktisk modul for alle naturfagene.

Realiseringen af naturfagene i den nye læreruddannelse i 2007 kan ikke samlet set begrundes særlig tydeligt i anbefalingerne fra Danmarks Evalueringsinstitut (2003) og (Andersen et al., 2006). Med reformen af læreruddannelsen indførtes et naturfagligt fællesmodul på 36 ECTS-point som er obligatorisk for alle lærerstudierende der ønsker linjefagsuddannelse i natur/teknik eller fysik/kemi. For at studerende kan opnå linjefagsuddannelse i et af fagene, skal de yderligere gennemføre et specialiseringsmodul på 36 ECTS-point, hvilket betyder at et linjefagsforløb i natur/teknik eller fysik/kemi samlet er på 72 ECTS-point. Linjefagsuddannelsen i geografi og biologi svarer til 36 ECTS-point og forudsætter ikke at de studerende har deltaget i fællesmodulet, for at opnå linjefagsuddannelse. Dermed kræves der mindre linjefagsuddannelse i geografi og biologi end i fysik/kemi og natur/teknik.

Læreruddannelsesreformen baserede sig blandt andet på Globaliseringsrådets vision for en bedre folkeskole, hvori der blandt andet står:

“Læreruddannelsen skal tiltrække dygtige studerende. Men nogle seminarier optager mange studerende, der reelt ikke har kompetencer til at deltage på det forudsatte niveau. For at styrke fagligheden er der behov for at stramme op på de studerendes indgangsniveau i linjefagene.” (Globaliseringsrådet, 2005, s. 18)

Reformen af læreruddannelsen skærpede efterfølgende adgangs- og niveaukurav. Rektorer fra landets læreruddannelser udtrykte bekymring over at dette kunne føre til færre lærerstuderende (Ravn, 2006). Reformen af læreruddannelsen medførte et fald i antal studerende i læreruddannelsens naturfag, hvilket fremgår af tabel 4. Den øverste række viser det gennemsnitlige antal lærerstuderende med et naturfagligt linjefag for årgang 2003-2006. De nederste rækker viser studerendes valg af naturfag for årgang 2007 og 2008 efter læreruddannelsesreformen. (M. Mommsen, Undervisningsministeriet, personlig kommunikation, oktober 2010).

**Tabel 4.** Antal lærerstuderende som har valgt et naturfagligt linjefag i læreruddannelsen.

Valg af naturfag	Natur/teknik	Fysik/kemi	Biologi	Geografi
Gammel læreruddannelse (gennemsnit 03-06).	348	196	235	250
Ny læreruddannelse (årgang 07)	104	114	135	69
Ny læreruddannelse (årgang 08)	77	179	234	167

Det er ikke intentionen at diskutere årsagerne til den vigende rekruttering til naturfagene her, men den kan formodentlig begrundes i flere problematikker der knytter sig til linjefagsstrukturen i den nye læreruddannelse (Krabbe Sillasen & Kronvald, 2007). Vi undlader også at redegøre for de forskellige tiltag læreruddannelser rundt i landet praktiserer for at modvirke den vigende rekruttering til naturfagene (Lauritsen & Ainsinger, 2010). Disse tiltag har ikke medført en rekruttering til naturfagene svarende til niveauet før læreruddannelsesreformen. Konsekvensen af den vigende rekruttering til læreruddannelsens naturfag er blevet en forringelse af læreruddannelsernes muligheder for at uddanne naturfaglige linjefagsstuderende. Det skyldes at læreruddannelsernes økonomi er styret af et taxametersystem hvor ressourcer til aflønning af undervisere i naturfagene hænger direkte sammen med rekrutteringen til selvsamme linjefag. Denne negative feedback kan i sidste ende betyde at der ikke er beskæftigelse til undervisere i naturfagene ved læreruddannelserne hvis den lave rekruttering fortsætter (Pontoppidan, 2007). Rekrutteringsproblematikken i læreruddannelsen kan isoleret set få negative konsekvenser for folkeskolelæreres kompetencer i naturfagene på længere sigt. Hvis der ikke løbende uddannes et antal lærere med naturfaglige kompetencer der svarer til det antal pensionsmodne lærere med naturfaglige kompetencer der forlader folkeskolen, vil den samlede kompetence

i naturfagene formindskes, hvilket kan medføre at linjefagsdækningen i naturfagene i skolen vil forværres (Danmarks Lærerforening, 2007).

Det politiske flertals reform af læreruddannelsens naturfag i 2007 tog afsæt i en intention om at styrke nye naturfagslæreres kompetencer ved både at øge læreruddannelsens adgangskrav og udvide linjefagene i natur/teknik og fysik/kemi. Denne løsning på læreruddannelsens indholdsmæssige problem kan ikke genfindes i de anbefalinger som var formuleret i udredninger og evalueringer (Norrild, 2007). Derfor fremstår den kvalitative forbedring ved naturfagernes nye struktur og placering i læreruddannelsen uklar. Aktuelt vil den lavere rekruttering til læreruddannelsens naturfag føre til en reduktion i læreruddannelsens kapacitet til at uddanne naturfagslærere til folkeskolen. Dette betyder udtyndede naturfaglige miljøer på læreruddannelserne med ringere mulighed for kollegial sparring. De forskellige lokale læreruddannelser har ikke generelt løst problemet med at få uddannet tilstrækkelig mange naturfagslærere. Udpiningen af læreruddannelsesstedernes økonomi og underviserkompetencer betyder ikke direkte noget for den enkelte naturfagslærers hverdag i folkeskolen. Derfor kan vores valgte analytiske fokus på læreres mulighed for at engagere sig i reforminitiativer ikke umiddelbart bringes i anvendelse. Men det faldende antal nyuddannede naturfagslærere udpiner folkeskolens samlede lærerkompetence inden for naturfag – hvilket på sigt negativt kan påvirke lærerkorpsets muligheder for kompetent at løse opgaven med at undervise i naturfag. Læreres fagdidaktiske kompetencer er ifølge Nordenbo et al. (2008) afgørende for børns læring.

## Konklusion

I artiklen har vi analyseret tre uddannelsespolitiske reforminitiativer i folkeskolens og læreruddannelsens naturfag: naturfagernes målsætninger, lærernes efter- og videreuddannelse og læreruddannelsen i naturfag. Reforminitiativerne afspejler på forskellig vis hvordan det politiske system ønsker at fremme kvaliteten af naturfagsundervisningen i folkeskolen. Dette er sket gennem såvel strammere styring af fagernes indhold (Fælles Mål) som kortsigtet (efteruddannelse) og langsigtet (grunduddannelse) kompetenceudvikling af lærere. Fælles for de tre initiativer vi har analyseret, er at de alle er centralt initierede reformer, men de afspejler forskellige grader af lokal forankring og samspil mellem aktører og ressourcer.

I forhold til naturfagernes målsætninger kan det konkluderes at intentionen bag de detaljerede statsligt formulerede målsætninger om at øge ansvarliggørelsen af lærerne opleves af dem som et tab af professionelt råderum. Med de hyppige revisioner er lærernes muligheder for lokalt at fortolke fagernes formål og udnytte deres professionelle kompetencer blevet indskrænket. Dette reforminitiativ griber således

direkte ind i kvaliteten af lærerens arbejdsliv. I fremtiden kan den større præcisering af Fælles Mål II blive en succes hvis der skabes "rum" til at lærerne kan fortolke målsætningerne i forhold til deres egen, kollegers og skolens samlede praksis i naturfagene. Derigennem vil lærerne have muligheder for at påtage sig ansvar for den lokale naturfagsundervisning.

I relation til lærernes efter- og videreuddannelse er støttemulighederne formidlet gennem kommunale skoleforvaltninger. Dette reforminitiativ har haft meget forskellig betydning for den enkelte lærer afhængigt af om vedkommende selv fik mulighed for at deltage i nogle af efteruddannelses tilbuddene eller ej. De deltagende lærere fik formel kompetenceudvikling gennem støtteordningen, hvorimod kommunerne generelt set ikke udnyttede det bevilgede tilskud. Det er p.t. uundersøgt hvordan lærernes nye kompetencer har påvirket deres samarbejde, deres strukturering af deres arbejde og deres interaktion med ledelsen. Staten havde færre udgifter til ordningen, men fik ikke indfriet sin målsætning om et bredt nationalt løft pga. den ringe udnyttelse af de afsatte midler. Eventuelle tilsvarende initiativer vil fremover have bedre muligheder for at lykkes hvis der gives større frihed for lokal tilretning af de afsatte midler.

Med hensyn til læreruddannelse i naturfag har den nye struktur givet færre lærerstuderende, hvilket vanskeliggør indfrielse af den politiske intention om en bred faglig styrkelse af naturfagene i læreruddannelse og folkeskole. Det har både kortsigtede og langsigtede konsekvenser. På kort sigt vil det udhule både læreruddannelsens økonomiske grundlag og underviserkompetencerne i læreruddannelsen. På længere sigt vil det udpine lærerkompetencerne i folkeskolen inden for naturfag. For at fremtidige reformer af læreruddannelsen vil kunne lykkes med at styrke naturfagene, er det vigtigt at de centralt styrede ændringer baserer sig på faktiske analyser af de lokale problemer i læreruddannelsen.

Sammenfattende peger vores analyse af de tre initiativer på at implementeringen er sket med klar central styring og ringe opmærksomhed og tålmodighed over for lokal forankring i folkeskole og læreruddannelse hvor de uddannelsespolitiske initiativer skal implementeres. Denne ubalance mellem aktørernes roller og ressourcer forringer kvaliteten af reformerne, idet de anvendte ressourcer ikke udnyttes optimalt i forhold til at forbedre naturfagsundervisningen i Danmark.

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**Abstract**

The quality of three reform initiatives in science education in Denmark is analyzed: reform of the central aims, reform of in-service teacher training programmes and reform of pre-service science teacher training. The analysis focuses on *teachers' possibilities and constraints to invest resources in implementing* reforms. The analysis indicates that teachers have had various degrees of possibilities for implementing the reforms. This situation has created an imbalance between teachers' and other actors' investments in resources, which reduces the quality of the reforms.



# The neoliberal utopia and science education in Denmark; from education for citizenship to education for working life

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## Abstract

This article presents an analysis of the political framing of science education in Denmark when a liberal-conservative government was in power from 2001 to 2011, and a new set of reforms of the educational system were put into operation at political, implementation and operational levels. Using critical discourse analysis the article builds an argument about how the new reforms have brought fundamental changes in the role of education within society, changes that resonate with a global discourse of neoliberalism. The analysis illustrates how neoliberal ideas about individualisation, competencies and accountability have penetrated science educational policy and the curricular aims of primary science. Finally, the article discusses whether the neoliberal trend in science educational reforms is viable for the future and whether there are alternatives to the existing scenarios.

## Introduction

Teachers lack ambitions for their students. Too much time is spent on social activities and nonsense. The Conservative Party wants to stop this waste of time and make school a place where kids really learn something (Dahlgaard, Frank educational spokesman for the Conservative Party, *Politiken*, 24 November 1996)<sup>1</sup>

It is crucial that our children and young people learn something they can use. Therefore, we have introduced mandatory aims for what students should know at certain years in school. And we will give schools a better opportunity to test whether the objectives are achieved (Fogh Rasmussen, Anders, Prime Minister, speech at the opening of Parliament, 5 October 2004)

Denmark needs more young people who want to be engineers, biotechnologists and science teachers. We need many of them to choose a career in the scientific and technological areas. Much of Denmark's prosperity and competitiveness are built on these areas. Therefore public as well as private companies are

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<sup>1</sup> All quotes in this article have been translated from Danish to English by the authors.

completely dependent on the availability of a qualified workforce in science and technology, now and in the future (Haarder, Bertel, Minister of Education, National Annual School Meeting at Sorø Academy, August 2009).

Who can deny the appeal of these words? Who can stand up to the politicians and argue against 'people learning something they can use' or science education that supports the 'prosperity' of society?

When politicians talk about the need to improve education in general and science education in particular, their claim seems to be irrefutable. From a researcher's perspective, no political statement is to be taken for granted nor can its 'innocence' be assumed. Consequently, we want to present an analysis of the political framing of science education in Denmark since 2001. There are three reasons why such an analysis is of relevance to (science) education research. First, since the 1980s, educational research has prioritised issues of learning whereas the political dimension of education has been under-researched (Biesta, 2005). In adopting a political approach in our analysis we want to emphasise that the recent changes to policy and education in Denmark, within the context of a liberal-conservative government in power from 2011 to 2011, have brought fundamental changes to the role of education within society. As a new set of reforms are put into operation at political and implementation levels, affecting the new curriculum, there seems to be a gap between general educational research and subject-specific research in terms of the political dimensions of education. Second, educational research literature adopting political readings of education has documented and interpreted the impact of neoliberal policies on education (Bascia, 2005). These types of analysis are seldom connected to specific subject domains such as science and mathematics, probably because their academic traditions tend to privilege the micro-pedagogical aspects of the subject matter while disavowing their place in social and political relationships (Pais & Valero, 2011). This type of distinction, however, benefits no one. Children in schools are being moulded not only as the result of their participation in schooling in general but also when they are taught science, mathematics or language. It is time to bridge this gap in order to understand the politics of subject matter pedagogy and curricular reforms. Third, whereas processes of neoliberalisation have impacted strongly in other parts of the world, the Scandinavian countries have lived through a long period without being influenced by these global trends to any marked degree. We will not study all the Scandinavian countries, but concentrate on Denmark, where until the late 1990s there existed an educational system based on principles of *solidarity* and *education for all* (Undervisningsministeriet, 1993). An analysis of this transformation might provide a deeper

understanding of the current political constitution of the Danish educational system, and in many countries in the world.

Drawing on critical discourse analysis (Fairclough, 2001), we intend to look for resonances between neoliberal discourses at a macroscopic level and political and educational discourses at a microscopic level. Our intention is to show how the reforms and political rhetoric in Denmark are embedded in and resonate with a neoliberal globalised discourse in which knowledge is a commodity that can be characterised by *individualisation*, *competence* and *accountability*. Such discourses have infiltrated Danish educational policy-making in the last decade, in general, and educational reforms in school science, in particular. We will illustrate how the Organisation for Economic Co-operation and Development (OECD) has played a crucial and dominant role in ensuring these resonances.

We start by presenting some theoretical and methodological reflections that guide our analysis. Then we put forward an overview of what we see as the hegemony of the current neoliberal discourse in education from an international perspective. We suggest why such discourse is based on a utopia. We then describe some important events which made it possible to implement reforms influenced by neoliberalism in Denmark. In the third part we will concentrate on the reforms in science education in Denmark in the period 1993 to 2009.

### **Theoretical perspective and method**

In the study of educational processes from a political perspective a discursive approach has been used to see how educational ‘realities’ are constituted in social practices. We intend to show how different discursive practices reproduce distribution of power within different levels of educational policy (Christensen, Stentoft, & Valero, 2008).

Following Fairclough (2001) we perform an analysis of three interrelated discursive levels: a macroscopic, a mesoscopic and a microscopic level. At the macroscopic level we locate the global discourse of neoliberalism and identify the central ideas. At the mesoscopic level we illustrate how the global neoliberal discourses entered the political and educational sphere in Denmark around the end of the twentieth century by focusing on the alignment of important events in the OECD and in Denmark in the 1990s and 2000s. We analyze the texts produced in these events. At the microscopic level we analyze how characteristics of the neoliberal discourse are aligned with science educational policy texts such as national curriculum. We point to the discursive resonances and relationships between them.

The empirical analysis of the reforms in science education in Denmark during the 2000s is based on the series of educational policy documents produced by the Danish Ministry of Education (Egelund, 2002; Søndergaard, Bang Pedersen, & Seest, 2009; Undervisningsministeriet & Ministeriet for Videnskab, Teknologi og Udvikling, 2004) and a series of political statements in the debates about the changes in educational policy. In particular, we examine the statements of the Prime Minister and the Minister of Education during that period, since they were central actors in bringing an ideological change into the educational system. We concentrate on statements expressed in political contexts, and how they resonate with the neoliberal discourse. Furthermore, we examine the historical conditions in which the emergence of such political statements and quotes are embedded and contextualise the educational statements within the general policy documents of the government (Regeringen, 2006; Undervisningsministeriet, 2002a; Undervisningsministeriet & Ministeriet for Videnskab, Teknologi og Udvikling, 2004).

Our search for discursive resonances in these three levels shows, on the first hand, that we cannot suppose a cause-effect relationship between them, because the complexity of how social and discursive practices are formed cannot be conceptualised in terms of mechanical systems (Fairclough, 2001). On the second hand, looking for discursive resonances paves the way for identifying the ideas that repeatedly appear in texts, as well as the conditions that make their repeated appearance in other linked texts and historical contexts possible. In other words, the analysis of discursive resonance is possible because we assume intertextuality to be a characteristic of discourse and discursive practices (Fairclough, 2001). This type of analysis allows us to link discourses that are apparently not connected, such as, in the case of this paper, neoliberal discourses and particular changes in science education policy.

An influential political statement that illustrates the resonances between the macroscopic and mesoscopic levels was that of Ulla Tørnæs in 2004 (Minister of Education 2001-05): '17% of Danish pupils are functionally illiterate' (Tørnæs, 2004). This statement shows how the OECD Programme for International Student Assessment (PISA) event affected the political discourse on school outcomes. The statement was a response to the PISA survey of 2003 and it was published in the media one day before the official publication of the survey. This gave the Government a political advantage in the media, even though the data were not in the PISA report. Researchers criticised the minister for being simplistic and drawing incorrect conclusions from PISA (Johansen, 2005). The statement is nevertheless one of the most frequently cited in Denmark contrasted with the fact that Denmark has one of the most expensive educational systems in the world. Immediately

after her statement Tørnæs proclaimed that the government would intervene. One of the consequences was that in 2004 the curriculum 'Clear Aims' was changed to 'Common Aims', whereby the curricular aims became compulsory for all schools in the country. They dictated specific aims for specific school years in the subject of science. Common Aims was meant to ensure a universal state school, all students having the opportunity to acquire the same knowledge and skills (Undervisningsministeriet, 2004).

With the introduction of Common Aims and national tests teachers' opportunities to act autonomously in schools detached from public scrutiny vanished in favour of demands for public accountability in accordance with standards of achievement and core curriculums (Ranson, 2003). An interesting reflection is that Tørnæs's statement repeats almost verbatim a comment in the report 'A Nation at Risk' (1983) commissioned by Ronald Reagan (National Commission on Excellence in Education, 1983). The interesting thing is that the comment caused as much debate in the Danish press in 2004 as it did 21 years earlier in the USA and in both countries it paved the way for big changes in the education systems.

### **The hegemony of neoliberalism in the education system**

Neoliberalism as an approach to economic and social policy is not new. Historically it is rooted in liberal economic theory. In a discussion of this trend in relation to various forms of governmentality, Foucault points to its several origins in the 1920s, and emphasises the effect of post-WWII German liberalism and the liberalism of the Chicago School. In both cases, the neoliberal approach legitimises itself with references to economic growth, the principles of competition, and the rights of the individual (Lemke, 2001). The Chicago School argued that the role of the state should be limited and be dominated by market mechanisms: the modern welfare state was focusing too much on public service which would limit economic growth (Lemke, 2001); instead, contracts between individuals and between single enterprises all over the world would ensure economic growth.

The more recent trends of neoliberalism since the 1990s have been strongly represented by politicians within what has been called the 'Third Way' (e.g. Tony Blair in the UK, and Bill Clinton in the USA). These politicians adopted liberal economic rationalism in the face of the fear of not being able to succeed in post-industrial society. Neoliberalism, therefore, appears to be an over-political phenomenon (Peters, 2001) which no government can resist. The reification of

neoliberalism creates the idea of its being an unavoidable state of affairs and of economic and political organisation. Neoliberal strategies have been 'naturalised' and are nowadays presented as if they are non-political and non-ideological and simply a matter of technical management (Ong, 2006). This type of *discursive construction* penetrates the micro-processes that constitute neoliberal forms of organisation.

Bourdieu and Gustavsson asked whether 'neoliberalism is the realisation of a utopia based on an economic theory containing a deliberately selective reconstruction of reality' (Bourdieu & Gustavsson, 1998, p 59). According to them, the neoliberal ideal is based on a utopia of an organisation with a perfect and unblemished market where individuals always act rationally. Neoliberalism puts a mathematical fiction into operation, reflecting a selective model of reality, where economic rationality is the very foundation of the perception of reality. Power is a central part of the neoliberal discourse based on a seemingly scientific knowledge base, and Bourdieu and Gustavsson argue that political programs help to ensure the realisation of neoliberal ideas:

The general trend in the neoliberal program is to reinforce the division between economic and social reality and thus to construct an economic system in reality, which fits the theoretical model. That means a kind of logical machinery which appears as a chain of compelling circumstances (Bourdieu & Gustavsson, 1998, p 60).

Furthermore, the implementation of a neoliberal utopia has consequences for society: commercialisation increasingly penetrates collective entities including state and public services and the pure logic of the market restricts the state's ability to act (Bourdieu & Gustavsson, 1998). Therefore, whereas national reform processes seem to be tied to local national characteristics and circumstances, at an international level there is a certain kind of pattern and homogenisation of the mechanisms for achieving reforms (Karlsen, 2004; Lundahl, 2006). In summary, neoliberalism constitutes an effective mechanism of governmentality (Ong, 2006) with all its associated discourses and techniques. In literature discussing the impact of the neoliberal discourse in education (Bascia, 2005; Mayo, 2009; Ranson, 2003), three particular neoliberal processes and their related practices are highlighted:

- *Individualisation* as the process that creates individuals as movable units in a competitive, flexible and global labour force.
- *Development of individuals' competencies* as a process whereby individuals acquire market value through the development of skills and knowledge that can be treated as a commodity.

- *Development of individual accountability* as a process establishing a clear relationship between individuals and the responsibility for their actions.

These three processes are important tools in the neoliberal philosophy of governmentality, that is, of setting in place practices and their associated discourses to regulate human behaviour in society. In what follows we outline the characteristics of these three processes and their connection with education.

### **Individualisation**

The neoliberal philosophy of individualism is a renewal of the classical economic liberalism. 'It asserts that all human behavior is dominated by self-interest' (Peters, 2001, p 118). Thus, the concept of neoliberal reflection lacks the social and collective dimension in explaining behaviour. The neoliberal philosophy of individualism provides the foundation for an extreme form of economic rationalism that focuses on individuals' knowledge as a dominant commodity. This economic rationalism is seen in many Western countries where it has resulted in standardisations in educational systems at the expense of self-development (Peters, 2001). Such standardisation relates to the possibility of comparing individual outcomes. Neoliberalism is desocialising because it knows nothing but the individual. In business and in government there is a belief in a hierarchy of skills guaranteed by exams with individualisation in a central position (Bourdieu & Gustavsson, 1998) .

The OECD has ensured a connection between the economic and educational spheres. The OECD convention states that economic strength is essential for individual freedom and general well-being (OECD, 1960). The OECD report *Education and the Economy in a Changing Society* stated that the role of education is to develop individuals' capacity, flexibility and quality to meet the demands of the labour market (OECD, 1989). The role of the OECD was to act as a catalyst in the process of aligning educational outcomes and economic outcomes. A key concept was the self-intended individual (Rubenson, 2008). The process of individualisation leads to a focus on individuals' competence-based learning.

### **Developing individuals' competencies**

Competence is a construction which combines acquired knowledge and skills with a capability to act in specific contexts (Wedegge, 2003). In a neoliberal discourse competence involves entrepreneurship, competitiveness and territorial mobility of capital and workforce. Education should be competence-based in order to strengthen the competitiveness of private enterprise. The

development of individuals' competencies for the benefit of private enterprises was explicitly formulated by the Danish Employers Society, who emphasised that knowledge production is a condition for economic growth and welfare (Ringsted, 1999). This idea derives from the demands of society and especially the requirement of the private sector for specific competencies that help to generate value (Mayo, 2009; Wedege, 2003). In this sense competence is outcome-based, and the educational system must ensure that individuals become more valuable in the global labour market.

The OECD has played a key role in implementing the concept of competence as a tool to characterise knowledge in education systems normatively. As part of its educational reforms and international coordination, the OECD in 1996 described key competences in planning, steering and control. The OECD competencies made it possible to compare student outcome at a national and international level (Durand-Drouhin, 1996). OECD ended the project Definition and Selection of key Competences (DeSeCo) in 2003 with the report *Key Competencies for a Successful Life and a Well-Functioning Society* (Rychen & Salganik, 2003). Later, the OECD selected and defined competencies that would be crucial to successful societal development after the millennium (Hermann, 2007). This work was intended to formulate the competencies that are vital for individual prosperity and well-functioning societies (DeSeCo, 2008). The essential and indispensable key competencies for successful life and well-functioning societies with sustainable socioeconomic and democratic development are organised in three competence categories (DeSeCo, 2005):

- *Ability to interact in heterogeneous groups*
- *Autonomous agency and the ability to act in social settings*
- *Autonomous agency in relation to the use of artefacts and language*

Underlying these competence categories, however, is an understanding of the development of individual competencies as a process whereby individuals acquire value for the labour market. Competence-based aims make it possible to hold the individual accountable for their performance in the educational system.

### **Developing individuals' accountability**

Accountability is a very complex concept that is difficult to translate into the Scandinavian languages and so it is often used without being translated. Even in English it contains multiple layers (Ranson, 2003). These include, on the one hand, answerabilities and, on the other hand, bookkeeping (Schedler, 1999). On a general and simplified plane it means that if a person is



accountable for certain activities, he or she will have to explain why the activities take place and how the activities can be justified. The answers to these questions are indeed related to power and distribution of power and, in public service, to forms of governance (Ranson, 2003) .

Within a neoliberal discourse the rationality of accountability is authority through calculation and instrumentalisation with a main focus on individualism, competitive advantage, control of input/output and profit (Ranson, 2003). This underlines how developing individuals' accountability has become more dominant in the neoliberal educational discourse. As we will show, the development of accountability affects both teachers and individual pupils.

This is not a new trend. By the 1970s education was already changing from an autonomous professional community detached from public scrutiny to a public concern faced with demands for public accountability that included standards of achievement, appropriate teaching methods and core curriculums (Donnelly & Jenkins, 2001; Ranson, 2003). Neoliberal accountability has generated a series of moves from professional judgement to market competition, from specialist knowledge to consumer choice, from internal reports to public data (Ranson, 2003). Public data (e.g. exam results) are standardised, so that they are comparable. This in turn will cause an increased focus on standardisations and assessment procedures based on educational outcome .The capacity to provide expert comparative knowledge according to accountability has afforded OECD a discursive advantage in accordance with other supranational organisations (Mayo, 2009) .

At a macroscopic level of analysis, the constitution of neoliberal discourses is notable, inter alia, for bringing into operation the processes of individualisation and developing individuals' competencies and accountability. We have shown how these processes emerge in the neoliberal discourse and how the OECD has played an important role in providing the mechanisms to trigger their operation. In the following section we will show how the neoliberal discourses have entered the political and educational spheres in Denmark. This will constitute the mesoscopic level of our analysis.

### **An ideological showdown with strong impact in Denmark**

At a mesoscopic level national educational policies have increased attention on the outcome of teaching. This is a consequence of the social and economic changes at the beginning of the new millennium (Rychen & Salganik, 2001). The background to these changes is, according to Bowden (1997), the necessary alignment between experiences under education and participation in working life. In this section we will illustrate how these imperatives are used as part of the neoliberal

discourse in the political and educational spheres in Denmark by focusing on some major events which brought the Danish educational policy in line with the educational policy of OECD and thereby had a strong impact on Danish education. These events are the use of results from OECD reports in designing Danish educational policy, publication and political use of the PISA results and the change of government in Denmark in 2001. Discursive resonances are investigated by studying texts and documents that relate to these events. The neoliberal movement started in the Danish educational system in the 1990s with New Public Management (Klaudi Klausen & Ståhlberg, 1998) and Human Resource Management (Hermann, 2007) but it was the change of government in 2001 to a Liberal-Conservative coalition that was the real launch of an ideological showdown with the reform pedagogy which prevailed in primary and lower secondary schools at that time. Reform pedagogy was much inspired by Dewey and focused on liberal, anti-authoritarian and student-oriented teaching methods (Dewey, 1938). The showdown with this pedagogical movement was part of a broader cultural campaign against cultural radicalism. It had a substantial impact on educational policy, because the criticism was grounded in the PISA results from 2000 and 2003 and the OECD review of Danish primary schools in 2004. The OECD reports (Centre for Educational Research and Innovation & OECD, 1997) and PISA surveys (OECD, 2001) were important tools for the educational policy strategy of the OECD membership countries in combining economy and education (Rubenson, 2008), and they were used to question what pupils should learn in school (Hermann, 2007).

The new government replaced the notion of information society with the notion of globalisation as a way of changing discourse in their efforts to implement neoliberal ideas. The focus on globalisation led to an increased economic focus in the educational policy in Denmark (Hermann, 2007). The new government had reform of the educational system as a key element in their general strategic plan:

In primary and lower secondary schools a high level of learning is essential for success in tomorrow's job market. Future primary and lower secondary schools have to be based on subject matter knowledge, flexible, and adaptable to future challenges (Regeringen, 2001, p 20).

In 2002 the Government formulated an educational strategic plan in which 'education for working life' was emphasised as the purpose of education (Regeringen, 2002). This focus aligned with OECD's recommendations (OECD, 1989).

The defining event was the change in government, because the new government used the OECD policy papers and the PISA reports to legitimise new political initiatives.

### **New political initiatives**

Following the major events presented in the previous section, the new government initiated an educational reform that enabled the implementation of their new educational policy. In this section we will present some mesoscopic political initiatives that had a strong impact on this reform and elaborate on how they are related.

The first initiative was the government's establishment of an expert panel that was mandated to formulate a coherent strategy for operationalising the government's educational strategic plan for science in the entire educational system (Regeringen, 2002). The members of the expert panel on science and science education broadly represented schools, teacher training colleges, universities and industrial organisations. The expert panel published a report in May 2003 in which they presented a coherent strategy plan with recommendations for the political system on reform of science education at all levels in order to meet the intentions outlined in the government's educational strategic plan (N. O. Andersen, 2003). The justification for this strategy plan was the poor performance of Danish pupils in international surveys like that of PISA (OECD, 2001) and TIMMS (TIMMS, 2007), pupils diminishing interest for doing career in science and technology, that the science education needed to be reformed so that pupils would acquire knowledge that enable them to act in a modern risk-society and that science education must be strengthened in order to prepare young people better for their future working life (N. O. Andersen, 2003). The report ended with several recommendations:

- All pupils in school must be taught science at some level, because science is an important component for pupils' self-development.
- The concept of competence must be used as a descriptive and normative tool at all levels in the educational system.
- The collaborative culture in science teacher communities must be developed so that the quality of science teaching is improved.
- Teachers' professional competencies must be improved by designing new and focused in-service teacher training programmes that aims at developing science teacher communities and municipal science consultants.

- Science educational research and development is defined as a strategic work area at a national level for universities and resource centre.

However, the political implementation of these recommendations was a complicated process, because the government's intention was to implement a broad reform that involved all levels of the educational system (Regeringen, 2002). Hence, the operationalisation of the recommendations depended on the realisation of other political initiatives, some of which are presented below.

The second initiative was the recommendations from the Globalisation Council established in 2005. The Council's task was to advise the Government on a strategy for Denmark in the global economy (Regeringen, 2006). The Council had high status, because the Council members held some of the highest ranking offices in business, government and other civil organisations. The first seven of 14 future globalisation priority items focused on education. In relation to state schools, the Council recommended that the objective clause should focus on increasing pupils' subject matter knowledge and preparation for further education. This recommendation is clearly in line with the OECD's recommended closer link between the sphere of education and the sphere of economy (Durand-Drouhin, 1996). There was also a clear similarity between the Council's recommendations and the government's political objectives in education (Regeringen, 2006). In relation to state schools, the Council's recommendations were put into action through the revision of the Danish state school act and the introduction of competence-based curricula in various subjects (Dupont & Holm-Larsen, 2006).

The third initiative was the reform of the Danish State School Act in 2006 (Dupont & Holm-Larsen, 2006). The purpose of schooling was changed from what can be characterised as 'education for citizenship' to a more utilitarian purpose that puts emphasis on 'education for working life' (Hermann, 2007). Hermann argues that the revision of the objective clause in the State Schools Act is to 'prepare them [pupils] for further education and training and instil in them the desire to learn more' so that an 'understanding of other countries and cultures contributes to their understanding of the interrelationship between human beings and the environment and promotes the well-rounded development of the individual student' (Undervisningsministeriet, 2008). This led to a curriculum that had more focus on the individuals' development of ability to act competently in a democratic society (Hermann, 2007).

The fourth initiative was the attempt to introduce a competence-based curriculum through repeated revisions of the national aims for science and pre-service teacher training programmes. This initiative was based on one of the recommendations presented by the expert

panel referred to above (N. O. Andersen, 2006). There was, however, much resistance to the process of implementing the four science competencies introduced by the expert panel (N. O. Andersen, 2006). This will be elaborated in the next section.

We will now give a more detailed presentation of changes in the Danish science curriculum and analytically establish the resonances between the presented case and the above-described neoliberal characteristics and various statements from interested parties in Denmark.

### A Danish version of global neoliberal science education

In this section we provide evidence to support the argument that a neoliberal discourse continuously influences the changes implemented in the educational curriculum on the microscopic level. We will present an analysis that illustrates how neoliberal key concepts such as individualisation, competences and accountability can be traced in factual legislation and the aims promoted in science curricula from 1993 to 2009. These descriptions will be collated with international trends. For reasons of simplicity, we will mostly be referring to primary science (year 1 to 6), and we will focus on how the aims of a single topic in the curriculum have changed over the years from indicative aims to mandatory aims. The chosen topic is ‘the weather and the seasons’. The changed phrasing of this topic illustrates the changing of the whole curriculum for primary science as we want to illustrate how the curriculum for science education has become standardised with detailed descriptions of competence-based aims.

**Fact box 1: Presents the aims for teaching weather and seasons in Danish primary science as they were stated in 1993 and 2009. It can be seen that the aims stated in 2009 are much more detailed than those in 1993. The aims stated in 2009 were mandatory, whereas the aims stated in 1993 were indicative.**

Aims for weather and seasons in primary science (year 1 to 6) in 1993 and 2009	
1993 CKS (Core Knowledge and Skills)	2009 (Common Aims)
The pupils shall work with:	The teaching shall ensure that pupils have acquired knowledge and skills that enable them to:
Phenomena associated with weather and seasons	After 2nd Year:

	<ul style="list-style-type: none"> <li>• Connect the different seasons with important events in nature</li> <li>• Investigate simple aspects of weather, including temperature and precipitations</li> </ul> <p>After 4th Year :</p> <ul style="list-style-type: none"> <li>• Use simple technical terms in description of weather observations, including temperature, wind speed, rainfall and visibility</li> </ul> <p>After 6th Year :</p> <ul style="list-style-type: none"> <li>• Compare their own data with a weather forecast</li> </ul>
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Note: Excerpts from (Søndergaard et al., 2009; Undervisningsministeriet, 1994). For reasons of simplicity we have shown just one of the topics in each of the curricula. The straplines ‘The pupils shall work with’ and ‘The teaching shall ensure that pupils have acquired knowledge and skills that enable them to’ are the same for all topics in the curricula.

Comparison of Core Knowledge and Skills (CKS) from 1993 and the Common Aims from 2009 shows clearly that the aims have become more detailed and more centrally (national) issued standards (Søndergaard et al., 2009; Undervisningsministeriet, 1994). Even some of the educational methods are dictated in the curricula, a new element in the Danish school system.

**Fact box 2: Presents the changes in regulations that have had significance for the translation of 1993's indicative aims to the mandatory aims of 2009.**

Year	Context	Comments
1993	In The State School Act of 1975 there was a sentence about responsibility for solving common tasks. This sentence disappeared in the Act of 1993. Retained from former school acts was, however, a dual purpose of ensuring: (a) versatile and personal development of students (b) pupils were provided with knowledge and skills to benefit society.	CKS were defined in all school subjects at a national level, but the concrete aims for teaching were formulated at a municipality level or a school level.
1994	A new science subject ‘Natur/teknik’ (Nature/technique) was introduced in primary school year 1 to 6 in Denmark.	
2002	CKS was changed to what was called Clear Aims. Examples of aims in science: <i>The education shall ensure that pupils have acquired knowledge and skills which enable them to explain the phenomena associated with the weather and the seasons’</i>	

	(Undervisningsministeriet, 1994)	
2004	<p>Clear Aims was changed to Common Aims. It became mandatory for all municipalities and all schools to meet the same national aims (Undervisningsministeriet, 2004)</p> <p>Examples of aims in science (<i>Natur/teknik</i>)  <i>The teaching shall ensure that students have acquired knowledge and skills that enable them to:</i></p> <p>After 2nd Year:  <i>'Know conditions that characterise the different seasons'</i>  <i>'Investigate simple aspects of the weather'</i></p> <p>After 4th Year :  <i>'Use simple technical terms in the description of weather observations'</i>  <i>'Use simple measuring instruments to monitor the weather'</i></p> <p>After 6th Year :  <i>'Compare own observations with a forecast'</i>  <i>'Talk about phenomena related to the different seasons'</i></p>	Clear Aims should ensure a common state school where all pupils in Denmark should have the opportunity to acquire the same knowledge and skills.
2006	<p>A New State School Act was introduced, in which focus on further education was central.  <i>'The Folkeskole is, in cooperation with the parents, to provide pupils with the knowledge and skills that will prepare them for further education and training and instil in them the desire to learn more, familiarise them with Danish culture and history, give them an understanding of other countries and cultures, contribute to their understanding of the interrelationship between human beings and the environment and promote the well-rounded development of the individual student.'</i></p> <p>Individual study plans were introduced:  <i>All students in primary and lower secondary schools must have a written study plan (Section 1)</i>  <i>A study plan is the name of one or more physical or electronic documents developed at a primary school for each student. Section 1, article 3. (Dupont &amp; Holm-Larsen, 2006)</i></p>	It was decided that all students in primary and lower secondary schools should take part in national tests regarding reading and mathematics and in lower secondary school in reading, mathematics, English and science subjects.
2009	<p>In 2009, 'New Common Aims' were introduced in accordance with the Public School Act of 2006.          (Example of 2009 aims is showed in fact box 1)</p>	The Common Aims of 2009 are more prescriptive with regard to which scientific concepts is are taught and learned than the Common Aims of 2004

### Individualisation in Danish science education

As shown in fact box 2, the new subject primary science (Nature/Technique) was established in connection with the State School Act of 1993. This was done to strengthen science education (Veje,

2001). In this act individualisation was more central and the sentence from the State School Act of 1975 about responsibility for solving common tasks disappeared. According to the State School Act of 1993 education should contribute to the personal development of the individual student (Lov om Folkeskolen, 1993). At the mesoscopic level this was expressed by Bertel Haarder as follows: 'If there are 25 students in a class, they must be taught as 25 individuals' (Bertel Haarder, Ministry of Education<sup>2</sup> (Hermann, 2007, p 109)). In 1993 the process of individualisation in state schools was already more important than learning to solve common tasks. At a macro level this idea resonates significantly with the report *Education and Economy in a Changing Society*, (OECD, 1989) in which a central point concerns developing individual capacity. It was in 2001, however, that the process of individualisation really took off in the education system. In our description of important events at the mesoscopic level we mentioned the change of government in 2001 and the PISA surveys in 2001 and 2003. These events ensured resonance between recommendations from OECD and the process of individualisation in the Danish education system. Against a backdrop of various OECD reports, the liberal/conservative Danish government ensured that individualisation in the education system was strengthened.

This was also seen in an expert panel report from 2003 (N. O. Andersen, 2003). The expert panel discussed among other things how to handle the challenge of recruiting young people to study science. The idea was that the benefits of studying science or technology such as secure, well-paid work would encourage more young students to make the rational choice of taking on such education. This illustrates the significance that the present discourse in Denmark puts on the individual's ability to do well in working life and be prepared for further study within science and technology. In the following we will illustrate how this discourse and the resulting recommendations for combining educational and economic outcomes have had a direct influence on the science curriculum in Danish primary schools.

In line with the PISA studies which are based on individual standardised tests, the Danish government in September 2005 abolished group examination at all levels with effect from the year 2007 and in 2006 the individual study plan was introduced. The decision to abolish the group examinations had its origin at a mesoscopic level in the government's strategic plan of 2005. In this strategic plan it is stated that: 'Each pupil must be evaluated against measurable, transparent

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<sup>2</sup> Bertel Haarder was Minister of Education from 1982 to 1993 and again from 2005 to 2010.



criteria. Group examination will be abolished. And it will be ensured that every student has a right to go to the individual exam and obtain an individual assessment' (Statsministeriet, 2005, p 14). In return, group examination was no longer mandatory.

In science the upshot is that biology, physics/chemistry and geography now conclude with individual examinations and individual national tests. The teachers have to make a student plan for each student. In resonance with the neoliberal point of view and recommendations of OECD the Danish school system moved step by step towards increased focus on individualistic learning and individualistic capacity (OECD, 1989). The liberal-conservative government in Denmark during 2001-2011 believes in a hierarchy of skills guaranteed by exams, with individualisation in a central position.

### **Developing individuals' competencies in Danish science education**

The introduction of a competence-based curriculum emphasised development of individuals' ability to act competently in different situations by applying knowledge acquired through education (Hermann, 2007). For science education, the plans to introduce a competence-based curriculum were formulated in the strategy proposal 'Future Science Education in Denmark' (N. O. Andersen, 2003). The Danish Ministry of Education used this proposal to initiate a reform process of the science curriculum in primary and secondary schools that aimed at introducing competence-based aims.

Fact box 2 illustrates how the process of implementing competence-based aims in the science curriculum has undergone several revisions since 2002. According to the government's educational strategy the continuous revision of these competence-based aims is a necessary process, because the educational system constantly has to adapt to the needs of the commercial sector:

The fundamental common, social, cultural and personal competencies shall be considered and the demands and levels of subject matter knowledge and relevant competencies shall constantly be under development. The educational supply shall constantly adapt to the structurally determined competence needs in Danish commercial life (Regeringen, 2001, chp 1).

The latest version of the science curriculum, 'Common Aims' (fact box 1), illustrates why the political focus on developing individuals' competencies in the educational system is a core issue. For the topic 'the weather and the seasons' the curriculum states that 'the education shall ensure that pupils have acquired knowledge and skills which enable them to: connect the different seasons with

important events in nature (after second year), use simple technical terms to describe weather observations (after fourth year) and compare their own data with weather reports (after sixth year)'. According to these aims pupils' acquisition of science concepts is not the only purpose of teaching science. The pupils should also learn to use the acquired scientific concepts competently in different situations.

The development of competence-based aims in the science curriculum can be understood as the Danish government's response to OECD's recommendations about implementing key competencies as descriptive and normative tools in educational systems worldwide.

In Denmark, the political challenge of implementing competence-based aims was not a legitimisation issue, because the OECD had published several reports about the necessity of standardising educational systems by using a competence-based approach (DeSeCo, 2008; Durand-Drouhin, 1996; Rychen & Salganik, 2003).

The experts in the project about the core science curriculum (N. O. Andersen, 2003) underpin the argumentation of the government in power at that time as they emphasise that the competencies and skills of future generations are vital for the wealth, growth and welfare of Danish society. The competencies as they are formulated by e.g. Andersen (2003, p. 42) do not address the overall purpose of the state school system, as they leave out the contribution of science to the versatile development of the pupil including social skill. The competence description used in science curricula in Denmark is a limited version of those of DeSeCo (Rychen & Salganik, 2003), Schultz Jørgensen (Jørgensen, 1999) and the Danish Council for Competency (Kolind, 1999).

Competence-based aims are introduced to sharpen the obligations of the individual and the school to develop globally valuable competencies. These competencies are those that are of general value in a global working life within science and technology rather than competencies that are of value in everyday life.

The implementation of key competencies, as developed by OECD (DeSeCo, 2005), in the science curriculum since 2002 and the PISA studies has made it possible to compare pupil outcomes at a national and international level. This situation aligns the opportunity to assess pupils' educational outcome from a utilitarian perspective with the neoliberal rationality that pupils' acquired competencies are to be understood as a commodity.

## Accountability in Danish science education

In 2002 the Minister of Education explained the change from CKS to Clear Aims as follows:

An enhanced professionalism in teaching goes hand in hand with the development of pupils' versatile skills. The new subject descriptions contain more detailed core knowledge and skill areas (CKS) and indicative aims, and constitute the backbone of the initiative, Clear Aims, which supports the government's policy of increased openness and transparency in the education sector (Preface, Ulla Tørnæs, Minister of Education 2001-05) (Undervisningsministeriet, 2002b, p 5)

The above statement illustrates how neoliberal key concepts such as accountability and transparency resonate with the changes within education in Denmark. The 1993 aims state that the pupils shall work with 'weather and season phenomena', leaving the teacher and the pupils to decide how the pupils must work and with what elements of weather and season. This means that the pupils and the teacher are mutually accountable for how the work is performed in the classroom. The 2009 aims state that 'Education shall ensure that students have acquired knowledge and skills that enable them to...'. This statement makes a demand of the teacher as well as the pupils. The teacher is accountable for the effect of her/his teaching on the pupils; after receiving this education, the pupils are responsible for fulfilling the stated aims. It is the pupil's knowledge on weather and seasons and their ability to apply this knowledge to daily weather and seasonal phenomena that decide whether (1) the pupils have met their obligations within primary science learning and (2) whether the teacher has met her/his obligations within primary science teaching. In relation to the introduction of the Common Aims, the Prime Minister (2001-09) Anders Fogh Rasmussen said:

Some would call it a little reform, but I don't think of it like that, because by introducing a new scale, we promote a new mindset: you get focused on the idea that children should learn something at school and we are giving parents a tool to hold schools responsible, if children do not learn enough (Larsen & Fogh Rasmussen, 2003, p 301).

Both answerability and bookkeeping have now become part of the teacher's role. The teacher is accountable for students learning 'something' in the school, and this 'something' becomes more detailed and prescriptive in 2002, 2004 and 2009, as illustrated in fact box 2. The frequent need for revision of the curriculum (see fact box 2) indicates a lack of political confidence in the school system to achieve the aims. Politicians have argued that more detailed and precise aims tend to make the school more accountable and thereby they hope that reform will restore the general public's trust in the school system. As Ranson (2003), who analysed the UK's educational system, says, however:

This regime of neo-liberal accountability, designed to restore trust to public service has, however, had unintended consequences of further eroding public trust in the stewardship of public services because it has embodied flawed criteria of evaluation and relations of accountability (Ranson, 2003, p 470).

As regards accountability the situation in the UK seems to illustrate a bilateral macroscopic resonance with the situation in Denmark.

From 2001 to 2005 centralisation of educational content took place. All schools had to implement the same aims in their curricula. The Prime Minister's statements illustrate that the move was intended to foster transparency and control of teachers' work. The pupils' study plans and prohibition of group examinations should further improve the transparency of the individual outcome in the education system, which is in accordance with the neoliberal idea of the accountability of individual pupils and the teachers' work. A macroscopic resonance between individualisation and accountability is also evident here. As discussed above, the neoliberal utopia will know of nothing but the individual which is set into action through individualisation and accountability measures. To borrow from Popkewitz (2004, p.13), the good student is easily turned into a scientific problem-solving child, but this also creates a group of pupils who do not meet the demands of the detailed competence-based aims. They are in an individualised educational system and are left alone with the pain of not meeting the standards of society (Popkewitz, 2004) (Popkewitz, 2004). In the neoliberal discourse children are moulded in science education to be individuals who will be good at doing standardised tests, and if they become good at science, they will be very valuable to the future labour market.

In summary, we see how individualisation through individual exams and study plans has become mandatory, supported by an obligatory competence-based curriculum description that leads to clearer demands for accountability of both pupils and teachers. By ensuring measurable individual competence-based outcomes teachers and pupils can eventually be held accountable for their contribution to the overall national competitiveness. The competencies are those of general value in a global working life within science and technology, rather than competencies that are of value in everyday life.

### **Neoliberal processes and discursive levels**

In this article we set out to fill a gap between science education research and political studies in education. We have done this by analysing educational political events in Denmark. At a macroscopic level we have shown how the global neoliberal discourse has used the DeSeCo framework to implement individualisation, development of individuals' competencies and accountability in educational politics. At the mesoscopic level these neoliberal processes were

introduced in Denmark as more detailed and competence-based curricula and a new purpose for the Danish State School Act from 2006 with more emphasis on preparing pupils for further education and thereby enhancing their future value for the labour market. At the microscopic level the new purpose and the detailed competence-based aims for state schools made it easier to hold the individual teacher and pupils accountable. Therefore, although the neoliberal discourse according to Bourdieu is a utopia, the political system in Denmark has been ensuring its existence by making education an increasingly integral part of this discourse.

### **Imagining alternatives for the future of science education in Denmark**

There are possible alternatives to the existing scenarios that we have discussed so far.

First of all it is necessary to argue against the neoliberal assumption that the ‘welfare’ of a society is an attribute of individuals. The notion of welfare builds on some degree of collectivism in society. Within the neoliberal discourse, however, collectivism is absent (Bourdieu & Gustavsson, 1998). As Hofstede argues, however, it is not fruitful to burden societies with either individualism or collectivism (Hofstede, 1983; Ranson, 2003). Thus, to balance the neoliberal focus on individualism, we think it important to restore a connection between education and democracy in the educational system (Ranson, 2003). Scientific education should contribute to pupils' ability to act more collectively as responsible citizens in a global world. This can be done by reintroducing the notion of collectivism in science education that places greater emphasis on how pupils learn to use a collective knowledge base and to have social responsibility (Boreham, 2004; Roth & Lee, 2004).

Second, in the contemporary neoliberal dominated discourse the most valuable competencies are those that make individuals suitable for the global labour market. Adjectives like commercially and market-oriented are used to characterise the competencies that are suitable for the labour market. The human identity is more than its abilities and skills (Carlsen, 2005). It also encompasses individuals' ability to act as informed and democratic citizens in society (Mayo, 2009; Roth & Lee, 2004). In the neoliberal discourse, however, the use of the word competence overemphasises individual agency in society (Karlsen, 2004). If we want to make use of competence to transform the science curriculum we need to redefine the concept to include collective properties, as actually stated in the DeSeCo (2005) framework: *ability to interact in heterogeneous groups, autonomous agency and the ability to act in social settings*. The implementation of competencies in the science curriculum might also be considered to provide an opportunity to transform the notion of the

science knowledge that pupils should learn. A competence-based curriculum opens up the possibility of redefining scientific knowledge as something dynamic, whereby pupils learn about acting in society and producing new things, rather than as something static, whereby the main focus is to acquire bits of established knowledge (Fensham, 2011).

Third, as in many other OECD countries, the school system in Denmark has changed to ensure greater competition and to give parents opportunities to choose the best school for their children. Science education has become part of the culture of accountability in which rigorous inspection and control are increasingly established. This kind of logic makes it suitable to use the term 'the learner' instead of 'education' (Biesta, 2005). This equates to the thoughts on education in economic terms presented by the OECD in *Education and the economy in a changing society* (1989), thoughts that Robertson (2008) crystallises as the teacher as a provider and the learner as a consumer. The aims and purpose of science education are more and more detailed and explicit, which enables better possibilities for evaluating and measuring the individual student outcome of science teaching. This is in accordance with the neoliberal agenda for better management and accountability of pupils' acquisition of subject matter content. Very detailed aims can control but not develop education, however (Biesta, 2007). Detailed aims do not improve the professional behaviour of teachers. A reduced space for teachers to act professionally can limit the implementation of reforms in the educational system (Biesta, 2007; Darling-Hammond, 2005; Fullan, 2007).

Fourth, in Sillassen, Schmidt, Daugbjerg, & Valero (2011) the significance of a balance between educational politics and their qualitative implementation is discussed. It is documented how imbalance leads to poor use of resources in reform processes. The introduction of competence-based aims as discussed in the present article further stresses the significance of taking into account the possibilities and constraints that neoliberal-driven educational reform creates for pupils and teachers in actual school settings.

Ranson (2003, p.474) points to the need for a process that 'will gain the consent of the constituent publics when it has enabled each actor to join a dialogue about the accounts, the interpretive schema, and normative grounds that should inform the practices of the public service'. We find it important that teachers have space for developing science education in accordance with their pupils' abilities. This means that a national curriculum should enable such a space as well as provide a normative framework for pupils' learning of scientific skills in order to act as collectively responsible citizens.

Fifth, the initiation of such a process will require, a showdown with the seemingly deep-rooted belief in the neoliberal idea of people as rational utility maximisers and with faith in the globalisation of market forces as natural laws prevailing in the international education policy of recent decades and in Denmark since 2001. It does not mean that we should abandon international co-operation and exchange of information, but it is important to introduce other supranational organisations such as UNESCO (United Nations Educational, Scientific, and Cultural Organization) which have a more complex and a more holistic point of view (Rubenson, 2008). Understanding how education and economy are connected offers the possibility of changing our way of ‘doing’ school without building another utopia (Biesta, 2005).

By applying the above five reflections, basic science education in Denmark can again balance learning and political education. This balance would benefit from education research literature adopting political readings of education with specificities of curricular areas in science education, because even curricular formulations are not ‘innocent’ – they have a background of power and purpose.

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# Lærerarbejde under social omstrukturering

“Mennesker vælger fag og  
faget gør dem til sine udvalgte”

(Muel-Dreyfus, 2004)



Af Peer S. Daugbjerg,  
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Det danske bondeland har historisk været grundlaget for en række forfatterskaber. Omkring Limfjorden har bl.a. Jeppe Åkjær (1866-1930) beskrevet husmændenes og arbejdernes livsform. I moderne tid er det forfattere som Knud Sørensen og Jens Smærup Sørensen, der i prosa har beskrevet en bondekultur under omstrukturering i kølvandet på industrialiseringen.

Det er i dette oprindelige jyske bondeland, de følgende fortællinger om læreres arbejde tager sit udgangspunkt i en egn, som udover landbokulturen også er præget af en fiskerkultur med fiskeri på både Nordsøen og i Limfjorden. Men

*Francine Muel-Dreyfus er en af Bourdieus ældste studenter og medarbejdere fra tiden på Ecoles des Hautes Etudes en Sciences Sociales. Muel-Dreyfus arbejder med en historisk sociologi, dvs. studier af de sociale fænomener som de optræder og forandrer sig over tid, og derpå en sociologi der studerer fænomenerne, som de er situeret i et rum af sociale klasser og andre skel. Antagelsen er, at tanker, ord og gerninger genereres ud fra en grundorientering, som er et produkt af slægtens, gruppens og individets opsamlede og nedfældede historie. Muel-Dreyfus interesserede sig for, hvordan sociale grupper med givne kapitaler og dispositioner (habitusformer) på grund af historiske forandringsprocesser forlod deres kendte sociale miljøer og blev 'presset' ind i nye livssammenhænge: Hvordan tilpasser man sig eksempelvis nye sociale rammer i byen, hvis man er opdraget i en bondekultur? Muel-Dreyfus viser, hvordan denne tilpasning ikke er determineret, da der altid gives alternative muligheder, men sker i en interaktion mellem den kulturelle ballast og de nye krav og livsbetingelser.*

*Konkret arbejdede Muel-Dreyfus med casestudier. Hun har studeret de første franske folkeskoleseminarier, som blev udviklet i en republikansk, modernistisk og rationalistisk tradition omkring år 1900, og som i stor grad rekrutterede døtre og sønner fra bondefamilier, der lykkedes med at tilpasse sig nye kravforventninger.*

*En anden case omhandlede det store antal nye socialarbejdere i 1960'erne og 1970'erne, hvor særligt unge mænd fra middelklassen med relativt dårlige karakterer så en mulighed for en karriere på det sociale område; ikke for at tilpasse sig, men ved at de forsøgte at forvandle et altruistisk erhverv, der skulle hjælpe de fattige og afmægtige til at blive en fortrap for revolutionen, da de grundet deres sociale herkomst havde et overskud, de kunne realisere i denne kamp.*

*Muel-Dreyfus blev således også i Skandinavien en eksponent for forskning i de praktiske professioner, dvs. lærere, socialarbejdere, sygeplejersker osv. (i Callewaert, 2005.)*

tiden er en anden, og de sociale og kulturelle livsbetingelser er ganske anderledes. Den udvikling der i det følgende beskrives for egnen omkring Lemvig i Vestjylland, er ikke unik, men typisk for det der kaldes 'udkanten' af Danmark.

Erhvervsmæssigt var kommunen tidligere domineret af primære erhverv. I dag er indbyggertallet godt 22.000, hvoraf de 7.000 bor i købstaden Lemvig. Beskæftigelsen har frem til 1960 været afhængig af landbrug og fiskeri. Bearbejdning af råvarerne (slagteri, fiskeeksportør mv.) til eksport og tilhørende servicefunktioner (håndværkere, grovvarerforretninger mv. i landsbyerne og ved havnene) var en vigtig del af grundlaget for lokal beskæftigelse. Industrialiseringen af landbrug og fiskeri fra 1960-1995 medførte, som i det øvrige Danmark, et overskud af arbejdskraft. Eksempelvis har omlægning af fiskeriflåden betydet færre, større, mere avancerede og mindre arbejdskraftkrævende fiskefartøjer på havet.

Nye typer af jobs blev skabt i industrien og i velfærdssamfundet indenfor administration, sygehuse, ældrepleje, undervisning og børnepassning. I 1980'erne får de ufaglærte, der forlader landbruget, typisk arbejde på industri- virksomhederne i lokalområdet. Den vestjyske industrialisering omkring 1990 er ikke drevet af tilflytning af virksomheder udefra, men i helt overvejende grad drevet af decentral fremspiring af nye virksomheder og vækst i lokale, bestående virksomheder. Rationaliseringen i landbrug og fiskeri er fortsat i moderne tid samtidig med, at en række virksomheder har flyttet produktionen til udlandet, ligesom fortsat rationalisering i landbruget og restriktioner i fiskeriet betyder, at arbejdskraften skal omskoles eller pendle til arbejdspladser i stadig større afstand.

## UDDANNELSESVALG I 'UDKANTEN' AF DANMARK

Uddannelsesniveaet i Vestjylland er lavere end landsgennemsnittet. I perioden 1988 til 2008 øges andelen af medarbejdere med videregående uddannelse lokalt i den primære og sekundære sektor, men langsommere end i resten af landet.

Erhvervsstrukturen afspejler også de ung-

es uddannelsesvalg. Uddannelse er nødvendig, hvis de vil skabe sig en erhvervs- og uddannelseskariere. De unge i Lemvig-området søger i højere grad end andre steder i landet ungdomsuddannelse og erhvervsuddannelse (Undervisningsministeriet, 2010). De fleste af de unge søger væk fra egnen for at tage videregående uddannelse i større danske byer (Beck & Ebbensgaard, 2010), ligesom en del af de nyuddannede håndværkere også søger væk fra egnen. Denne demografiske udvikling afspejles i en stadig affolkning af landdistrikterne i kommunen og flytning fra disse til købstaden.

Efter kommunalreformen i 1970 var der i Lemvig Kommune 3.235 elever i folkeskolen fordelt på 13 folkeskoler. Den første skolelukning skete i 1985. Selv om elevtallet samlet i Lemvig Kommune var faldet til 2.190 i 1991, opretholdt man stadig de resterende 12 skoler. Før år 2000 bliver kun yderligere én skole lukket. Først i 2009 lukkes der 3 skoler med henblik på at opretholde et acceptabelt elevtal på de resterende. Efter sammenlægningen af Lemvig og Thyborøn/Harboøre kommuner i 2007 er det samlede elevtal i 2009 i alt 2.631 elever fordelt på tilsammen 10 skoler.

### Sociale mekanismer bag lærerarbejde i en udkant

Det er i dette lokalmiljø, vores lærere har levet deres familieliv og udført deres lærerarbejde. De er alle - på nær to - født i Lemvig eller omliggende kommuner og har således siden barndommen været en del af lokalområdets udvikling.

Beskrivelsens teoretiske udgangspunkt er hentet hos Francine Muel-Dreyfus. Hendes teori om betydningen af de historiske og sociale livsbetingelser viser, hvordan et samspil mellem det man kan kalde "det socio-geografiske rum" med dets givne livsbetingelser, påvirker de enkelte menneskers livshistorie og dermed også deres karrieremuligheder. Der er tale om en relation, der kan ses som en symbiose mellem erhverv og erhvervets udøvere.

Vi har at gøre med en teori om basale reproduktive strategier, familiens faktiske

sociale livsbane og de dertil knyttede værdi- og normsystemer, som formidles og inkorporeres som dispositioner. At anvende individuelle sociale historier betyder (jf. Bourdieu og Muel-Dreyfus), at samme historie følger habitus og "habitat". Det vil sige, at analysen af sociale praktikker hænger sammen med en analyse af feltet (habitatet) samt de aktører, som skaber og genskaber et fag (Muel-Dreyfus 2004: 49). Vi ønsker at analysere livsbaner, der har ført frem til aktuelle sociale positioner hos et udvalg af lærerstuderende.

Relationen mellem livsbane og en uddannelses sociale historie ses som afgørende for en forståelse af mødet mellem fag og individ/familie: En karriere som lærer baseres således på en families symbolske ressourcer, dens forventninger, dens økonomiske, kulturelle og sociale ressourcer mv. Med Muel-Dreyfus (ibid:50) kan man sige, at "harmoni" mellem menneskene og deres fag indebærer, at fagets historie har ladet sig integrere i familiehistorien. Denne integration har form som en social-historisk virksomhed, der skaber både faget og dets udøvere på en måde, hvor "...mennesker vælger fag og faget gør dem til sine udvalgte" (ibid:47). Vi ser derfor slægtens og familiens betydning som en væsentlig faktor i forklaringen af familiehistoriens relation til social mobilitet. En konvertering af kapitalressourcer og et skift i mobiliteten er også afhængig af de familiære bånd, der kan virke som et socialt drivvækst i oprørte vande.

Muel-Dreyfus giver os nogle perspektiver at analysere lærernes fortællinger ud fra. Det første handler om vejen ind i lærerarbejdet. Her er vi endvidere inspireret af Hultqvist (1988) og hendes undersøgelse af socialrådgivere i Nord-Sverige, der viser, hvordan socialrådgiveruddannelsen anvendes som en mulig vej væk fra et job som skovarbejder. Det andet perspektiv handler om lærernes veje inde i professionen. Her henter vi yderligere inspiration fra Müller et al. (2007), som har gennemført interviews i 7 europæiske lande med 22 lærere. Disse er interviewet om deres nøgleerfaringer, jobtilfredshed, etc. Nordenbo (2008) har gennemført litteraturstudier af forskning om hvilke lærer-

kompetencer, der er af størst betydning for eleveres læring.

### Om informanterne

Vi har interviewet syv lærere fra Lemvig-egnen i perioden januar til marts 2009. Lærerne repræsenterer forskellig alder, erhvervs erfaring og lokal tilknytning. Disse interviews supplerer vi med et interview med en enkelt lærer fra en nabokommune til Lemvig (tidligere omtalt i Olesen 2005).

Lærerne vi skal møde i det følgende, er forskellige målt på en række indikatorer, men deres livsbaner har samtidig en række fælles træk, hvoraf nogle få kan fremhæves her: De er socialt mobile i forhold til social baggrund og deres liv i øvrigt. Samtidig står det nye erhverv (lærerarbejdet) frem for dem som tilgængeligt og opnåeligt. De vælger faget, fordi det således også er det, som er muligt på denne tid og dette sted i deres liv. Samtidig ses der ikke de store følelser i forbindelse med valget af ny karriere: De taler ikke om et kald, men hellere om, at dette arbejde nemt kan tilpasses deres øvrige familieliv, dvs. partnere og ægtefælles behov og situation.

Deres tilfredshed med valg af job skal derfor også ses i forhold til mulige alternativer, hvor lærerarbejdet trods alt tilbyder en løn på højde med håndværkere og andre faglærte samt en god jobsikkerhed. De er vant til hårdt arbejde og ved intuitivt, at jobmulighederne er begrænsede i denne del af landet. Samtidig er de også afskærmede i forhold til de belastninger, der kan ligge i lærerarbejdet i f.eks. forstæderne til de større danske byer. Her er lærerens arbejde vævet sammen med sociale problemer, etniske konflikter og bandekriminalitet. Lærerjobbet er i Lemvig en relativt beskyttet metier, som kan tilpasses deres øvrige familieliv og behov.

I det følgende præsenteres to informanter, som illustrerer både forskellige livshistorier og veje ind i lærerarbejdet. Fortællingerne er et billede på byens og egens økonomiske og sociale udvikling.

### Knuds vej fra fisker til lærer

Knud er født i en vestjysk fiskerby på egnen i 1969. Hans mor var hjemmegående og hans far var fisker. Selv blev han udlært fisker efter 10. klasse. Knud har fire søskende, hvoraf én også arbejder med undervisning. Efter 11 år som fisker begyndte han at læse til lærer og bor nu i en landsby vest for Lemvig, hvor han er gift og har to børn. Knud er således eksempel på et menneske, der har skiftet fra et primært erhverv til et lærerjob i den offentlige sektor.

Knuds livserfaringer er grundlaget for den fortolkning, han fremlægger i sin beretning. Hans beretning er derfor både en individuel beretning og samtidig en fortælling, der kan løftes frem som del af et kollektivt minde, dvs. som et bidrag og en brik i en mosaik, der kan skabe grundlag for at forstå den kompleksitet, der ligger bag social mobilitet. Forståelsen af Knuds beretning skal ses i sammenhæng med det teoretiske udgangspunkt i analysen: De kapitalressourcer der ligger til grund for "valg" af livsbane og erhvervsvalg, er også familiære og knyttet til både mikro- og makrosociale mulighedsbetingelser på en måde, hvor aktøren selv tager aktiv del (jf. Prieurs introduktionsartikel).

Allerede mens han fiskede begyndte Knud at overveje, om han skulle vedblive med fiskeriet eller prøve noget andet: *"Vil jeg være ked af når jeg blev 50 og så stadig gik på et dæk på et skib? Ikke fordi det kunne da være godt nok, MEN sæt jeg gik på skibet med den tanke: det var lige godt dumt du ikke prøvede noget andet."*

Det er tydeligt, at Knud er en åben og interesseret person, der hele tiden søger at tolke både sit eget liv såvel som den verden, han er en del af. Han fortæller om sin glæde ved at vide noget og lære mere: *"Jeg har altid gerne ville vide meget. Læst meget ... høre radio, de rigtige programmer, eller de forkerte efter hvem man nu spørger. Sådan har jeg det stadig væk. P3 det er ikke lige mig."*

På et spørgsmål om, hvad han så hører, om han f.eks. hører P1, svarer han: *"Ja, det gør jeg, jeg synes det er fantastisk at høre om mennesker, det er mange historier 'Danmark rundt' for eksempel. De underligste ting, som man slet ikke tænker over, at nogen kan finde på at sidde og spørge om. Og når så der er*

*nogen, som laver et kvarter om noget sådant, det er fantastisk."*

I 1996 stopper Knud med fiskeriet og tager en række VUC-fag for at kvalificere sig til at læse til lærer på det lokale seminarium i Nørre Nissum. Dette gør han fra 1996 til 2000 og får efter afsluttet uddannelse ansættelse på sin nuværende arbejdsplads.

Knud repræsenterer de fire ud af syv informanter, som i vores undersøgelse skifter sit erhverv ud med lærerarbejdet. Ved læreruddannelsen i Nørre Nissum drejer dette sig bl.a. om militærpersonel, medarbejdere fra tekstilindustrien og andre industrier samt medarbejdere fra offentlig og privat service. Ansættelse i den offentlige sektor indenfor børnepasning, pleje, sundhed og undervisning er nogle af de muligheder, der bliver mere aktuelle og attraktive i takt med, at private arbejdspladser lukker. Lemvig-områdets store afstand til egentlige universiteter kommer også til udtryk ved, at der er meget få akademikere, som omskoler sig til lærere lokalt.

Knud udtrykker lærernes glæde ved at omsætte viden til glæde for børnene: *"Det er et godt job, det er godt job. Det er det der med at sætte sig spor, det lyder måske lidt ... Men sådan har jeg det, det der med at man har gjort noget, man laver noget, der har indflydelse på andre menneskers liv. Det skal det jo nok have på den ene eller anden måde."*

På denne måde beskriver Knud én af lærernes motiverende faktorer, nemlig dét at have indflydelse på børnenes udvikling og dét at følge denne udvikling over tid. Samtidig realiserer han gennem sit erhvervsskifte sin interesse for omverdenen, sin åbenhed og sit tilhørsforhold til egnen, hvor han fortsat forbliver boende.

## LISES VEJ TIL AT BLIVE LÆRER, LANDMANDSKONE OG LEDER

Lise er født i 1971 i en vestjysk landsby syd for Lemvig-egnen. Hendes far er udlært og har arbejdet som flyelektriker. Moderen er uddannet folkeskolelærer og har arbejdet som sådan i omkring 35 år. I 1991

blev Lise student og har efterfølgende arbejdet som pædagogmedhjælper samt været et år i huset i USA. I fritiden er hun meget aktiv inden for gymnastik, både som udøvende og som instruktør. Hun er samlevende med en landmand, og de har på interviewtidspunktet et fælles barn, ligesom han har to børn fra et tidligere forhold.

Allerede som efterskoleelev ville Lise være lærer: *"Da jeg så var på efterskole, så en af mine lærere, en kvindelig gymnastiklærer, hun havde lige jobbet for mig. Jeg kunne lige se mig selv, jeg var også meget sammen med hende, og egentlig også efterfølgende har jeg haft meget kontakt med hende og hendes familie. Det var lige præcis det liv, jeg efterstræbte, og det er det, jeg lever nu. Hun levede så også sammen med en landmand, og det gør jeg også."*

Lise læste til lærer i Østjylland og blev færdig i 1998. Hun er den eneste af informanterne, som ikke er uddannet lokalt i Vestjylland. Inden hun blev afdelingsleder på sin nuværende arbejdsplads, var Lise ansat på friskoler og efterskoler i Vestjylland. Indgangen til hendes første ansættelse var bl.a. hendes gymnastikkompetencer. Valget af et arbejde som lærer integreres her med hendes idealer og livsstil og falder således helt naturligt. Drømme-scenariet blev virkeliggjort ved realisering af en livsform knyttet til lokalområdet og med tilknytning til gymnastikforeningens samvær og traditioner. Livsformen og dens forventninger forenes og forløses i lærerarbejdet.

På samme måde som friskolen og efterskolen lader arbejde og fritid smelte sammen, giver lærerarbejdet mulighed for en livsform, der på en række punkter kan matche ægtefællens landbrugsarbejde. Man kan selv bestemme, opleves det, og livet som landmandskone forenes som yin og yang med arbejdet som lærer. Lærerens arbejde matcher derfor også de gældende kønsroller: Et stigende antal kvinder søger ind i erhvervet og finder dette attraktivt i forhold til deres øvrige familieliv. Hvis lærerens arbejde ikke længere er højt estimeret, er det trods alt respekteret som et kvindeerhverv, der samtidig kan tilpasses de opgaver, familierne typisk forventer

hører til kvindernes domæne. Samtidig ses det som en realistisk og attraktiv vej ind i middelklassen for kvinder fra familier med lavere uddannelsesbaggrund (Lortie, 1975).

Erfaringer fra forskellige skoletyper gør, at Lise kan sammenligne disse skoleformer. Det spændende ved arbejdet på fri- og folkeskoler er muligheden for at følge en udvikling, siger hun. Dette giver hende motivation i arbejdet med børnene: *"Jeg vil også sige, at mit job som henholdsvis friskole- og folkeskolelærer har været anderledes end efterskolelærerjobbet på den måde, at man følger nogle elever og ser resultatet af det, man nu sætter ind med overfor de her elever, og det synes jeg er fedt. Det kunne jeg mærke. Det var ikke noget, jeg havde tænkt, da jeg gik fra at være efterskolelærer til at blive friskolelærer, at der var den forskel, men det synes jeg er fedt."*

Lise har holdt et års pause fra lærerarbejdet for at videreudanne sig med en lederuddannelse: *"Jeg trådte vande der på friskolen. Jeg syntes måske, nu skulle jeg også lidt videre. Så ville jeg også gerne lidt videre i mit lærerjob. Jeg ville gerne lidt mere end være almindelig lærer. Jeg ville også gerne noget administrativt. Så blev jeg personlig hjælper. Når man har den type job, så har man 24 timers vagter. Det gjorde så, at jeg havde meget fri, og så læste jeg simpelthen en mellemlæderuddannelse. Det gjorde, jeg syntes, jeg kunne lidt mere, men var egentlig ikke klar til at søge videre og vidste heller ikke helt præcist, hvad jeg ville med mit lærerjob. Jeg var lige omkring min gamle skole og være barselsvikar i en periode, og så var der nogen som kom og prikkede mig på skulderen. De spurgte, om jeg ikke skulle søge jobbet herhenne. Det var jeg slet ikke klar til, men der var så nogen, der fik overtalt mig til, at det var jeg alligevel. Jeg var så herhenne og se skolen og så var jeg solgt. Så søgte jeg det og var så heldig at få det."*

Lærers arbejde er karakteriseret ved sine relativt få vertikale karrieremuligheder. Man kan avancere som skoleleder samt gå ind i de relativt få niches, der findes som f.eks. skolebibliotekar, faglige vejledere, mv. Den samfundsmæssige uddiffe-

rentiering har ikke givet afkast i form af et stort antal specialiserede arbejdspladser i folkeskolen.

## ANDRE VEJE TIL FAGET:

### Et valg blandt få alternativer

En del af forklaringen på valget af arbejdet som lærer kan ses som et ønske om at vedligeholde en tilknytning til lokalområdet og i forlængelse heraf læreruddannelsens tilgængelighed i området. I lokalområdet ved den vestjyske købstad er læreruddannelsen den eneste mulighed for en videregående uddannelse indenfor en radius af 30 km. Dette forhold med nærhed til læreruddannelse har betydning for nogle af vores informanter. Endvidere repræsenterer læreruddannelsen som nævnt ovenfor en mulighed for beskæftigelse i et job med en vis autonomi, en relativ sikker ansættelse og en pensionsordning. Fremhævelse af jobets mere intellektuelle sider er ikke så udbredt, hvilket stemmer overens med Lortie's konklusion, nemlig at det interpersonelle element (børnenes udvikling og trivsel, kolleger på skolen mv.) betones som det væsentligste (Lortie, 1975).

*"Der kunne jeg bedst se mig selv som lærer"*

Lærerprofessionen opleves som et erhverv med en relativ stor autonomi (jf. Vidø & Marcussen, 2002). Lærerjobbet har samtidig i de sidste 15 år stort set været uberørt af ufrivillig arbejdsløshed, hvilket gør det attraktivt for personer ansat i job, der er påvirket af strukturforandringer.

En af vores informanter (Tine) tager sit liv op til revurdering i en alder af 43 år og skifter en bankkarriere ud med en læreruddannelse (dimitteret 2005) og efterfølgende lærerarbejde: *"Jeg var i [XX] i banken i 2-3 år for ligesom at prøve lidt andet. Vi startede 8 mennesker og blev reduceret til 3 til sidst, og så tænkte jeg, at jeg kunne sidde dernede i 21 år mere, hvis jeg havde lyst til det; jeg havde været der i 21 år. Det er tit det der med, når man når 40 års alderen, så begynder man at revurdere sit liv. Er det dét, du skal resten af dit liv? Så*

havde vi i banken nogle gode fratrædelsesordninger.”

Tine havde forberedt et karriereskifte og havde gjort sig en del overvejelser over, hvad det skulle være, men alle valg var indenfor det, som kunne realiseres i lokalsamfundet, dvs. nås med en bil: *”Jeg havde taget nogle HF-fag nogle år før, hvis der var noget andet, jeg ville. Jeg tænkte at indenfor en radius af køremuligheder, så kunne det være sygeplejerske, pædagog eller lærer. Det var det, der afgjorde, hvad det skulle være. Der kunne jeg bedst se mig selv som lærer. ... Jeg synes det var en rigtig dejlig periode, som jeg nød at kunne få lov til at prøve. Jeg søgte lærer og pædagog - lærer som første prioritet -, og så kom jeg ind på lærerseminariet i 2001. Der kunne jeg også se på det stamhold, jeg kom ind på, der var den yngste 19 og den ældste 49. Det var noget af en spredning, og jeg var ikke engang den ældste. Det gjorde at der var en vældig dynamik i klassen, Det var ikke fordi vi var de ældste og kedeligste.”*

”Kan jeg blive lærer?”

Helles vej er en anden. Hun er 44 år og dimitterede i 2005. Her er tale om en revalidering, idet hun i år 2000 i alder af 34 år får en arbejdsskade i sin skulder, som følge af arbejde på en vinduesfabrik: *”Det er anerkendt som en arbejdsskade. Jeg stod med træ-alu-serien. Der skal sidde sådan nogen plasticclips, for at du kan klikke alu på ydersiden. Dem stod jeg og monterede 35.000 af hver dag med trykluftboremaskiner.”* Dette kunne armen ikke holde til i længden, og for Helle var ønsket om omskoling derfor ikke et frivilligt valg. Hun var tvunget til at skifte karriere som følge af sin arbejdsskade: *”Havde jeg ikke fået den arbejdsskade, havde jeg helt sikkert lavet døre og vinduer i dag. Det er et fantastisk fag tømrerfaget. Jeg er ikke udlært, men det er fantastisk.”*

Egentlig ville Helle have været revalideret til teknisk tegner, men arbejdet med en computer kan hun ikke passe pga. den ”kolde” skulder, hun har pådraget sig. Hendes valg af lærerarbejde opleves som ganske impulsivt: *”Det popper pludselig op i hovedet på mig: kan jeg blive lærer?”*

Lærerarbejdet tiltrækker mennesker, der også har behov for et karriereskift, som ikke nødvendigvis er et frivilligt valg. Men samtidig kommer man væk fra mere rutineprægede arbejdstyper spændende fra fiskeri (Knud) over kontorarbejde (Jesper, som vi møder senere) til bankvirksomhed (Tine). De vælger det bl.a., fordi det er muligt at uddanne sig den vej med en rimelig økonomisk sikkerhed i ryggen. Skiftet kræver en omskoling, hvilket betyder, at de lokale muligheder for HF- og VUC-opkvalificering spiller en ligeså afgørende rolle, som læreruddannelsens lokale placering. Disse forhold gør det overkommeligt at vælge undervisning som en ny levevej.

### Om at være lærer

På trods af at alle gennem egen skolegang har kendt mange lærere, kan forestillingerne om, hvordan ens eget liv vil blive med lærerarbejde og familie, møde en virkelighed i arbejdet, der prøver den enkelte af som både menneske og professionel.

I det følgende vil vi se nærmere på de fortællinger, lærere giver om de forhold, som presser dem i deres daglige arbejde, herunder mekanismer som fastholder dem i lærerarbejdet. De to første temaer handler om besvær med og trusler for det gode lærerarbejde, mens de sidste to handler om glæde over og tilfredshed med lærerarbejde.

Lærerarbejde er som alle erhverv præget af krav til arbejdets udførelse og dokumentation af dets resultater. For lærerarbejde følges dette dog ikke op af tilsvarende muligheder for individuel kompetenceudvikling (se f.eks. Møller Christiansen & Larsen, 2007). Lærerne oplever, de er fanget i et dilemma mellem på den ene side nye krav og negativ mediedækning af professionens resultater i form af elevernes færdigheder og kundskaber, og på den anden side manglende muligheder for at dygtiggøre sig.

### Fanget i et dilemma

Marie (53 år, dimitteret i 1980) vil gerne udvikle arbejdets faglighed, og hendes fag-

lige ambitioner betød, at hun oprindeligt hellere ville have undervist på et gymnasium: "Hvis jeg skulle lave det om, så ville jeg læse engelsk eller dansk. Så ville jeg have undervist på et gymnasium. Jeg vil gerne være ekspert på et område. Det kunne jeg godt tænke mig."

Hun har systematisk søgt mod højere faglighed i sin karriere, og har selv bekostet en del af sin efteruddannelse: "Det er vel en 7-8 år siden jeg begyndte på at læse pædagogisk diplomuddannelse [PD] i dansk. Diplomuddannelsen var ret ny. Den bestod af 4 moduler, og der tog jeg så de første, der var et sprogligt modul og et litteraturmodul. Dem tog jeg i Østjylland. Det var for egen risiko og regning, så det betalte jeg selv, og så for ikke at skulle betale mere, så efter det, så kunne man starte på cand. pæd., det var jo gratis. Så tog jeg 2-3 semestre på cand. pæd. i dansk, så jeg til sammen er godskrevet for hvad der svarer til et års efteruddannelse i dansk. Man får idag, i den overenskomst vi har, et løntrin for at have en PD. Efterfølgende så tog jeg videnskabsteori og pædagogik bare for sjov skyld."

For 3 år siden, da blev jeg skolebibliotekar. Den er også blevet en PD uddannelse med 3 PD-moduler, den afsluttede jeg for godt et år siden. Så nu er jeg skolebibliotekar. Skolebibliotekaruddannelsen den fik jeg indregnet. Det andet det var tid, bøger og kørsel, jeg selv betalte. Men det var rigtigt spændende, det synes jeg i det hele taget de der PD-moduler har været."

Marie og Lise har begge et syn på uddannelse, der gør dem villige til selv at investere i deres egen uddannelse, idet de ved, at investeringen giver afkast i form af bedre løn, og de får stimuleret deres nysgerrighed og lyst til at være specialist eller leder.

Jesper, der er 53 år og som dimiterede i 1986, søger derimod ikke teoretiske kurser: "Kurser vi har været på, hvis de har været af teoretisk art, så er vi jo åbne og kæmper for at se, om vi ikke kan bruge det noget. Så ender det jo der, men det er jo tit nogen, som er smarte og har solgt de modeller, solgt de kurser. Sådanne har det også været, når man har fået tilbudt nogle kurser, så vi har sagt: 'Vi vil ikke have flere

teoretiske kurser. Vi vil have ting, vi kan bruge'. Det bedste kursus jeg har fået, det er et IT-kursus og så nogle videokurser. Jeg har haft så meget ud af de ting, jeg har fået så mange gode ting igang. Og bruger det stadigvæk."

Mens Marie bruger fagligheden som et pejlemærke for både sit eget arbejde såvel som sin karriere, og ser folkeskolens hverdag og udfordringer fra en skærmet position som skolebibliotekar, er Jespers perspektiv et andet: Han arbejder i skolens maskinrum, dvs. klasseværelset, og herfra opleves efteruddannelsen som noget, der skal bidrage til det daglige arbejde her og nu. Hans horisont er konkret og rettet mod håndtering af hverdagens presserende opgaver.

## KOLLEGER SOM KILDE TIL ARBEJDSGLÆDE

Det er et kendetegn, at informanterne henter deres motivation for at være lærere fra relationerne til børnene og kollegerne. I disse relationer kan de hente daglig anerkendelse og værdsættelse af deres lærerarbejde og ikke mindst nogen at dele frustrationerne med.

På et spørgsmål til Jesper om, hvad der er den vigtigste forandring i hans lærerkarriere, tager han fat på teamsamarbejde: "Det er, at vi arbejder meget tættere sammen. Vi ved fuldstændig, hvad de andre laver, deres holdninger til det og giver hinanden en positiv kritik i vores team. Vi fordeler opgaver. Også efter skal vi sige, hvem der har nogle kvalifikationer, det gør vi selvfølgelig: 'Du er god til det, du tager dig af det', også nogle gange sådan lidt personlige hensyn."

Herefter spørges der, hvilke opgaver, de fordeler, og om det f.eks. er forældrekontakt og hvem der ringer til forældrene, hvis der har været problemer med en elev: "Nu er det jo lidt styret med forældrekontakt og de andre faste ting. (...) Nogle gange siger man, det vil jeg egentlig godt gøre, for det er mig, der har været udsat for det eller oplevet det. Andre gange siger man, det må klasselæreren gøre, for det er sådan en del af en større sammenhæng.



*Det er ikke sådan, nu er det din tur. Det har vi aldrig prøvet med. Vi har ikke sådan noget med, at nogen synes, at nogen laver mindre end andre."*

Interviewer slår fast, at nogle lærere synes, det her med lærersamarbejde er en tidsrøver, mens andre synes, det er en gave fordi man får løst nogle problemer i fællesskab og får svaret: *"Det er da en god ting at vi arbejder sammen på den måde, det der med team det var som med andre forandringer, man var lidt skeptisk overfor det i starten. Men det er vi blevet meget bedre til."* I er et forholdsvis lille og tæt team, konstaterer interviewet og får svaret: *"Det er jo altid små team med 5-7 mand."*

Det kollegiale har betydning, og lærerne omtaler det positivt og fortæller også, hvordan de selv bidrager konstruktivt til samarbejdet med kolleger. Paradokset i form af afstanden mellem nogle af professionens idealer om autonomi og hverdagen i folkeskolen, er til stede i disse fortællinger. På den ene side er lærerens arbejde karakteriseret ved en oplevelse af at "her regerer jeg i min klasse". På den anden side er man afhængig af de andres indsats og omgivelsernes bedømmelse. Lærerens arbejde bliver gjort kollektivt ejet og underlagt både intern kontrol i teamet såvel som ekstern vurdering og evaluering fra bl.a. politikere, fagforeninger, eksperter, forældre m.fl.

Gertrud, som er en rutineret folkeskolelærer på 53 år, beretter om dilemmaet mellem hendes eget professionelle skøn og krav fra skolens ledelse. Hun føler sig klemt mellem sine forventninger til jobbet som lærer og de realiteter og uløselige opgaver, hun står over for i sin hverdag i folkeskolen. Hun er repræsentant for en gruppe af lærere, der også resignerer, dvs. hun har også fået sig placeret i en funktion som skolebibliotekar, hvorfra hun kan skabe et pusterum i form af en vis distance til skolens mere påtrængende problemer, planlægning af møder, deltagelse i lærerteams, registrering af fremmøde mv., som hun oplever, fylder mere og mere i forhold til selve undervisningen. Gertrud siger om forventningerne til hende: *"Jeg synes, vi er spændt for – spændt hårdt for.*

*Vi møder os ihjel. Og vi dur ikke til at holde. Hver eneste eftermiddag, da sidder man deroppe og planlægger næste skoleår. Og jeg kan – altså jeg – der er ingen, der har fundet ud af det endnu, at jeg laver kun ½ år ad gangen. Og jeg kan ikke følge dem – du kan da ikke med levende mennesker lave en plan for et helt år frem."*

## SUCCESTOPLEVELSER I MØDET MED ELEVERNE

Lærerne fremhæver alle relationen til eleverne som det afgørende, som illustreret af Lise og Knuds beretninger. Dette er i overensstemmelse med, hvad forskning afdækker som afgørende for såvel lærere (Müller et al., 2007) som elevers udbytte af undervisning (Nordenbo, 2008). Knud formulerer det kort: *"Man skal kunne lide mennesker. Det er forholdsvis vigtigt. Hvis man ikke kan li' mennesker, hvis ikke man vil kontakten med andre mennesker, så er det nok et dumt valg, et dumt erhverv at gå ind i."*

Anne på 39 år (dimitterede i 1996) fortæller om relationen til eleverne, og hvordan lærerne prøver at hjælpe hinanden kollegialt, men at nogle ikke har evnen til at håndtere eleverne. Vi spørger hende, hvad der er det vigtigste, man skal kunne som lærer i dag for at håndtere et lærerliv og hvilke kompetencer, det kræver: *"Det er forholdet til eleverne, at man kan håndtere dem.(...) Jeg synes, det er at kunne være rummelig, men samtidig have nogle rammer. Det er indenfor de her rammer, vi arbejder. At kunne være konsekvent og mene dét, man egentlig står og siger. Være tilstede. Jeg synes, det er den, der kommer til kort, det er, hvis man ikke kan håndtere de her kære elever. Man kan være enormt dygtig fagligt og have nogle søde kollegaer, men kan man ikke få de timer til at fungere, så duer det bare ikke."*

Hun uddyber det senere: *"Jeg har også oplevet kollegaer, hvor jeg har ærgret mig, at de bare er kommet forkert ind. Hvor det egentlig ikke har været det faglige. De har menneskeligt bare ikke kunnet finde ud af det. De var for dårligt rustet til det, de er blevet smidt ud i."*

Kompleksiteten i forhold til en vurdering af lærerens faglighed, illustreres her. Det er et spørgsmål, som igen og igen gøres til genstand for diskussion i offentligheden såvel som i faglige kredse: Hvad kendetegner en dygtig lærer? Er det fagligheden og indsigten, eksemplificeret ved læreren som en respekteret vidensperson, der med sin faglige ballast sikrer kvalitet og faglig udvikling? Eller er det læreren som pædagogisk 'håndværker', der ved udøvelse af sin dømmekraft, håndelag og erfaring håndterer en stor gruppe børns samvær og faglige udvikling? Under alle omstændigheder fortæller lærerne om et krævende arbejde.

Gertrud beretter om, hvordan nærhed til eleverne og deres sociale situation er opslidende: *"Der var en pige, der blev skilt – eller hendes far og mor blev skilt sidste år. Det var så grufuldt. Hun måtte ikke se sin far, og når hun så endelig så ham, så var hun ked af det, når hun kom hjem. Så troede moderen, hun var sur. Så skændtes de jo hele eftermiddagen, så siger jeg: 'Har du fortalt mor, at du er ked af det?'... 'Jamen, hun kan ikke forstå, jeg er ked af det, fordi han var ikke værd at samle på.' Så siger jeg: 'Men det er din far. Du må prøve'. Så kom hun så her også og sagde: 'Nu har jeg prøvet at få fat i mor.' Jeg vil sige, min lærerrolle i dag, er helt anderledes end dengang. Og det kan være, der var lige så mange børn, der havde lige så mange problemer, det anede man ikke. Og det er det, jeg synes, der gør det belastende at være lærer, det er alt det, du får herind (peger på sit eget bryst)."*

Lærernes behov for at få anerkendelse står i kontrast til dele af den offentlige diskurs om lærerprofessionen, som illustreret med Statsministerens tale ved Folketingets åbning i 2003 om for megen rundkreds-pædagogik i den danske folkeskole. Det er i samarbejdet, lærerne finder et rum, hvor de selv definerer tolkning af regler, hvor de selv oplever at gøre en forskel for andre mennesker. Dette er afgørende for, at de oplever mening med deres arbejde som lærere. Dette er en basal værdi i lærerarbejdet for en del lærere.

## DE NYE UDFORDRINGER

Relationen til forældrene afspejler udviklingen med stigende ekstern indflydelse på lærerarbejdet formelt og reelt.

Forældrenes påvirkning af skolen kan ses som udtryk for en markedsførelse af skolen, hvor forbrugerne (forældrene) skal have større indflydelse på produktionen (undervisningen) af varerne (børnernes dygtiggørelse) (Hermann, 2007).

### "Forældrene siger: mit barn kan ikke"

Helle har valgt en meget kontant håndtering af dialogen med forældre for at sikre et fornuftigt samarbejde: *"Krav fra forældre om, at du ikke må presse mit lille barn, fordi det kan mit lille barn ikke tåle. Jeg siger: 'Aarrh, vi er ved at være så højt oppe i aldersgruppe, så det der skal kunne honoreres.' ... 'NEJ, det kan det sørme ikke, og det der med lektier hver dag, det er da også noget forfærdeligt noget, skolen kan komme med.' Det er også noget med at i den anden ende: 'Mit barn lærer ikke nok fordi mit barn skal det og det og det med videre uddannelse, så du kan nok forstå, at du er nød til at rykke dit matematik op på et højere niveau'... 'Ja det er så meget fint, at du synes det, men mine CKF'er [centrale kundskabs- og færdighedsområder] siger noget andet, og så er det sådan det er'..."*

Så sidder man til en forældresamtale og forældrene siger: *'Mit barn kan ikke, hvorfor har skolen ikke lært mit barn at læse?' Så siger jeg: 'Dit barn kunne jo starte med at lave sit habengut hjemmefra. Har I egentlig styr over hvad der står i lektiebogen? Ved I hvilke bøger jeres barn sidder med?' Nej det ved de ikke! 'Jamen så start med at tømme tasken. Engager jer i det, det er faktisk det, vi gør.' Det der med, at vi skal huske på, hvad vi skal gøre. NEJ det skal vi godt nok ikke! Vi snakker 7. og 8. Klasse. 'Det er jeres børn, så det er jeres ansvar. Vi er 2 parter i det.' Vi gør, hvad vi kan indenfor rammerne her på skolen. Så må forældrene også yde, men der er et krav om at lægge over og lægge over."*

Helles fortælling er meget detaljeret, og de øvrige lærere har tilsvarende beretninger om forældres meget enkeltelev-orienterede krav. Hendes håndfaste metoder

afspejler et spændingsfelt, hvor lærerne forsværer deres position ved at pege på forældrenes ansvar for børnenes adfærd. De modsætningsfyldte arbejdsbetingelser forløses ikke gennem en analytisk forståelse, men ved en let kynisme, der samtidig udtrykker en afmagt.

### Der solgte vi ud af arvegodset

Marie fortæller også om den udvikling der har ført til den stigende forældrendiffidelse på skolen og lærernes arbejde: "...noget af det jeg har oplevet der er blevet værre og værre, altså vores omdømme den måde vi bliver omtalt på, vores status er faldet på de der 28 år. Det påvirker mig. På den måde er det blevet sværere, synes jeg. (...) Jeg synes, vi har mistet meget, det er også den her historie med.... Vi har mistet meget af vores professionelle autoritet i alle de år. Det handler nok meget om, da vi gik fra skolenævn til skolebestyrelser, hvor jeg var fagpolitisk engageret, og hvor jeg synes, at vi som forening lagde os fladt ned på ryggen og sagde: 'Jamen selvfølgelig. Det har I ligeså god forstand på, som vi har', sagde vi til forældrene dengang. Da solgte vi ud af arvegodset, fordi det har de ikke!" Der synes jeg, vi har været for ringe til som lærerstand at sige: 'Vi kan noget. Vi er knaldhamrende dygtige til noget! Det er derfor, vi bestemmer de her ting. Vi vil gerne snakke med jer, men det er os, der ved, hvad det handler om'...."

Maries beretning illustrerer, hvordan samfundets generelt øgede kompetenceniveau medfører, at lærerens autoritet betvivles og ikke længere opfattes som naturlig. Læreren skal tilkæmpe sig respekt og anerkendelse, den er ikke givet i sig selv. Reaktionen bliver et forsvar for lærerens kompetence, som hverken begrundes eller udtrykker forståelse for forældrenes måske legitime synspunkter og forventninger.

### Afmagten

Gertrud fortæller engageret og med indlevelse om sine elever og sin undervisning: "Og det er skægt, når jeg sidder over for de

her 20 elever, hvoraf de 10 har så store problemer, og snakker om deres skilsmisser og deres tab, om deres sorg. Og jeg skal til næste år bruge en måned på at gennemgå alt om stoffer, alkohol og tobak. Og jeg gider det ikke, for det hjælper ikke en pind. Så det vi prøver på at gøre, det er at spørge: 'Hvad er det, der er et godt liv? Og hvad er det, der er et dårligt liv?' Det har vi kørt meget på.' Så igår, så var vi færdige, så får I en blå kuvert. Så skal I lægge 5 sedler i hver med, hvad er et godt liv.' Altså jeg sagde det ikke lige på den måde, altså 'hvilke ting gør dig glad?' ... og sådan noget, og 'hvilke ting gør dig ked af det?'. Og så havde de så de her 10 sedler. 'Og så må I gå ud to og to. I skal ikke læse alle sedlerne op for hinanden, I må gerne.' Og [navn], som er mest hårdt ramt af dem, han ville ikke læse op for nogen. Så siger jeg: 'Vil du læse op for mig?' Det ville han så godt. Men det er sådan, jeg kan græde, bare ved tanken om det, han sidder og fortæller sådan en bitte dreng. Du kan ikke hjælpe ham. Du kan overhovedet ikke hjælpe ham. Hans mor har haft 3 eller 4 mænd inde, og nu er nr. 3 eller 4 droppet for to måneder siden. Nu har hun fået en ny, og så er hun nede i byen hver aften, ikke. De har selvfølgelig barnepige på. Jeg kan ikke gå til de offentlige myndigheder – de sociale myndigheder. Det kan jeg ikke. Fordi altså – det kan du godt se – altså – det er så forfærdeligt. Hvor var det, jeg ville hen med det her?"

Afmagten som Gertrud konfronteres med i sit arbejde, fremmer en reaktion, der kan beskrives som en blanding af kynisme og realitetssans ("der er ikke noget at gøre"). En følelsesmæssig afmagt, hvor hun har svært ved at lægge afstand til oplevelserne og de følelser, som de enkelte barneskæbner vækker i hende. Gertrud har erfaret, at de etablerede tilbud, som består af undervisning i forebyggelse af alkoholmisbrug og narkomisbrug, er værdiløse. Hun har en 'realistisk' tilgang i den forstand, at hun med sin mangeårige erfaring ved, at skolen ikke kan ændre på disse forhold. Der er en kompleks konstellation af en praktisk sans omkring, 'hvad skoler kan' eller rettere 'ikke kan' og en 'træden tilbage' fra problemerne. Hun

anerkender den sociale orden og skolens nødvendighed som afgørende for hendes egen baggrund og nuværende position, men samtidig mærker hun afmagten på sin krop. Dette vendes dog indad og giver sig udtryk i, at hun nu selv siger nej til flere møder og i stedet vil leve op til sine krav om at være en nærværende mor over for sine egne børn.

### Man skal kunne holde fri

Helle giver en karakteristik af lærerarbejdet, som sammenfatter lærerens udtalelser om lærerarbejdets kompleksitet, samt det forhold, at man også skal kunne holde fri for lærerarbejdet: *"Du skal have situationsfornemmelse. Det handler om lynhurtigt at kunne pejle, hvad der sker her. Du skal kunne navigere i rigtig mange forskellige signaler, du skal lynhurtigt reagere på det. Situationsfornemmelse, det er du nødt til at have. Så skal du kunne multitasking. Det oplever jeg er rart, at jeg ikke bliver stresset af det, for hold kæft hvor kan der være mange ting på engang. Kan du ikke multitasking så ... jeg har jo stadig kontakt med nogle af mine med-studerende fra seminarierne. Der er da nogle af dem, der allerede er kommet ud af lærerfaget, fordi de ikke kan. Fordi der er for meget på én gang. Og så skal man måske også lige besidde evnen til at sige: 'Nu lukker jeg skoletasken, nu er jeg hjemme, slut. Nu har jeg fri.' Altså forholde dig til det som et arbejde. Igen selv om man engagerer sig, så skal man også kunne lukke af og sige, at det er ikke personen, det går på. Det er læreren."*

Helles beskrivelse af kompleksiteten i klasseværelset giver et indblik i lærerarbejdet, og hvordan hun søger at håndtere denne intensitet. Helles distinktion mellem rollen som lærer og privatpersonen kan tolkes som påpegnings af nødvendigheden af frihed og pauser for at kunne agere professionelt i den egentlige arbejdsituation, nemlig undervisningen. Helle fortæller om evnen til at tilpasse sig de øjeblikkelige arbejdsvilkår som et kendetegn ved lærerarbejdet. Tilpasningsevnen strækker sig også udenfor det øjeblikkelige i klasseværelset og omfatter tilpasning til de

ændrende vilkår for lærerarbejde givet af stat og kommune. I vores lokale undersøgelse kan det også tolkes som accept af et grundvilkår i en egn uden store økonomiske ressourcer, hvor lærere har erkendt, at fremsatte krav altid afvises med mangel på penge.

Jesper oplever således, at hans påpegnings af problemer med at differentiere sin undervisning overfor 30 elever, affærdiges med: *"Det er sådan en almindelig arbejds-situation. Jeg kan ikke forvente at få alle sammen med, men det er en stor gruppe, der aldrig kommer med."*

Vores informanter forholder sig forskelligt til deres arbejde, og de viser en evne til at opsuge og afbøde effekten af regler, de oplever, styrer deres arbejde. De udvikler forskellige overlevelsestrategier i hverdagen.

### Autonomien er under afvikling

Susan Robertson diskuterer, hvad der giver lærere myndighed i deres arbejde. Hun peger på indflydelse på ansættelse af kolleger, beslutningskompetence over læseplaner og undervisningsmetoder samt rum for selvledelse. Sammen med forældres frie skolevalg burde dette skabe en mild konkurrencesituation mellem skolerne, hvilket alt andet lige vil give lærerne rum for at udfolde deres autonomi (Robertson, 2000). Autonomien er under afvikling, idet staten gennem den politiske og økonomiske styring af skoler og lærere fremmer arbejdsforberedelsen og standardiserer målsætninger i skolen (Hermann, 2007) samtidig med, at en række aktører søger indflydelse på skolens virksomhed. Disse ydre faktorer betyder, at lærernes autonomi begrænses.

Konfrontationen med eleverne presses af de ændrede vilkår for velfærdsprofessionerne, hvor man f.eks. som lærer, skal tage mere individuelle elevsyn. Dette stiller spørgsmål til troværdigheden af fortællingen om, at elevrelationen giver lærerne anerkendelse; eller om det er en erkendelse af, hvad der er det vigtigste for at kunne fungere som lærer. Dette er netop kernen i resultaterne præsenteret af Müller et al (2007) og Nordenbo et al

(2008). Müller et al refererer lærerudtalelser om problemer med en stor diversitet blandt eleverne og store problemer med at opretholde ro og orden, hvor Nordenbo et al på baggrund af litteraturstudier fastslår, at en social relation til den enkelte elev og tydelig ledelse af klassens undervisningsarbejde, er de mest afgørende faktorer for elevers udbytte af undervisningen. Da lærerne søgte ind i professionen, kunne idealet være ønsket om dialog med børnene og mulighed for at følge deres udvikling, som Knud og Lise fortæller. Men realiteten i professionen er ofte en anden: den rummer både problemer med afmagt, diversitet og uro, og glæder ved samværet med børn. En arbejdsituation som kun kan håndteres gennem sociale relationer til den enkelte elev og tydelig klasserumsledelse.

## STATUS OG ANERKENDELSE UNDER PRES

Lærerne oplever, at de er under et øget pres i forbindelse med velfærdsstatens omstrukturering, kombineret med ændrede opfattelser af, hvilken status og anerkendelse lærerjobbet kan repræsentere.

Vores informanter fortæller om de medstuderende, som har forladt lærerprofessionen, at det var fordi de ikke oplevede, at de havde evner til at håndtere eleverne i klasserummet, og at de ikke kunne finde sig tilrette i jobbet.

Lærerne begrundede både deres glæde og sorg ved samværet med eleverne og deres kollegaer. Det er i disse to relationer, lærerne søger at udøve deres professionelle råderum og fastholde et værdigrundlag for deres eget lærerarbejde. Men det er også her, nederlagene lurer, og det er her, lærerens arbejde udfordrer den enkelte. Beretningerne fortæller, at de reelt eksisterende alternative erhvervs muligheder for nogle af informanterne er begrænsede af alder, specialisering eller allerede foretagne karriereskift.

Informanterne er rekrutteret til lærerarbejdet såvel direkte som fra en ungdomsuddannelse senere i deres karriere. At gøre det op i konstateringer om, at 'de

passer som hånd i handske med deres job' eller 'forbliver i det, fordi de ikke ser andre udveje', vil være en for simpel og unuanceret beskrivelse. Måske kan man nærme sig en forståelse sammen med Muel-Dreyfus, når hun taler om, at man tilpasser sig et givet job og lader sig forme til det. Denne tilpasning sker sammen med andre lærere, i en given social og kulturel kontekst, med den specifikke baggrund den enkelte lærer bringer ind i erhvervet. Den sociale historie de enkelte lærere bringer ind i jobbet, spiller aktivt sammen med de muligheder, man har og får givet som et vilkår, den enkelte som individ kun vanskeligt kan udfordre. Vores informanternes beretninger skal ydermere ses i lyset af, at de er fortalt i en udkant af Danmark med givne historiske, økonomiske, sociale og kulturelle betingelser.

En gennemgående figur i de præsenterede interviews er graden af tilpasning til det sociale landskabs forvandling. Over et tidsspand på én til to generationer fortæles i interviewene om familiers livsbaner og veje, der fører til, at fortælleren bliver lærer. Vi befinder os i en egn af Danmark hvor virksomheder kollapse, håndværk, landbrug og fiskeri industrialiseres, livsformer mister status og udbredelse. Børn vælger - eller bliver valgt til - andre erhverv end forældrenes eller bedsteforældrenes, fordi erhvervsstrukturen ændres af både lokale, nationale og globale mekanismer. Vi må forstå disse veje i det sociale landskab for at forstå, hvorfor man bliver lærer, og hvordan man oplever og udtrykker sit lærerarbejde.

Folkeskolen er knyttet til opkomsten af det moderne samfund. De reproduktive uddannelser som læreruddannelsen, er specielt knyttet til velfærdssamfundets udvikling, hvor antalsmæssigt store grupper arbejder med pasning, oplæring og undervisning samt pleje- og omsorgsopgaver. Lærerarbejdet i det moderne velfærdssamfund er præget af vekselvirkning mellem regelfortolkning og et professionelt skøn. Denne vekselvirkning stiller krav til lærerne i deres mangeartede relationer til andre mennesker.

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# UNDERSTANDING TEACHER PRACTICE USING THEIR OWN NARRATIVES

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## ABSTRACT

This paper discusses ways of understanding teacher practice in educational settings. An educational setting consists of cultural, social and historical elements that all influence the teacher's practice and, how she experiences this practice. It is argued that teaching science and technology is a socially conditioned practice. The teachers' practice are formed by their previous education and experience but also influenced by their private life. This way of looking at teacher knowledge and experience requires attention to teachers' perception of these aspects. Teachers seldom talk about their knowledge of teaching, but they willingly tell their experiences from being a teacher. Therefore it is argued that narratives and life history of teachers can give insight into teachers experience, knowledge and practice. The notion of habitus is used to merge the former experience with the actual practice.

The paper discusses pitfalls and steppingstones in the process of using narratives to understand teachers' experiences and knowledge. Important steppingstones are few questions, teacher written contributions, careful analysis and supplementary collection of observations. Important pitfalls are ideologism, psychologism, exclusion of teachers' perspective and lack of distance to practice. Pitfalls and steppingstones will be illustrated in relation to narratives of Danish science teacher.

**Keywords:** *Teacher practice, habitus, narrative inquiry, life history, pitfalls, steppingstones.*

## WIDENING THE PERSPECTIVE ON TEACHERS' PRACTICE

Teacher practice is composed of many different work functions, where teaching is predominant, others being dialogue with colleagues, principals and parents. Characteristic for all of them is relations to other humans; teachers are therefore constantly engaged in social relations.

The Danish male teacher Knud puts it this way: *"You have to like humans. That is rather important; if don't like humans, if you don't want the contact with other humans, then it probably is a foolish choice, then it is a foolish profession to enter."* I met Knud during a series of life history interviews conducted in the western part of Denmark close to the North Sea. At an age of 40 Knud had been a teacher for 9 years. Knud is a former fisherman, after 10 years of fishing on the North Sea he started taking higher preparatory courses; afterwards he entered the teacher education and became a teacher. Knud was replying to the interviewer's question of whether everybody could be a teacher, this question was posed when they were talking about what it takes to be a teacher. Knud's mildly ironic phrasing of his answer is characteristic for the understated use of speech language is this part of

Denmark. You never exaggerate and you seldom address critique directly. Being aware of this local nuance of spoken language it is easy to see his main point, the deciding factor in the teaching profession is the relations to other humans.

Roth (2002, p. xv) describes how his detailed knowledge on a pupils short-term knowledge didn't help him in understanding the learning difficulties that a particular pupil was facing upon the death of his aunt. His uses this example to illustrate the awareness that he developed when returning to teaching after finishing his doctoral study on pupils' short term memory and learning in science. He realised that theories on the reflective practitioner by Schön (1987) or pedagogical content knowledge by Shulman (1987) didn't describe his teaching practice in its complexity; they all just described parts of it.

These two narratives from actual teaching practice illustrate the social skills teacher have to possess in their relation with other humans in their daily practice. Researcher of all types needs to be sensitive to these and other elements of teachers practice in research in science education. Roth (2002, p. 21) adds a critique of mono-theoretical approaches to education research, which raises questions on how to gain insight in what really matters to teachers in their practice and how to research this. Roth (2002) points to the fact that awareness of details in an educational setting can lead to focus on the significant detail in an actual teaching situation. Roth (2002) was in the actual case acting as a teacher-researcher observing and reflecting on his own practice, but this observation and reflection could also have been done by an academic researcher in dialogue with the teacher. The point is to get the story with the boy in learning difficulties told in its entirety. So by starting with sampling what is present in the classroom we have a better chance for getting back to what is actually the problem.

A Danish female primary school teacher – Helle gives a characterisation of teachers' work, which reflects Roth's (2002) experience of the complexity of the teacher profession.

Helle: *"You must have situational awareness. It's about very fast to pinpoint what is happening here. You should be able to navigate in very many different signals, you must quickly respond to it. Situational awareness is what you have to possess. Then you have to multitask, it's nice seeing that I do not get stressed out by it, damn there may be many things at once. Can't you multitask then ... I have contact to some of my classmates from the teacher education, which some of them have already left the teaching profession because they can't. It is because there is too much going on."* Roth (2002 p. 21) formulates the same experience as follows: *"I noted that in becoming a teacher, there was a development in my capacity to do the right thing at the right moment"*. I met Helle during the formerly mentioned life history interviews. She had only been a teacher for 4 years despite her age of 43 years. She has worked 15 years as an industrial worker. Her last employment was at a male-dominated window assembly plant. She suffered a work injury and had to be rehabilitated. She chose teaching as her new career. The years of working at industrial plants shaped her approach to relations with others: *"I have a sharp tongue and the parents learn that is the way I am."* Helle's former lived experience forms her relation to the parents and her present lived experience of teaching add to these embodied experiences and shape her notion of teacher practice. I shall return to such embodied experiences later.

Jacobsen (2004 p.15) discusses ambiguity using Ziehe's writings on youth culture. Ambiguity is increased in the contemporary society, but it also gives great satisfaction being able to cope with it. Helle's narrative above illustrates this point by giving a picture of the awareness on details and ambiguities in the teaching situation among the teachers' we met. Such an awareness we academic researcher also have to develop in order to provide recognisable pictures of science teaching back to the science teachers. Carr (2006) discusses educational



theory and its relation with practice, he emphasises in his conclusion the need for practical justification of educational theory (ibid. p. 155). Roth (2002, p.21) joins this view as he says “*I believe that the ultimate test of theories is the capacity to explain subjective human experience*”.

## **UNDERSTANDING TEACHER PRACTICE USING KNOWLEDGE AND EXPERIENCE**

Research on science teacher practice is conducted by both academic researcher and by science teachers. Science teachers own research provide an inside perspective on science teaching practice, whereas academic researcher provide an outside perspective. Both approaches have benefits and pitfalls. Inside perspectives are often very true to the context with the advantage of providing direct improvement to the actual practice, but being without value in other contexts. Outside perspectives tries to decontextualise the developed knowledge in order to make it valuable in shifting context, a process that renders it of less value in the context where it is developed (Roth 2007, Jenkins 2000).

Many investigations focus on development, change and intervention, very few deals with analysis or description of the actual status. This renders the departure point for development and intervention uncertain. Therefore the following improvement and its direction is sometimes blurred (Hewson 2007).

Roth (2007) reviews the approach of science teachers as researchers. The majority of these studies are conducted during part of pre-service and in-service teacher education or professional development. The research is often part of the assessment of changes in practice generated by these interventions. Roth (2007) states that high-quality inquiries and analyses should prompt teacher researchers to develop new understandings that have implications for his or her teaching and improve students learning (ibid. p. 1241-1242). She recognizes that it is a high bar to hold up. She presents no reflections on where in their teaching career the involved teacher researchers might be in relation to their capacity or motivation to make such improvements. Hewson (2007, p.1200-1202) notes in his review of science teacher development, that it is not possible to paint a coherent picture of the best way to perform science teacher development. He summarizes his findings in a 3 step model 1) define starting point, 2) define end point and 3) the ways they might be connected. Combining these two notions of development it would seem fair to include attention to teacher experience and work conditions in the 3 phases suggested by Hewson in order to increase the ownership of the developmental process.

Tsai and Wen (2005) gives a quantitative review of the content of research presented in three leading journals, they analyse 802 papers. They find that 7% deals with Teaching, which is the category that includes teacher thinking, behaviour and strategies along with teacher knowledge. This indicates that teacher knowledge and teacher experience is not a dominant research field in science education at the moment. Contemporary international research in science teachers' professional development is reviewed in the Handbook of Research on Science Education edited by Abell and Ledermann (2007). These reviews show that the research has its primarily focuses on individual teachers' knowledge, attitudes and beliefs. The notion of teacher knowledge has several prominent theories such as Pedagogical Content Knowledge (PCK) and Subject Matter Knowledge (SMK).

PCK is often presented as an integrative approach to the science teacher profession (e.g. Gess-Newsome and Lederman 1999, van Driel et al 1998), that weaves together different

representations of experience. The PCK tradition prescribes experience and narrative accounts to be processed in order to serve as basis for learning or development. The intention of collecting narratives in this tradition serves a larger purpose namely the description of the PCK of the individual teacher. This individual focus might lead to superficial analysis of the narratives. Teachers' knowledge on science and technology or on science and technology education does not provide the full picture of how they perform their work as teachers and how they understand this work.

Teachers in the school are not isolated islands; their professional knowledge is socially conditioned. Kosonen and Houtsonen (2007) explore this point by using the Bourdieu notion of habitus. The interaction with the pupils is influenced by a lot of other factors, that Kosonen and Houtsonen summarizes in the habitus of the teacher. They state:

*"Their [the teachers] habitus are formed by past practices in different settings, especially, in their professional education and training, in their work and career, and also in their personal lives"* (Kosonen and Houtsonen 2007, p.172). Roth (2002, p. 45) describes habitus in an educational setting as *"the patterned ways in which we interact with the world, including those practices that embody actions, perceptions and expectations."*

This way of looking at teachers' knowledge requires attention to their perception and appreciation of their own experience and knowledge and how they see this in relation to colleagues and pupils. Helle and her sharp tongue is an example of how past and present experiences merges to form a coherent notion of a practice. I will use this notion of the habitus as embodied experiences to summarize my main points in the conclusion.

This insight in teacher understanding of their practice is brought forward by the use of a teacher's own language about her own practice. Jenkins (2000, p. 21) summarizes his health check on research in science education by stating: *"Is it perhaps because the research community fails to grasp the complexity of teaching science or lacks an adequate indigenous pedagogical language and conceptual structure with which to capture what really matters about teachers' work? ... It isn't simply that the existing language fails to capture the essence of what teachers do when they teach science. It can also present a seriously mis-leading picture of what is involved in teaching."*

Roth (2007) quotes a few studies that argue for rising the teachers own voice in science education research (ibid. p. 1236). This indicates that it is not a very strong tradition in science education research. Furthermore teachers seldom talk about their knowledge of teaching, but they willingly tell their experiences from being a teacher. Lortie (1975 p. 77 ff) and Müller et al (2007 p. 4) has interviewed teachers. Their findings furthermore point at experience as being the significant mode teachers learn teacher practice. Perhaps we as academic researcher should lend more ears to the narrations of the teachers when they are talking about science education in order to understand the experience and knowledge at play in science teaching.

## **NARRATIVE RESEARCH STARTS FROM THE TEACHERS OWN LANGUAGE**

The use of narrative inquiry in creating an understanding of the work conditions of science and technology teachers is an inclusive approach that unveils details and ambiguities. As discussed earlier details are important in order to understand the complexity of teaching in its entirety. The narratives about the context of teaching from Roth (2002) and the informant

Helle presented earlier illustrates the contribution narratives give to understanding which detail to focus on in the actual situation. A given narrative contains many opportunities for interpretation but the relevant one can only be chosen through simultaneous understanding of the context of the school, including pedagogical trends, colleagues, curricula and ongoing reform processes (Elbaz-Luwisch 2007). In this process of understanding the context of the teacher's work it can be beneficial to include some aspects of the life history of the teacher (Goodson 2008, Clandinin and Connelly 2000) as illustrated by the way the informant Knud talks about being a teacher.

An example of presenting interesting stories of teachers is the cohort study by Goodson and Numan (2003) on a class of Swedish teachers who graduated in 1960. These stories tell about the changes in the Swedish primary school over a period of 40 years. Many interesting aspects are raised by the teachers, but the presentation given by the authors lack exhaustive analysis of the circumstances and contexts that might have extracted knowledge of more general interest from this impressive material. As the authors themselves are aware of as they promise to provide (ibid. p. 228) this analysis in a later publication, unfortunately this publication is still lacking. The details and ambiguities is overwhelming in such a large set of data, therefore you need to choose a theme that you want to focus on – it can be how former life experiences can form the teacher in their relation to pupils and parents as given by the examples presented from my own life history interviews, or it can be becoming a science teacher (Roth 2002).

Clandinin and Connelly (2000) stress that narratives are the best way to get teachers experiences verbalized. A narrative includes interpretation, reflection, history, environment, relations, ontogenesis and exclusion of experiences. It is not an accurate and true version of the teachers' past but a recollection of past experiences recreated in the dialogue with the researcher.

### **Narrative interviews**

Kvale and Brinkmann (2009) give detailed guidelines on how to perform different types of interviews. They stress that the narrative interview focuses on the stories the informants tell as well as how they tell them. The narratives are the fundamental given data in this type of research. The narratives are either told freely or the interviewer helps constructing them through questioning the informant. It is important that the interviewer clarifies details in the storyline, so that conflicts, solutions and tensions are formulated by the informant. Researchers affect the participants. Their questions start reflection and development among the participants. The narrative emerges in the dialogue between participant and researcher; it does not exist prior to this dialogue.

Herman and Vervaeck (2005) present the main characteristics of structuralism in their *Handbook of Narrative Analysis*; they distinguish between the Narration, the Narrative and the Story. The Story includes events and presents the characters involved, the Narrative gives the timeline, details about the characters and the focus of the story finally the Narration is the actual dialogue – the spoken words – and actions between the characters. This distinction between the elements in a story is good structuring tools in the process of selecting relevant details for further analysis.

### **Life history**

Bruner (1984) defines a life history as: "*A life as told, a life history, is a narrative, influenced by the cultural conventions of telling, by the audience, and by the social context*". Goodson

(1992) distinct between life story and life history, his notion of life history is in accordance with Bruner including contextualisation; but he introduces life story to describe life as told as merely the story without elaborate inter-contextual elements developed by the researcher.

The researcher arranges the narratives in chronological and contextual order to create a coherent life story. This life story is related to essential historical events regarding society, school, science and science education creating a life history of the science teacher. This work involves an analytic and interpretive process where the researcher is looking for harmony and interaction between teachers narratives and experiences on the one hand and on the other hand the historical context. In this process the researcher sensitivity towards the teacher's life and the evolution of the society is essential to avoid intimidation of the teacher.

Clandinin and Connelly (2000) stresses the importance of this part of narrative research, they describe it as composing a research text based on the interviews. A research text includes the story of the researcher in the inquiry, the story of the participant and the larger landscape on which they all live. Clandinin and Murphy (2009) further elaborate this point of view as they state that the research text speaks to 3 audiences: the participants, the researcher and a larger scholarly and public audience.

The relation with the participants is of great importance, so that they remain ownership to their statements (Roth 2002). It is important to maintain the original coherence between conscience and the historically lived life of the participants in order to fulfil the relational responsibilities of representing the experiences we co-construct with the participants (Clandinin and Murphy 2009).

Lortie (1975 p. 79) raises an interesting methodological problem as he writes: "... *socialization into teaching is largely self-socialization; one's personal predispositions are not only relevant but, in fact, stand at the core of becoming a teacher.*" This could indicate that psychological interviews would be the best way to understand teachers' notions of teaching. Leontjev (1981, 267-271) points to the difficulties in trying to understand human activity as psychological processes. We have primarily access to the external notions of the teachers' experiences through the physical statements and utterances they produce. We do not have insight in their inner reflections unless they provide us this insight through their utterances. Narrative research is not providing psychological insight or evidence it provides narratives that can be interpreted in relation to relevant historical, cultural and social conditions. Clandinin and Connelly (2000 p.50) describe dimensions for analytical handling of these conditions. They first describe inward, outward, backward and forward directions of experience. The inward direction relates to feelings and moral dispositions. The outward direction relates to the environment. The backward and forward directions relates to time. They condense these 4 directions to 2 dimensions one dealing with inward-outward and one dealing with backward-forward, then they add a third dimension space, that deals with the landscape of inquiry. I would like to sharpen their definition of these dimensions. I see one dimension dealing with the time line of events and experiences, another one dealing with the educational settings of the events and experiences and a third dealing with social and personal relations of the events and experiences. This is in agreement with Goodson (2008) who emphasizes the importance of relating the personal teacher story to the more general history of changes in the school. Furthermore the coherence between the time and the settings dimensions can be analysed using Bakhtin's notion of chronotope (1981, p. 84), this notion grasp the interplay between time and space in narrative analysis and inquiry.

## HOW CAN NARRATIVES CONTRIBUTE TO OUR UNDERSTANDING OF TEACHER PRACTICE?

In following I will present yet another teacher from the life history interviews conducted from January to March 2009. I will give a more extensive introduction to him in order to shed light on his handling of a difficult teaching situation.

Jesper (male 53 years, 24 years as teacher) grew up in a village in the western part of Denmark near the North Sea, this part of Denmark is called West Jutland. He was originally trained in trade and office in a larger town 15 km from his birth place, after finishing this training he worked in an engineering company in a larger town on the east coast of Danish peninsula Jutland for 2 years. He finds the work boring, so he moves back to his birthplace in West Jutland. The story of Jesper entering the teacher profession is interesting as he moves back from the more densely populated east coast of Jutland to take a teacher education and work locally as a teacher subsequently. This move back west is unique; very few people who have left the western coastal region moves back again. His upbringing in West Jutland retracts him to this part of the country. The teacher education is one of the few available higher educations in the local area. Jesper had already after finishing high school considered becoming a teacher, but due to family tradition he chose otherwise in the first place. A choice he later regretted and returned to become a teacher "back home".

Jesper teaches primary science and mathematics. Jesper describes the problem with large class and the need for differentiated teaching.

*"Now we have classes that are huge, so it was no way the way I thought it would be. We did not know initially that they would be so big. In mathematics, it is not possible to do practical work. I've tried dividing the class, and then take care of one half and then have the other half do something themselves. It's not a solution, I tried it 3 times and then I went back to having the entire class together. Of course you have a lot of different activities and they work in groups. Many changes to give variation to the lessons, but they are always under control, because those who do not want to do something. You always have to keep an eye on them. It is rather difficult, but goes fairly well."*

*"There is a teacher's aid here, she should be in every Friday in the 2nd module, but she has not been there yet because either she has been sick or she has been set to do other practical chores here at school. Today I came and had again planned and duplicated ten sheets she had to work with 10 vulnerable pupils who actually just is being fobbed off, as we can not get at them because there are too many, then I will teach the 20 who can and will on their own. You know it's not something we hide. It is somewhat sad to see a group that is falling through. It has been reported to the office many times. I've had the headmaster down a few times because she has to see it. She says it is such an ordinary working situation. I can not expect to get them all to work, but it is a big group that never has any benefit of the teaching"*

*"On the other hand, when they are divided in small teams in primary science it works well, and you will learn to know the pupils much better."*

This report describes a teacher with a professional dilemma of wanting to do more than he can overcome on his given conditions. Jesper know he can make a difference to more pupils if he had other conditions for his work. The context is a small rural school with only 30 pupils at this year level. A division into two classes will cost the school more hours to be paid to the teacher, which then will reduce the economy for the entire school as it is paid per pupil not per teacher work-hour. In order for all pupils to achieve well in mathematics the right thing to do professionally would be two minor classes, but this collides with the economic conditions given this school in a rural area of Denmark. In an international perspective class with 30

pupils are not rare, but this is not relevant in the actual case where the teacher experiences that he is not able to differentiate detailed enough to reach all his pupils. His frustration on the situation in the mathematics class is also affected by the fact that in the integrated primary science class he has the class divided into 2 teams of 15, and here he experiences, that all the pupils participate and contribute to the learning in the classroom. So he knows that all the pupils can be reached but his conditions for doing this are different when he teaches the two subjects. The story illustrates the cultural and social conditions that govern his possibilities for teaching according to his personal and professional optimum.

Jesper has deliberately chosen the teacher profession in this part of the country after trying something else. His devotion to the teaching profession and the well-being of his pupils is uttered in a low voice, because he also realises that the economic constraints put on the school can't easily be changed. Despite his frustration there seems to be established a harmony between the teaching profession and the attachment Jesper has to the local area. Muel-Dreyfus (1983) talks about this harmony between humans and professions, she states that: *"People choose a profession and the profession makes them it's chosen ones."* Roth (2002) would with Bourdieu say that Jesper's habitus is to deal with these conditions without making a big fuss of it.

In this example of interpretation of a teacher narrative I have included my general knowledge of the local area. I have managed to get Jesper to tell a coherent story about a part of teacher work that worries him. I lack making observations of his teaching in order to get a more detailed understanding of the problems he is telling about.

These things would improve my foothold in walking in the landscape of teaching science and mathematics in a rural part of Denmark

My intention has been not to prescribe either psychological or theoretical explanations on Jesper's story and I have tried to stay close to the perspective Jesper present. My intention has though been to avoid ending in a pitfall of practice from where the applied reflections would lack a general overview of teacher practice. I have aimed at giving primarily sociological explanations of the narrative.

Not every aspect of narrative research can be illustrated from a single example, but some of the qualitative benefits and points of caution can be presented.

### **Steppingstones working with narratives**

Combining my own experience with recommendations from Ivor Goodson (see e.g. Goodson 2008) some steppingstones can be formulated for the work with narrative research:

*Ask few open questions* – like these:

- Tell about your childhood and home?
- Tell about your teenage years and schooling?
- Tell why you chose teacher education?
- Tell about how you plan and perform your teaching?
- Tell about what the next development move is going to be?

*Make the teacher write:* About a limited number of significant episodes, in their teacher career.

*Make supplementary interviews and observations:* After analysing the collected material it can be necessary to collect further narratives, information's or observations in order to have a rich understanding of the life history.

*Keep open for the personal voice of the teacher:* Teachers can be exaggerating in order to promote themselves, they can be understating as an ironic distance or in order to appear as victims, they can be objective leaving little space for their personality to show or they can be empathic focusing primarily on the relations to the students and colleagues.

*Make detailed analysis of the utterances:* This extracts more knowledge from the narratives by 1) analysing for intonations and pauses (see Roth and Thom 2009) or 2) linguistic analysis see Herman and Vervaeck (2005).

*Analyse for what matters in teacher practice:* The analysis can proliferate from looking for the 3 significant teacher competences identified by Nordenbo et al (2008):

- 1) Teacher relation to the individual pupil – social relation competence;
- 2) Teacher relation to entire class - competence to make class rules and support pupil autonomy;
- 3) Didactics and subject matter competence.

### **Pitfalls working with narratives**

The process of interpretation and contextualisation contains several chances to trip over blind spots and dwell comfort zones. It is important to be aware of these in the process of creating a true and valid life history. The following list is inspired by Elbaz-Luwisch (2007) and my own experience:

*Beware of ideologism:* The teacher's life history is unique, it is not the entire truth about science teaching, and it does not serve a politically correct agenda within education or research. Bourdieu (1999) provides reflections on how to grasp the social conditions of which informants are the product.

*Beware of psychologism:* Narrative research is not therapy; it tries to understand not to cure. Leontjev (1981) gives guidelines for a dialectic approach to reflection and activity. Husserl (1999) advocates for a phenomenological reduction in order to start with the immanent and observable given facts.

*Beware of causalities:* The interpretations shall qualify relations, causes and actions with care and empathy for the teachers work conditions and private life.

*Beware of excluding the teachers' perspectives:* The teacher can have mixed motives for their choice of career and their mode of teaching.

*Remain critical towards practice:* Narratives interviews are collected in an atmosphere of confidence, this confidence can become a blind spot in the interpretation process.

## CONCLUSION

The 3 teachers you have met in this paper all have changed to the teacher profession after years of other work. They all have a sharp focus on the main work function in the teacher practice – teaching. They clearly have become teacher. Their habitus has changed from their former careers to the teaching profession, in this change their former experiences have been supplemented with new experiences. They consolidate their present habitus by giving clear statements on central aspects of the teaching practice. Given the opportunity to tell about their experiences with the teaching profession they all do this in a committed manner.

In the article I have been trying to illustrate the qualities of narratives in providing insight in teacher practice. I have theoretically positioned narratives as a significant element in teacher practice research because it contributes with the teachers' perceptions and experiences of their own practice. Narratives construct the past in the present. Narratives give a language to teachers' disposition for doing their job. The teachers' dispositions are structured by their past and are structuring their presence and future.

To understand teachers we need to know their history and how they have experienced it. This is the basis for their present teaching and for their potential to develop their teaching. The history of teachers is more, than is normally assessed by looking at their knowledge on pedagogy and subject matter. I do not reject that assessing teacher knowledge can contribute to understanding their practice. I only say that using narratives unveils subjective understandings that are close to everyday teacher practice.

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## **SCIENCE TEACHERS' NARRATIVES ON MOTIVATION AND COMMITMENT – A STORY ABOUT RECRUITMENT AND RETENTION**

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*Abstract:* Evidence of problems in science teacher recruitment and retention are often provided in statistical overviews. The individual science teacher's recruitment is based on subjective motivation, and retention is based on continued motivation and commitment to science teaching. Narratives constitute a way to learn more about the individual teacher's motivation and commitment. Narratives were collected from 10 Danish science teachers, teaching 4<sup>th</sup> to 10<sup>th</sup> year science subjects. This paper focuses on two of these. Their motivation for choosing and staying in science teaching differs. Tina was recruited into science teaching through inspiring teachers in primary and high school and a desire to do good for others; this motivated her to choose teacher education and biology as a major teaching subject. After 9 years of teaching she is retained in teaching by her commitment to treating the children as whole human beings. Jane was recruited into science teaching by an interest in outdoor life; this motivated her to choose teacher education and biology as a major teaching subject. After 32 years of teaching she is retained in teaching by a commitment to developing outdoor science education. Teachers' narratives give individual stories of science teacher student recruitment, as well as retention for in-service science teachers. It is the individual choices of coming and active science teachers that sum up in the recruitment and retention statistics.

*Keywords:* Narratives, Commitment, Motivation, Retention, Recruitment

### **BACKGROUND**

Teacher recruitment and retention has been an area of much interest (e.g. Cooper & Alvarado, 2006; Guarino, Santibanez & Daley 2006; Nordisk Ministerråd, 2009; Hare & Heap, 2001). In many countries there are reports on problems of imminent shortages of science teachers (Danmarks Lærerforening, 2007; National Comprehensive Center for Teacher Quality, 2007). The above studies provide mostly statistical overviews of the problem, which show the magnitude of the present problem and the expected development of the future problem. In Denmark e.g. only 57% of the lower secondary teachers teaching biology have completed subject matter education in biology and only 18% of the teachers teaching primary science have completed subject matter training in primary science (Danmarks Lærerforening, 2007). Such statistics gives an idea of the scope of the problem, but do not provide any insight in the individual teacher's reasons for and approach to teaching science. Many studies focus on the first difficult years of teachers' professional careers studying different forms of mentor programmes and their effect on the retention of newly started teachers (Ingersoll & Smith, 2004; Hanuscin & Lee, 2008 and Luft, Wong and Semken, 2011). Luft, Wong and Semken (2011) call for a more comprehensive and strategic orientation towards the recruitment of secondary science teachers, and they recommend more focus on the induction period and science teachers' start of their professional career. Such studies on induction programmes are beneficial for expanding our understanding on relations

between recruitment into and the start of science teacher careers, but do not provide insight into the long-term retention over an entire science teacher career.

Recruitment and retention studies on teachers use different approaches such as questionnaires among first year teacher students in order to understand the social and cultural background for recruitment to teacher education (Stage Petersen, 2010); or narrative inquiry in order to understand details in teachers' life and work contexts (Day et al, 2007). This paper will present experienced science teachers' narratives on their experiences in the teaching profession. The research interest is focused on understanding long-term retention through questions on the reasons why the individual teacher chose a teaching career and why the individual teacher chose science as a teaching subject.

## **RATIONALE**

Science teachers' narratives on their choice of education and on their practice is a way to learn more about the recruitment into science teaching as a profession, and the retention in it over an entire career. Persson (2009) interviews teacher students in Sweden and find their recruitment being motivated by experiences prior to starting on teacher education. Using their narratives he is able to describe their subjective motivation for choosing teacher education and to partly understand the underlying social recruitment patterns. He distinguishes between 4 types of motivation: walk in the footsteps of a master, work with your hobby, invest in teacher education, and avoid beers and mopeds.

Day et al (2007) has made an extensive study of teachers' lives, work and effectiveness in the UK using both qualitative and quantitative methods. They distinguish (ibid, p. 213) between two types of retention: a physical continuation, and a maintained commitment and motivation. They base the latter retention type on interview-generated teacher stories and conclude that commitment has major implications for teacher effectiveness.

This paper will discuss these types of motivation and retention using narratives on initial motivation and the commitment of two science teachers in Denmark. The science teacher narratives on motivation and commitment illustrate aspects of recruitment into and retention in science teaching.

## **METHODS**

The narratives were collected in the autumn of 2010 and the spring of 2011 during an ongoing Ph. D. research project in Denmark. The project uses primary and lower secondary school science teachers' life histories to investigate their motivation for and commitment to science teaching. The research design is inspired by Norrie and Goodson (2011) using life-history interviews, observation of the teachers teaching, and collection of materials produced by the teachers such as pupil assignment sheets, subject-oriented letters to parents, and written in-service training assignments, etc. The narratives will be presented in a condensed form in this paper; all translation is done by the author.

The teachers were chosen so that they have several years of teaching experience; such teachers are past the first troublesome years in a teacher career. Their long experience in science teaching makes it possible for them to tell about the long-term retention in focus in this research project.

## **RESULTS**

The 10 teacher-narrators represent 6 schools placed in different socio-economic settings. The teachers have all completed the 4-year teacher education in Denmark; they have attended 3 different colleges of education for their pre-service qualification. They are all qualified for teaching in Danish public education from 1<sup>st</sup> to 10<sup>th</sup> year. Table 1 presents background data of the teacher-narrators' life and education prior to their teaching practice. The two oldest

teachers were recruited directly from high school, whereas the others all had other work or educational experience prior to starting their teacher education. This pattern of delayed recruitment including changes from other careers into teaching has become more frequent during the last decades in Denmark (Stage Petersen, 2010).

Teacher alias	Gender	Year of Birth	High school or similar finished in	Other training or employment prior to teacher training	Start of teacher education	Graduation as teacher
Jane	♀	1954	1974		1974	1978
Erik	♂	1957	1977		1977	1981
Lars	♂	1956	1976	Clerk	1982	1986
Diana	♀	1970	1990	Shop assistant	1992	1996
Linda	♀	1956	1994	China Painter, shop owner	1994	1998
Simon	♂	1971	1990	Laboratory worker	1997	2001
Tina	♀	1975	1995	Kitchen assistant, Videoshop manager	1997	2001
Frank	♂	1973	1997	Farmer, Nursery assistant	1999	2004
Karen	♀	1966	1985	Industrial worker	2001	2005
Ruth	♀	1972	1992	Nursery assistant, Occupational therapist	2002	2009

Table 1: Background data of the 10 teacher-narrators.

The two teachers in focus, Jane and Tina, were chosen since they represent different commitment to and motivation for science teaching. Jane teaches 4<sup>th</sup> to 6<sup>th</sup> year at a school with 400 all Danish-speaking pupils in a small town of 8,000 inhabitants. She is married to a farmer and lives on a farm; she was born in a town 30 km from her present home. Tina teaches 7<sup>th</sup> to 10<sup>th</sup> year at a school in a town of 25,000 inhabitants. The school has 800 pupils of whom 200 are bilingual. She is married to a mechanic and lives in the town where she was born and now teaches. Jane and Tina were both trained at a teacher college (approx. 125 teacher students at each year) close to where Jane now lives. In pre-service education Jane was educated in Biology and Sports as her major teaching subjects, whereas Tina was educated in Biology and Danish.

### Motivation for choosing science teaching

The majority of the 10 teacher-narrators tell that they chose teaching because they care for children and other people. Tina is in accordance with this majority in describing her motivation for choosing teacher education.

Tina: From 1<sup>st</sup> to 6<sup>th</sup> year I had a male class teacher, he was so nice, a very good newly educated male teacher. What he gave us I also wanted to give someone someday.

Jane has another motivation for choosing teacher education; she considered university studies in biology or a career as ballet dancer.

Jane: After high school I wanted to be either a ballet dancer or game biologist, in teacher education I could get a bit of both. The teacher college wasn't that far away, I had a sick mother at that time.

All the teacher-narrators have positive experiences with science education, nature preservation or outdoor life prior to entering teacher training. Jane and Tina illustrate different types of experience that have motivated them to choose biology as a major teaching subject.

Jane: I loved helping out at my uncle's farm. Our holidays were fishing trips. It was obvious for me to choose biology as a subject for teaching, biology has been THE line for me.

Tina: I had the nerdiest nerd in biology in high school, but he was very funny, he had a good approach to biology ... very good at making images in our heads.

Jane's narratives are in accordance with Persson's 'work with my hobby' type of motivation, and she is still very active hunting and caring for game in her spare time. Tina's narratives are an example of Persson's 'walk in the footsteps of a master', she tells of no science or nature related hobbies. The narratives presented are more focused on everyday teaching and less oriented towards conditions of employment than discussed in the literature available in general (e.g. Hare & Heap, 2001; National Comprehensive Center for Teacher Quality, 2007)

### **Commitment to science teaching**

The teacher-narrators have very different reasons for still being committed to science teaching. Jane is committed to improving the possibilities for outdoor oriented science teaching as she has raised money to restore a pond near her school, so that it can be used in biology teaching.

Jane: This pond is a little diamond, but it needs restoration so as not to become choked. You should be able to fish for water insects in it.

Tina has taken on the task of being a coach to pupils with emotional problems and in her biology teaching she puts emphasis on sex and health education, which is part of the biology curriculum in lower secondary school in Denmark.

Tina: I want to have a positive influence on the young people. My attitude is that it is half subject matter and half social worker, because we are to turn whole humans out in the end. I'm developing a curriculum for the sex education at my school.

Tina's commitment is the relation to the pupils and their well-being both physically and emotionally as whole human beings. Jane and Tina both show continued commitment and motivation to developing science teaching at their schools, which is in accordance with the way Day et al. (2007) describe maintained commitment and motivation. The narratives give more positive and affective reasons for staying in the science teaching profession than those provided in the literature in general (e.g. Guarino et al, 2006; Hare & Heap, 2001).

### **CONCLUSIONS AND IMPLICATIONS**

The teacher-narrators carry their initial motivation for choosing teaching into their science teaching practice. Tina was recruited into science teaching through inspiring teachers in primary and high school and a desire to do good for others; this motivated her to choose teacher education and biology as a major teaching subject. After 9 years of teaching she is retained in teaching by her commitment to treating children as whole human beings. Jane was

recruited into science teaching through an interest in outdoor life; this motivated her to choose teacher education and biology as a major teaching subject. After 32 years of teaching she is retained in teaching by a commitment to developing outdoor science education. Despite their commitment to parts of the science curriculum, Jane and Tina teach the entire curriculum of their science subjects with competence.

Teacher education is no longer a frequent first choice of education, which brings different types of experiences of relevance to science into teacher education (table 1). Recruitment to science teacher education could benefit from engaging in initial motivations and prior experiences in order to challenge and develop student teachers' interests and perspectives beyond their immediate motivation for science teaching.

Retention in science teaching can be accomplished through the development of opportunities that support the science teachers' specific commitment. Commitment through participation in on-going changes at their school is typical of all the teacher-narrators as arguments for staying in teaching, not all of these though are related directly to science teaching.

Teachers' narratives give individual stories of science teacher student recruitment, as well as retention for in-service science teachers. It is the sum of individual choices of future and active science teachers that make the recruitment and retention statistics.

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## Mapping the entangled ontology of science teachers' lived experience

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**Keywords** lived experience · embodiment · relational ontology · entanglement · science teachers

### Abstract

In this paper we will investigate how the bodily activity of teaching, along with the embodied aspect of lived experience, relates to science teachers' way of dealing with bodies as living organisms which are both the subject matter as well as the site or vehicle of learning. More precisely, the following questions are pursued: (1) *In what ways do primary science teachers refer to the lived and living body in teaching and learning?* (2) *In what ways do primary science teachers tap into past experiences in which the body figured prominently in order to teach students about living organisms?*

We draw on the relational ontology and intra-action of Karen Barad as she argues for a “relational ontology” that sees a relation as a dynamic flowing entanglement of the matter that is being related (the *relata*) as well as the relation in itself. We combine this with the phenomenological studies of embodiment by SungWon Hwang and Wolff-Michael Roth, as they address how the teachers and students are present in the classroom with/in their “living and lived bodies”. These theoretical tools help us to map the embodiment of teachers' experiences and how it shows in their actions. We build our understanding of experience on the work of John Dewey and also Jean Clandinin and Michael Connelly, leading us to propose three relating dimension: settings, relations and continuity. This means that bodies and settings are mutually entailed in the present relation, and furthermore that the past as well as the present of these bodies and settings—their continuity—is also part of the present relation. We analyse the entanglement of lived experience and embodied teaching using the three proposed dimensions of experience: continuity, relation and setting. Analysing interviews and observations of three Danish primary science teachers—Erik, Jane and Tina—, we look for

how their lived experiences become and appear entangled with their content knowledge and their classroom practice. Our addressing embodiment from a phenomenological perspective allows us to study the entanglement of lived experience and the living body in the data collected from the three teachers. We focus on Erik's teaching experience and his bodily gestures in teaching biological concepts and explanations to the pupils. We discuss how Jane embodies and enacts her own childhood relations to nature and natural phenomena, recent in-service training, teaching experience and continued enthusiastic relation to nature and natural phenomenon. We also discuss how Tina exhibits an entanglement of experience and embodiment, consisting of knowledge on genetics and ethics of a specific hereditary cancer disease along with a dedication to do good for others and intent to work with the whole persons of the teenagers.

Our analyses suggest that the work of Hwang and Roth on the significance of bodily actions and lived experience in understanding students' learning is also applicable to understanding teachers' teaching. Barad's philosophical reflections on the entangled nature of being, becoming and knowing remind us to be cautious when looking for decisive single factor explanations to observed teachers' actions. By carefully attending to the entanglement of the three dimensions —continuity, setting and relation—, we hope to offer insight into the complex ways in which the body factors into science teaching practices.

## **Sumario**

En este artículo investigamos cómo la actividad corpórea de la enseñanza, junto con los aspectos corpóreos de la experiencia, se relacionan con las formas como los profesores de ciencia manejan sus cuerpos como organismos vivos que son tanto el objeto de enseñanza y el vehículo del aprendizaje. Este artículo tiene como objetivo iluminar esta problemática al explorar la experiencia vivida de profesores de ciencia en la escuela primaria, al usar el cuerpo como el punto central de estudio de cómo experiencias corpóreas pasadas tienen un impacto en su práctica de enseñanza. Más precisamente iluminamos las siguientes preguntas: 1. ¿De qué maneras los profesores de ciencia de primaria se refieren a lo vivido y al cuerpo vivo en la enseñanza y el aprendizaje? 2. ¿De qué formas los profesores hacen uso de sus experiencias pasadas en las que el cuerpo ha tenido un papel preponderante, para enseñar a los alumnos sobre organismos vivos?

Nos basamos en la ontología relacional y la intra-acción de Karen Barad, quien defiende una "ontología relacional" que ve una relación como una maraña dinámica y fluida de aquello que se

relaciona (los relatos) con la relación misma. Combinamos esta idea con los estudios fenomenológicos de la corporealidad de SungWon Hwang y Wolff-Michael Roth, ya que permiten dar cuenta de cómo los profesores y estudiantes están presentes en el aula con/en sus “cuerpos vivos y vividos”. Estas herramientas teóricas nos ayudan a ubicar la corporealidad de las experiencias de los profesores y cómo aparece en sus acciones. Desarrollamos una conceptualización de experiencia con base en el trabajo de John Dewey quien propuso tres principios de la experiencia: la continuidad, la interacción y la situación. Expandimos estos principios con ayuda del trabajo de Jean Clandinin y Michael Connelly sobre métodos personales de experiencia, para abordar mejor la naturaleza corporeal de la experiencia vivida. Proponemos tres dimensiones de relacionamiento: el escenario, las relaciones y la continuidad. Esto significa que los cuerpos y el escenario están mutuamente implicados en las relaciones actuales, y que más aún, el pasado tanto como el presente de estos cuerpos y escenarios —su continuidad— también es parte de la relación presente. Analizamos la maraña de la experiencia vivida y la enseñanza corporealizada usando las tres dimensiones de experiencia propuestas.

Con el análisis de observaciones y entrevistas de tres profesores Daneses de ciencias en la escuela primaria —Erik, Jane y Tina—, buscamos cómo sus experiencias vividas aparecen y se enmarañan con su conocimiento de los contenidos y su práctica en el aula. El abordaje de la corporealidad desde una perspectiva fenomenológica nos permite estudiar el enmarañamiento de la experiencia vivida con el cuerpo vivo en la información recolectada sobre los tres profesores. Nos enfocamos en la experiencia de enseñanza de Erik y sus gestos para enseñar conceptos y explicaciones de biología a los alumnos. Discutimos cómo Jane corporealizó y puso en actuación sus relaciones de infancia con la naturaleza y los fenómenos naturales, sus experiencias recientes de desarrollo profesional y la experiencia de enseñanza, y su relación continua y entusiasta con la naturaleza y los fenómenos naturales. La intra-acción compleja entre sus acciones y las experiencias pasadas muestra cómo Jane enseña a través de la corporealización del entusiasmo y empatía hacia naturaleza y los fenómenos naturales. También mostramos cómo Tina muestra un enmarañamiento de experiencia y corporalidad, que consiste en el conocimiento sobre genética y ética de una enfermedad específica de cáncer junto con una dedicación para hacer el bien hacia otros y la intención de trabajar con jóvenes como personas holísticas.

Nuestros análisis sugieren que el trabajo de Hwang y Roth sobre la relevancia de las acciones corporeales y la experiencia vivida para entender el aprendizaje de los alumnos es también aplicable para comprender la enseñanza de los maestros. Las reflexiones filosóficas de Barad sobre la naturaleza enmarañada del ser y el conocer nos llaman la atención a ser cuidadosos cuando explicamos las acciones observadas de los profesores con factores únicos decisivos. Al atender el enmarañamiento de las tres dimensiones —continuidad, escenario y relación—, esperamos ofrecer una entrada en las maneras complejas como el cuerpo hace parte de las prácticas de enseñanza de la ciencia.

### **Udvidet Sammendrag**

Denne artikel diskuterer sammenhængen mellem læreres livserfaringer og deres kropsliggjorte undervisningserfaringer. Dette bliver særligt interessant i Natur/teknik og Biologi undervisning, hvor levende organismer (kroppe) er undervisningens indhold og hvor læreren og eleverne samtidig er til stede som lærende levende væsener. SungWon Hwang og Wolff-Michael Roth (2011) diskuterer hvordan læreren gennem sprog, gestik og anden kropslig kommunikation kan formidle matematik og naturfag. Denne forståelse af kroppens betydning i naturfagsundervisning kombinerer vi med Karen Barads (2003) betragtninger over menneskers relation til fysiske materialer. Hun benytter Niels Bohrs arbejde til at udvikle en ny forståelse af interaktioner mellem stof og mellem stof og mennesker. Hun benævner disse relationer for intra-aktioner, idet hun ønsker at præcisere at en intra-aktion også omfatter de fysiske genstande eller levende organismer som indgår i relationen. Dette betyder at relationer sammenfiltrer f.eks. mennesker med det de ønsker at undersøge. For at kunne håndtere en sådan kompleks analyse af erfaringer udvikler vi John Deweys 3 (1938) principper om erfaringer med Michael Connelly og Jean Clandinin (1994) dimensioner om erfaringer til 3 erfaringsdimensioner: en tidlig dimension om kontinuitet, en relationel dimension om sociale og materielle relationer samt en omgivelsesdimension om miljø.

Vi bruger disse 3 dimensioner til at analysere 3 danske naturfagslæreres fortalte livshistorier og observerede undervisning. Erik underviser bl.a. biologi i en 8. klasse, den observerede undervisning omhandlede menneskets bevægeapparat. Erik anvender sin egen krop til at illustrere en arms bevægelse og menneskets balance. Den observerede undervisning stemmer overens med anden forskning om læreres anvendelse af gestik i undervisningen. Eriks 29-årige lærererfaring er sammenfiltret med og i hans aktuelle primært begrebsforklarende undervisning om menneskets

bevægeapparat. Jane underviser bl.a. en 4. klasse om navigation. Den observerede undervisning handler om kompasnavigation. Jane anvender sig egen krop til at dramatisere de forskellige kompasretninger, hun beder også eleverne om at stå op og udpege forskellige kompasretninger. Janes undervisning er en sammenfiltrering af hendes egne barndomsoplevelser i naturen, hendes aktuelle store begejstring for natur og naturfænomener og hendes 32 års erfaring som lærer. Hendes undervisning formidler begejstring og indlevelse i naturen. Tina underviser en 9. klasse i biologi, herunder seksual- og sundhedsundervisning. Tina har udviklet en læseplan for seksual- og sundhedsundervisning for alle skoler i hendes kommune. Tina har egne erfaringer med de etiske overvejelser ved at have en arvelig dødelig kræftsygdom i hendes familie. Hendes arbejde med teenagerne i hendes klasse viser en sammenfiltrering af hendes families sygehistorie, hendes eget ønske om at gøre noget godt for de teenagere hun arbejder med i det daglige.

Vores undersøgelse viser at læreres livserfaringer før og udenfor deres lærerarbejde har betydning for den lærer de er blevet og ønsker at fremstå som. Lærernes handlinger i undervisning er en sammenfiltrering af deres tidligere og nuværende erfaringer og af de sociale relationer og miljøer, hvor de har gjort disse erfaringer. Uden hensyntagen til sammenfiltreringen af tidlige, relationelle og omgivelses faktorer for en given lærer i en given undervisningssituation kan man risikerer at fejlfortolke de observerede handlinger og erfaringerne bag dem.

## **Introduction**

In primary science classrooms the body comes to matter in at least two ways. Not only does the curriculum attend to the nature of living and lived bodies, but the teachers and students are present in the classroom with/in their “living and lived bodies” (SungWon Hwang and Wolff-Michael Roth, 2011, p. vii). In other words, living organisms are the subject matter as well as the site or vehicle of learning. Students are living organisms learning about the life of other or their own living organism(s). Teachers are living organisms communicating with the pupils as living organisms about the life of living organisms. This raises a complex educational question regarding the relation between knowing and being in the science classroom. Addressing this question from a learning theory perspective, Luis Radford (2008) suggests that knowing and being are deeply entwined in classrooms, arguing that the epistemological (knowing) and the ontological (being) need to be studied together. According to Radford, learning is not simply learning *to do* but also learning *to be*. Thus teaching and learning are complex processes in which *knowing* and *becoming* are inextricably

entangled. Such insights suggest the need for more detailed case studies of how this entanglement of being and knowing emerges in particular classrooms and in relation to particular *kinds* of knowing and knowledge. In the science classroom, for instance, scientific knowledge concerns relations between material bodies while also being enacted and lived in and through the material bodies of students and teachers. The post-humanistic philosopher of science Karen Barad (2003) offers a set of theoretical tools for studying the ways in which knowing and becoming are entangled, arguing for an “onto-epistemology” that would better address the ways in which scientific knowledge is bound up with the material world. Using the work of Niels Bohr and quantum theory, Barad argues for a “relational ontology” that might better grasp the spread of agency across human and non-human agents, granting matter and materiality the power to exceed our discursive framing (2003, p. 829). She uses the term *intra-action* rather than interaction to help us think, talk and write differently about experience. In rejecting the separability of knower and known, Barad denies that scientific knowledge is “ideational” or immaterial and claims instead, like Niels Bohr, that concepts are specific physical arrangements (p. 814). Thus scientific knowledge is in a lived/living relation to the knower, rather than being an inert, abstract and immaterial set of concepts separated from the knower. Barad leverages these claims from quantum physics to speak to the entanglement of knowing and becoming, arguing that “the relationship between the material and the discursive is one of mutual entailment” (p. 822).

Radford, Barad, Hwang and Roth provide a framework for understanding science teachers as presently living and teaching bodies. But the body and culture are mutually entailed, and thus one needs a theoretical approach that does justice to both. To address the lived history of the primary science teacher, as a *presently* living organism with *past* lived experiences, we include John Dewey’s writings on the relation between education and experience (1938). Our aim is to broaden the study of teachers’ lived experience by attending more carefully to the material nature of these embodied experiences. We focus on how the body figures prominently in teaching primary science, and on how teachers’ leverage their bodies in their classroom to communicate their knowledge. Teachers will often deploy particular embodied gestures that are part of their repertoire for managing the disruptive and non-disruptive behaviour of pupils’ in the classroom (Nancy Rappaport and Jessica Minahan 2012). In this paper, we want to shift our attention away from these more obvious ways by which the body is used to manage other bodies, and point instead to the ways that teachers also leverage their bodies—through gesture and action—to model and explore scientific knowledge *about the body*. Louisa Webb and Mikael Quennerstedt (2010) do however

present a study on physical education teachers where they stress the close relation between the teachers' own healthy body and the teaching of physical education. The authors point themselves to the special nature of the teaching subject of physical education, where the students and the teachers own bodies are the central tool of work.

Various educational researchers have begun to attend to the way that the body figures prominently in learning. Focusing on mathematical cognition Martha Alibali and Mitchell Nathan (2012) find that embodiment is 1) based on perception and action and 2) grounded in the physical environment of the present classroom. Within mathematics education research there is growing awareness of the significance of teachers' use of gestures as one among many semiotic resources in a multimodal approach to mathematics teaching (Ferdinando Arzarello, Domingo Paola, Ornella Robutti and Cristina Sabena 2009). Other researchers add significance to the developmental aspects of including "personal, embodied understandings of the lived terms of inquiry" into teacher education (Margaret Macintyre Latta and Gayle Buck 2008. p.315). However much of this research tends to decode bodily activity in the classroom in terms of semiotic registers rather than taking more of a material phenomenological approach which, in our opinion, studies the body as body (Hwang and Roth 2011).

More specifically, within the domain of science education research, there is little to no insight into how the bodily activity of teaching, along with the embodied aspect of lived experience, relates to teachers' way of dealing with bodies as living organisms which are both the subject matter as well as the site or vehicle of learning. This paper aims to address these oversights by exploring the lived experience of primary science teachers, using the body as the pivot point to study how these past *embodied* experiences impact teaching practice. We analyse the way that teachers speak about the body as part of the science curriculum, and how what they say correlates with particular aspects of their embodied teaching practice. We do so by comparing interview data where teachers discuss the ways in which the lived and living body is taken up in primary science classrooms with observational data of the same teachers in their classroom. Our two research questions are:

(1) *In what ways do primary science teachers refer to the lived and living body in teaching and learning?*

(2) *In what ways do primary science teachers tap into past experiences in which the body figured prominently in order to teach students about living organisms?*

We address these questions by first discussing theoretical approaches to teachers' lived experiences, starting from the work of John Dewey (1938). We extend the notion of experience brought forward by Dewey (1938) and elaborated by Jean Clandinin and Michael Connelly (1994), using the work of Hwang and Roth (2011) to accentuate the deeply material and embodied aspects of teaching. We then describe how Karen Barad's onto-epistemology allows us to rethink the embodied nature of scientific knowledge so that we can better study the entangled process of knowing and becoming in the case of science teaching. The third section presents and analyses interview and observational data collected from a set of Danish primary science teachers, showing how the body figures in their accounts of both their teaching practice and their reference to disciplinary knowledge.

### **Teachers' lived experiences**

Teacher experience is always acquired through presence in "*this* classroom at *this* time and with *these* students" (Roth, 2002, p. 21 italics in original). This indicates that teacher experiences are emergent in specific teaching situations. But, as Dewey suggests, they are also shaped by prior experiences.

Different situations succeed one another. But because of the principle of continuity something is carried over from the earlier to the later ones. As an individual passes from one situation to another, his world, his environment expands or contracts. ... What he has learned in the way of knowledge and skill in one situation becomes an instrument of understanding and dealing effectively with the situations which follows. (Dewey 1938, p. 44).

In this quote Dewey describes one of his principles of experience —continuity. The principle of continuity describes the way in which experience is always embedded in temporal flows, despite our sense that experience sometimes stands out as disruptive or unmotivated. Continuity points to the significance of temporality in gaining experience. Experiences become seasoned into more general experiences and contribute as such to future actions. The 'now' is always related to past and future experiences, "we can no more conceive of an experience empty of future than one empty of past" (David Carr 1986, p. 29). This is especially so in education, where the teacher is designing teaching situations based on prior experience with specific subject matter and pupils in order to teach the pupils this specific subject matter. By using continuity to describe the temporality of experience Dewey points to the coherence of past, present and future in gaining experience.



Dewey uses another principle—interaction—to describe the entanglement between the material conditions or factors at play in our experience. He argues that it is important to be aware of how internal material factors (i.e. the role of feelings) are bound together with environmental forces as part of the objective conditions that regulate experience. Dewey names these environmental forces the “objective conditions” that together with the internal conditions constitute an experience (Dewey 1938, p.44). This division between “internal” and “objective” elements of experience can help educational researchers think through an individual’s learning while also understanding the social setting in which it occurs (Clandinin and Connelly 2000, p.2).

The interaction between the objective and internal conditions form what Dewey calls a “situation” (Dewey 1938, p.42). He furthermore stresses that any attempt to understand experience in education demands that situations be studied with both the principle of continuity and the principle of interaction in hand. Dewey’s two principles of continuity and interaction “provide the measure of the educative significance and value of an experience” (Dewey 1938, p.44) and together they form what he calls the situation where the experience is gained. Dewey uses the notion of situation to specify the close relation between the individual, his environment and the gained experience.

Clandinin and Connelly (1994, p. 417) use Dewey (1938) to describe inward, outward, backward and forward directions of experience. The inward direction relates to feelings and moral dispositions. The outward direction relates to the social environment. The backward and forward directions relates to time. Clandinin and Connelly condense these 4 directions to 2 dimensions one dealing with inward-outward and one dealing with backward-forward, then they add a third dimension space, that deals with what they call the landscape of inquiry. Peer S. Daugbjerg (2010) has previously used the work of Clandinin and Connelly to put forward a redefinition of Dewey’s principles of experience as three dimensions of experience. We will here present a more explicit formulation of three dimension of experience that is congruent with our investigation of teachers’ bodies in teaching. We see one dimension dealing with the temporal *continuity* of actions and experiences, another one dealing with the educational or other *settings* of the actions and experiences and a third dealing with social, material and personal *relations* of the actions and experiences. The three dimensions provide our overall analytical framework for interpretation of teachers lived experiences and their living bodies in the classroom.

What seems to be missing from Dewey's account, and much of the other literature on lived experience in education like Clandinin and Connelly (2000), is a treatment of matter and the material world that actually gets at the embodied aspect of experience. This may in part be due to how Dewey's concept of interaction, takes the setting/situation and the individual as distinct entities prior to the relations that are formed between them. We find inspiration in the work of Barad (2007) to rethink this interaction of entities in terms of mutual entailment or relational ontology. Before we adapt this ontology to our research agenda, we will first clarify a notion of body that it supports. Hwang & Roth (2011), drawing on the material phenomenology of Maurice Merleau-Ponty and Michel Henry, attempt to address the issue of body as an interface between mind and culture, emphasizing the importance of the body in everyday settings and the multiplicity of relations at play in these settings. More generally, the phenomenological tradition in educational research aims to capture the "complex entanglement between consciousness and the world" (David Carr 1986, p.28). The body becomes the pivot point of this relation as it combines the impressions of the objective social cultural context and the internal individual mind (Carr 1986). This relation between mind and culture is not a simple or unidirectional one, as individual experiences affect the coherence of the gained experience.

Students' power to act knowledgeably in their familiar world is inseparably intertwined with their everyday experiences. Everydayness, which refers to the condition that real people (embodied creatures) inhabit in and for their everyday practice, constitutes both the context of and resource for expanding the sense of the world and therefore for learning science and mathematics. (Hwang and Roth 2011, p.2)

The fundamental conditions of teacher experiences arise from an irreducible unit of being in the world and everyday knowing (Roth 2002). The world of a teacher consists of work, home-life and spare time relations and activities. The motives and interests, by which teachers as well as other people engage themselves in these relations and activities, constitute how they experience the settings of things and people around them (Søren Overgaard and Dan Zahavi 2009). This means that all the material settings and relations in a teacher's life and work interact, and make sense—at least to some degree—in relation to individual experiences and interests. In an educational setting Hwang and Roth (2011, p.11-12) point to how cultural forms of language, sense and knowledge always are collective forms that make "the individual intelligence possible in the first place." Coherence between the dimensions of continuity and the settings is well-established in analysis of

narratives based on Mikhael Bakhtin's notion of chronotope (Bakhtin and Michael Holquist 1981, p. 84). This work emphasizes the entanglement between time—continuity—and space—settings—in narrative analysis and inquiry. Relations are experienced most intensively in the present, in the immediate now of communicating with a person, or sensing an emotion, or enjoying a landscape, or performing an action. All these moments of presence are however somehow seasoned into general experiences that can be activated when a similar relation occurs. Such formative and transformative experiences consist of “isolable sequences of external events and internal responses to them...” (Turner 1986, p. 35)

The entanglement between and embodiment of continuity and relation points to an understanding of experience, where the body is integral to sense-making (Hwang and Roth 2011), and the surrounding matter is integral to the body's sense making (Barad 2003). What we find in Barad is a shift to see relations as originary, rather than secondary. Moreover, Barad helps us look more closely at how knowledge of one's past and present environment is at play in our embodied actions. We build on this approach to explore the ways that the material conditions of the setting, and the embodied ways in which teachers relate with these settings, impact their teaching practice in both conscious and unconscious ways.

### **Teachers' embodiment of teaching**

The above discussion of teachers lived experience indicates that the teachers living body is not a solitary timeless gestalt. The teachers past experiences of teaching and life in general are always present as embodied corporeality and are expressed through the observable actions of the teacher. Not necessarily as a one-to-one direct representation of experience in their actions, it can also be other feelings or behavioural preparedness that gives the teacher benefit of his/her experiences in the actual teaching practice. More specifically for the purposes of this paper, we need to study the way that material and highly embodied past experiences play a part in teaching practice. A teacher's experiences enliven the teacher's living body with its current motor functions and senses based on bodily engagement in managing classrooms, illustrating scientific principles, setting up experiments or investigations, guiding field trips, dealing with emotional relations, hunting, fishing, picking berries, gardening, bringing up own children, feeding own pets, etc. It is this entanglement of feelings, actions, knowledge and experiences that the teacher uses when (s)he teaches subject matter in biology or other science subjects. Our attempt to understand the entanglement between

teachers lived experience and teachers embodiment of teaching calls for reflections on how embodiment of sensual and corporal experience and perception inform teaching practice. Anita Roychoudhury (2012) presents reflections on the relation between everyday experiences and preschool science teaching. She points to how feminist education research literature focuses on interconnectedness between teacher, subject matter and everyday experience, emphasising how such relations are essential in underpinning knowledge in science teaching. Such reflections and observations calls for more philosophical consideration on how to understand and talk about relation and entanglement.

Starting from the work of Niels Bohr, Barad (2007) specifies the fact that our understanding of the world is not only based on how we relate to the world but also on how the world—the matter—relates to us. This leads her to conclude that primary ontological units are not “things” but relations. Barad stresses that a relation must be understood as a dynamic flowing entanglement of the matter that is being related (the *relata*) and the relation in itself. This means that the bodily interface of Hwang and Roth (2011) between mind and culture should be understood as a dynamic flowing entanglement where mind and culture are the *relata* and the living body is the actual relation. But neither can be understood if it is taken apart. The only way we know in our minds that our living bodies exist is to dwell in that space of relational ontology where matter and meaning are mutually entailed. Barad (2003) develops the concept of relation further as she introduces the notion of “intra-action”. Intra-action is distinct from interaction because the latter tends to treat the subjects as given or prior to the relation they enter into, while the former treats the dynamics of the relation as constitutive of the subjects. Intra-actional relations constitute the things or matter that relate within the entanglement of analysis, whereas interaction would describe a relation as a connection that consists of the entities that relate and the relation as three distinct elements of analysis. In order to distance her understanding of relations from mechanistic unidirectional processes, Barad uses the adjective *iterative* to characterise how relations and matter reconfigure each-other in an on-going fashion. This reconfiguration is dependent on prior situations, and sometimes loops back to earlier seen forms. This dynamic aspect of Barad’s development of intra-acting relations is important to keep in mind as it constitutes the transitional and developmental perspective in her ontology. Ontology for Barad is about becoming rather than being. In other words, her approach to ontology, which is generally considered the study of being as both material and mindful, is taken up as a theory of process and change. Barad argues that development—becoming—is a process that is indistinguishable from and dependent on the involved entities and that this process also evolves

along a winding and not determined road. This makes her approach to the relation between matter and human very appealing in this study, since it allows us to examine the complex entanglement of lived experience and living bodies of teachers in primary science teaching. A living body develops over time and carries along accumulatively its history and experience in that development. Barad offers an iterative intra-active understanding of matter that avoids separating living bodies and matter, thereby granting the living body as the ontological primary in this study.

Combining Barad's iterative intra-actional relations with Hwang and Roth's study on embodiment allows us to study the three dimensions of experience; we elaborate from Dewey's work. Barad's iterative perspectives add nuances to becoming and thus to *continuity* of past, present and future in our analysis. Hwang and Roth (2011) add attention to the deeply material activity of teaching, as they study teaching as a *setting* of and in physical *relations*. Hwang and Roth show how internal pre-conscious or pre-reflective embodied activity sheds considerable light on the way that students learn in and through their bodily communication in its entirety of actions and sense experiences (2011, p. 8-9). Following Barad's ontology helps us understand pupils, colleagues, subject matter, classrooms and other materialities as equal in the teaching setting; Barad's notion of relation takes in such diverse entities (i.e. matter) of the settings as well as the *relation* itself.

We leverage the ideas of Karen Barad (2007) on the significance of relational ontology onto Roth and Hwang's idea of the living body as the interface between mind and culture, in doing so we have to clarify our understanding of mind and culture. The mind can be understood as a container like the Cartesian interpretation of the pure episteme (Sylvia Scribner 1998). Hwang and Roth (2011) offer a phenomenological understanding where mind and body are different manifestations of the same flesh, meaning that a mind or a body approach offers different ways to understand the living body. Their understanding is more applicable in our study as we investigate the entanglement between teacher embodiment and experience. Hwang and Roth (2011, p. 2-3) refer to learning science as 'becoming part of a community of cultural (linguistic) practice'. With this they emphasise the importance of bodily communicative actions and experience in participating in a given culture, but also the collective and societal aspects of a culture. Following Barad it could with some justification be argued that our mind is undistinguishable entangled in our living body, and the culture that surrounds our living body. Hwang and Roth (2011) made a distinction for analytical purposes between mind, body and culture. Barad rephrases this in a more fundamentally ontological way. The question is not as much whether the mind is part of the body or how the body

is represented in the mind. The issue is rather what specifies as mind, living body and culture in their iterative entangling relation.

Barad's relational ontology together with Hwang and Roth's embodiment approach provide a frame to investigate the entanglement between teachers' lived experience and embodied teaching. This frame brings together their subject matter, their life history, their pupils, but also other materialities within the school setting, like the physical aspect of classrooms, desks, chairs, blackboards, textbooks, etc. and also as the organisational relations that bind colleagues, management, and other administrative bodies together. This expansive and inclusive approach is used in this paper to help unpack the complexities of science teaching. In the next section, we discuss the kind of data we collected for this purpose.

### **Empirical research approach**

When teachers tell their life stories in the context of a research interview they do it to a researcher who is somewhat of a stranger to them. The stories are more cover stories of their lives than exact reconstruction of their lives. The told stories are typically what the teacher frequently tells when asked to talk about their teaching career (Ivor Goodson and Pat Sikes 2001). The stories in the interviews are therefore giving the best side of the interviewed teacher. Stories that tell how the teacher sees him/herself as a teacher, how he/she has engaged and handled challenging situations in his/her career with excellence and/or cleverness. But the stories are anyway unique for exactly that given interview situation (Nancy Brickhouse and George Bodner 1992). Given another interview situation regarding the individual teachers life story slightly other nuances of their life would have been given to the researcher. So the interviews provide an entanglement of core stories from the teachers' lives concerning how they want to appear to the researcher, with some significant events in their life from which decisive experience has been developed and also with topical elements added by the interview situation (Ivor Goodson 2008).

Observations are also framed by the particularities of the situation being observed: the interplay of pupils' and teachers' mood in the lesson, the subject matter, the pupils' activities, and the physical appearance of the classroom. Observations allow us to saturate the told words about past practice and experience with observed actions and practice of the present (Caroline Norrie and Ivor Goodson 2011). Furthermore they are direct observation of the teachers living body acting in the classroom and at work at the school. Thereby they are invaluable in the researchers understanding

and interpretation of the teachers phrasing of their retold experiences (Norman Denzin 2001). An interpretation will always be affected by the observant. For this reason the participating teachers in this study have had the opportunity to comment on the observation transcripts, as one of the following cases will illustrate.

There is however a small catch here that has to do with the media we have chosen to communicate our investigation through: academic writing. The multi-dimensional perception of teacher interviews and classroom observations are reduced to the one-dimensional text-string logic of academic writing. Choosing this media for our communication we subscribe to the criteria and restrictions of academic writing. We are thus conscious about the fact that we lose a considerable amount of information that is not graspable by the one-dimensional text-string logic of academic writing. We will try and compensate for this loss of information by choosing examples from the data that in our opinion illustrate the complexity and saturated nature of teaching, where the entanglement between teachers' lived experience and living bodies in teaching appears clearly in the flow of life, experiences, stories, events and actions.

We have two time scales informing us about the continuity of the teachers' actions and experiences. One is the here and now actions chronologically noted during observation of the teachers teaching and working at their schools. The other is the teachers' retrospect retelling of their experienced life in the interviews. Time is mostly used in this study to keep track of the events and actions in the teacher's life and teaching, rather than as an explaining element of cause and effect.

The teachers' lived experiences addressed in this study are acquired in variety of settings: forests, hospitals, classrooms, streams, consulting rooms, homes, etc. The present educational settings provide the framework for the teachers' exercise of their professional work. The settings are much contextualised to the specific conditions of the specific school, where the teachers work and teach; and to the specific surroundings where they grew up, have lived and still are living in.

Social and personal relations are documented in both the observations and the interviews. Within the personal, we have teachers' retold stories about on how their senses combine between their actions and experiences in engaging persons and objects (Marianne Horsdal 2012). The teachers' relation to the subject matter combines the social—in dialogue with pupils and colleagues—and the personal—in own experiences with nature, animals, etc.—in the relation dimension. The social relations also include pupils, colleagues, neighbours, etc. Barad leaves us with a demanding

analytical exercise in order to deal with relation as, the entangled relation and relation of whatever we choose to focus on. In our understanding of teachers living bodies relating to pupils and subject matter Hwang and Roth provide two bodily communications: actions and experiences. We will use such bodily communications to describe, analyse and discuss the way the body is fleshed out in the observations and life story interviews. We are focusing on the way that the teachers speak about their experiences in biology and primary science curriculum and teaching, and how this way of speaking points to particular assumptions—sometimes tacit—about how the body figures and acts in teaching and learning biology and primary science.

### The applied method

In the present study introductory semi-structured life history interviews were followed by observations of each teacher for 2-4 entire workdays at their schools or during field trips to saturate and enable a thick description of the field situation (Norman Denzin 2001). The observations were documented through handwritten logbook notes of time, staging and dialogue. Along this interaction with teachers some of their own produced teaching material was collected. A second interview was based on themes and questions that appeared from preliminary analysis of the first interview, the observations and the collected material such as pupil worksheets, curricula, etc. The interviews were performed, transcribed and translated by Author1. All data was collected from February 2009 to November 2011 by Author 1. The analysis and coding is performed using the Nvivo8 qualitative analysis software. The coding framework is constructed in accordance with the recommendations by Johnny Saldaña (2009) and Lyn Richards (2008) using a mixture of free nodes and tree nodes in Nvivo8. The structure of tree nodes was developed from a pilot study (for details see Author 1 2010). The free nodes appeared during the analysis when a theme presented itself in the data. The presented excerpts of observations are translated by Author1 and presented in three column tables, where the first column is time (24 hour notation), the second is the staging of teacher and pupils, and the third is the dialogue.

### Observed actions and lived experience

Prior to presenting the individual cases of three teachers from our study we will provide some background on science teaching of children from age 6 to 15 in Denmark. In Denmark 80% of all pupils age 6 (year 0) to 15 (year 9) attend *folkeskole*—the Danish public, comprehensive form of schooling for children, from year 0 to 9 (Matilde Molsgaard 2012). These schools are managed by



the local municipalities and are 100% tax financed. In Denmark the pupils follow the same cohort of peers from year 0 (kindergarten class) until year 9. During these 10 years of schooling the pupils meet 4 different science subjects. From year 1 to 6 they meet a primary science subject called 'Natur/teknik' (Nature/Technique), and from year 7 to 9 they study Biology, Geography and Physics/Chemistry as three independent science subjects.

For Natur/teknik in primary school (year 1 to 6) in Denmark the purpose and curriculum in force is to give the pupils knowledge on important phenomena and connections in nature and technology that has value in their everyday life. In teacher education the stated curricular identity of Natur/teknik in force is to make the students able to perform a creative and committing teaching in natural science topics for year 1 to 6.

For Biology in lower secondary school (year 7 to 9) in Denmark the purpose and curriculum in force is to give the pupils knowledge on organisms, nature, environment and health. Emphasis is on biological concepts, relations and applications. In teacher education the stated curricular identity of Biology in force is the teacher students' use of knowledge on living organisms and their surrounding environment in order to teach biology and develop biology teaching.

A science teacher in Denmark can teach one or several of the science subjects depending on the local school organisation and his/her pre-service and in-service education. In Denmark, *folkeskole* teachers' teach different subjects and different years. This study has focused on biology and primary science teachers, but the involved teachers also teach other subjects in the Danish public school. We offer this brief synopsis of the data so that the reader can get a better sense of the variety of teachers involved in the study.

Teacher alias	Gender	Birth year	High school or similar finished	Other training or employment prior to teacher training	Start of teacher education	Graduation as teacher
Jane	♀	1954	1974		1974	1978
Erik	♂	1957	1977		1977	1981
Lars	♂	1956	1976	Clerk	1982	1986
Diana	♀	1970	1990	Shop assistant	1992	1996

Linda	♀	1956	1994	China Painter, shop owner	1994	1998
Simon	♂	1971	1990	Laboratory worker	1997	2001
Tina	♀	1975	1995	Kitchen assistant, Video shop manager	1997	2001
Frank	♂	1973	1997	Farmer, Nursery assistant	1999	2004
Karen	♀	1966	1985	Industrial worker	2001	2005
Ruth	♀	1972	1992	Nursery assistant, Occupational therapist	2002	2009

Table 1: Basic biographic data of the teachers

We have chosen to focus on the entanglement of teaching and life stories of three teachers from the material: Jane, Erik and Tina. The teachers differ in age, gender, seniority, actions in the classroom and life stories in ways that capture the diversity of the teaching and teachers that Author 1 met. We present the teachers' bodily communications through actions and experiences in classroom settings and relations, their reflections on these settings and relations, and parts of their retold life experiences that are in continuity with these relations and settings.

#### Teaching biological phenomena and concepts through bodily gestures

Teachers use their own body and gestures to illustrate biological or other scientific phenomenon as illustrated by the following case of Erik. Erik teaches Biology and Danish in year 7 to 10 and integrated science at year 10. He works at a school with 640 pupils, in a town with 34.000 inhabitants. Erik is 53 years old and has been a teacher for 29 years. Erik has had a devotion to nature ever since his youth. He made biological fieldwork since he was a teenager. Erik chose to become a teacher as he could study biology at the teacher college, even though he seriously considered studying biology at a university. Today he partly regrets not going to university. Today he is a very skilled ornithologist and since 2011 he holds a leading position in a Danish nature conservancy association. But he is very aware of not mixing his passion and voluntary work into to his everyday biology teaching.

Erik used to be class teacher for the class, so he and the pupils know each other very well. Erik points in the interviews to this fact as being important in his relation to the pupils and the reason for the very few disciplinary comments from him.

Time	Staging	Dialogue
10.00	Year 8 class in the biology laboratory	Erik asks for silence
10.02	2 Pupils arrive late  Erik doesn't stop his dialogue with the girl and clarifies this misconception—either he didn't hear or he chose not to react.	Erik takes the word: "For today you have read page 22-24 on muscles. Ok now look at page 23. What happens when you bend and stretch your arm?"  Erik illustrates with his own arm which muscles that are involved.  Erik: "Where are the muscles attached?"  Erik engages in a dialogue with a girl on how arm muscles work.  A boy joins the dialogue stating that: "So this pushes the arm out."
10.16	During the entire lesson there are very few disciplinary comments.	
10.25	Erik brings out the skeleton from a cabinet in the rear of the laboratory.  Erik repeats the movement of the arm using the skeleton.	Erik: "Now on to the skeleton. Anybody has anything they want explained?"

10.38	Lunch Break	
11.17	The pupils are back in the biology laboratory.	The dialogue starts on sense organs
11.37		<p>Erik then asks: “How do we hold our balance?”</p> <p>A boy: “It is something in our ear.”</p> <p>Erik: “Correct but not the entire story. Anybody wants to add anything?”</p> <p>Silence</p> <p>Erik: “We sway. Just a little. If we didn’t we would fall.” Erik illustrates this by standing on stiff legs, he starts to tilt forwards. He stops his falling by putting out a foot.</p> <p>Erik: “This constant swaying is what keeps moving our balance back and forth all the time.” He illustrates it by making exaggerated sways standing in stiff legs and joint feet. “It’s also the reason why our muscles get sore and tired, when we have to stand up for a long time. The muscle movements are guided by signals from our balance organs situated in the ear.”</p>

Erik’s use of his body illustrates an experienced teacher using a very precise demonstration to communicate the biological phenomenon of movement of the arm and of human bipedal balance. It is clearly gestures Erik has performed many times, as he does it with great routine in getting the pupils to understand the principle of human motor functions. Erik doesn’t involve or invite the pupils to do the same exercises; he goes on talking about other elements of the human body.

During the following interview Erik comment the above observation of the incident with the boy who says that the arm is pushed out by muscles.

Erik: ” ... you notice, that a pupil asks about this with bending and stretching of the arm. I

demonstrate it on my own arm with these two muscles, and you write that I either refrain to comment it or I don't hear it."

Author1: "It is because the pupil says afterwards: so these muscles they push the arm. I think immediately: either you react or you don't. And you continue with the line of what you were talking about."

Erik: "I don't remember anyway, it is exactly therefore I show it like this, I want to say that there is nothing that pushes it is only pulling. But I think I didn't hear it or ... I don't know."

Author1: "Because many have this image, that it is like a piston, if it can go one way, than it can also go the other way."

Erik: "No, no"

Author1: "I see it as an example of the many dialogues that is active in a classroom, and how in many cases you have to decide shall you follow up on it, or do you have to leave some of them for now because you have to get on."

Erik: "Yes, yes there is a lot going on, and you can take up many things and make much of it, and you can make less of it. So there are many choices; that is anyway visible when you see your teaching written out like that."

Erik's demonstration of the motor functions of the skeleton and the muscles is made as an integrated part of his classroom actions and dialogue. He manages the dialogue so that it remains in the classroom settings, where he clearly is focusing on teaching concepts and notions on the human motor apparatus. Erik is familiar with what bodily gestures to make to visualize this particular biological subject matter. The embodiment of his demonstration is continuous with his acquired experience through 29 years of teaching biology. His relation to the pupils is shaped by a mutual respect, where Erik's position as leading the dialogue in the classroom never is challenged. Erik is however disturbed by the observation transcript that shows how he did not respond to a boy presenting a mistaken description. The interview dialogue however suggests that Erik's description of skeleton and muscles is consistent, as he repeats his demonstration and states "it is exactly therefore I show it like this". His concern is not on his own understanding of the motor apparatus; it is on the researcher's conception of what Erik understands. As the researcher acknowledges that he

does not question Erik's understanding, and turns the dialogue onto the complexity of teaching, Erik is confident with the observed situation.

Erik's use of his body in this teaching sequence illustrates how a teacher coinciding can use the body as vehicle for teaching and as subject matter. The interview dialogue adds an aspect of professional pride to Erik's personality, as he wants to assure that Author 1 is aware of Erik's—correct—notation of movement of the arm. This case illustrates a teacher using gestures in visualizing subject matter to stimulate the pupils' cognitive acquisition of knowledge, and where lived experiences outside school are not that prominent. We will now turn to examples where lived experience is directly in entanglement with the embodiment of teaching.

Children experiencing nature and natural phenomena and enthusiasm for nature

Some of the teachers emphasize the importance of children experiencing nature and natural phenomena with their own body. The most prominent example is Jane. Jane teaches Danish, Swimming and Natur/teknik (primary science) in year 4 to 6 at a *folkeskole* with 420 pupils, in a town with 7000 inhabitants. Jane is 56 years old; she has been a teacher for 32 years. Jane chose to become a teacher after high school as she in teacher education could combine interests in dancing (sports) and nature (biology). Jane has an intense interest in wildlife and nature; she uses this in her everyday work at school, field trips, and in the local area caring for wild partridges besides being an active hunter. Jane has documented the history and status of a pond and a forest near her school in an assignment she made while she was taking a half year education in the teaching subject Natur/Teknik. Jane is pushing on the municipality to make them take responsibility for cleaning up the pond and maintaining the footpaths in the surrounding forest:

“It is such a beautiful little place if only more would use it more. It is so full of opportunities. I even stayed overnight up there with a group of pupils once. We had wonderful evening, a clear sky and lots of stars. Children nowadays don't see stars; they don't sleep in the wild. It is a shame.”

Jane's passion for nature was founded when she was young: “We went swimming in the creek near my uncle's farm when I was girl. I remember one evening we were going home and the sun was setting, this red evening sun and there came a bumblebee very quiet (.) and the smell of bugs, these leaf bugs, who were hanging up in the trees, this sharp smell, no really (...) such an experience stands very strong for me (..).”

Such an experience motivates Jane to give the same kind of experiences to children. The following example is not from a biology topic within Natur/technik, but it illustrates the way Jane uses her own body and makes the pupils use their own bodies in learning of science.

Time	Staging	Dialogue
8.14	The pupils of a year 4 class have arrived at the primary science laboratory.	
8.17	Jane shows a 1,5 m. mossy branch.  Jane writes on the blackboard “finding your way” in an oval.	Jane: “Today I have brought a branch, this is my compass. Today we will talk about finding our way. Can you find your way from home to school, can you find Fabjerg Church [3 km away], can you find Italy, you have to raise your hands”  A classroom dialogue starts.  Jane asks the pupils how they would find their way on the sea, in the desert, above the clouds or in the forest, while asking she is showing transparencies of these places.
8.25	The pupils’ contributions are written on the blackboard around the oval.	Branch/tree, the wind, landmarks, church, GPS, waves, points of the compass (n, w, e, s), map, the sun, make your own compass, telephone, stars/north star.
8.34		Jane: “My branch, how has it pointed.”  Pupil1: “The moss has turned north.”
8.38		Jane: “Now close your eyes and point north.”
8.39	The pupils point in different directions, disagreeing on where north is.	Jane: “Where is north.”  Jane: “...where is the sun in the morning?”  Pupil5: “In the east”

8.41	The pupils adjust the orientation according to the majority of the class.	Jane: "Now stand up, point your arms north-south and then east-west."
8.42	Jane hands out an assignment sheet. A classical compass but without any letters on.	
8.43	Jane dramatizes how to walk according to a compass.  East, west and south is drawn during class dialogue.	Jane: "The holes on the sheet, shall be to your left. Then up will be north."
8.46	North east, north west, south east and south west are entered on the compass sheet.	
8.47	Jane hands out a new assignment sheet. This assignment is developed by her.	Jane: "Now we will make a 'dictation'* using the points of the compass. The sheet shall have the holes upwards."
8.49	Jane dramatizes northeast. The drawing instructions go on. The pupils end having drawn a house.	Jane: "Start 4 check patterns from the lower left and go 10 to the north and then 3 towards north east."
8.58	Jane asks the pupils to hand out the materials for making a magnet of a needle that she has prepared in advance on a table in the room.	Jane: "You have to remember the polystyrene pieces to put the needle on, so it can float on the water."  Jane reads out loud from page 20 on magnets.
9.14	Jane is switching between letting the pupils investigate, coming up with ideas and making them pay attention	Jane: "Put everything on the table and fold your hands and listen. Did the homemade compass work, did the real compass work?"



	to important concepts.	The pupils reply yes.  Jane continues: “Now what is magnetic, try and find something in the room that is magnetic.”
9.27	The pupils start talking and walk around to ask others about their results.	Jane whistles through her fingers to get the pupils attention. She uses the split-second surprise and silence the loud whistle created, to take the word.  “Now tell us what is magnetic,” The pupils mentions what they have found, it was always things of metal. Jane specifies that it typically is iron and nickel.

\*) By using the term ‘dictation’ Jane refers to an exercise the pupils know very well from their Danish mother-tongue teaching, where the teacher dictates words that the pupils have to spell correct on assignment sheets.

Jane’s enthusiasm for nature and natural phenomenon in general is also apparent in her approach to teaching about magnetism. Her actions in the classroom includes using the pupils own bodies both to make them understand the points of the compass but also to regulate the commotion of the pupils working with the compass and magnet experiments. Her disciplinary actions are based on 32 years of experience. The children folding their hands stop them fiddling with the materials and reduce the noise level immediately. Her whistling is a skill she uses to direct her hunting dogs, by it also focuses the children’s attention towards her immediately. But she only applies these specific disciplinary actions, when pupils are getting tired at the end of two lessons and are losing concentration. Jane includes the pupils in her bodily demonstrations. The children are having primary experiences when pointing out the corners of the compass with their bodies and as they make their own compass and as they investigate what is magnetic.

Jane recently had an opportunity to reflect upon her 32 years of teaching experiences as she a year prior to the observations has finished in-service training for teaching primary science. This was

a 6 months fulltime supplementary education similar to the one in teacher education on the teaching subject Natur/teknik. Jane reflects on the outcome of this course in the interviews: “I have had many good and interesting discussions with my in-service educator (.) and we still send a mail when we have a small biology challenge for each other. Yeah that is nice, I mean of course, now you are into some areas, we had very interesting discussions but I feel, that I was well prepared with my basic education and of course both education and many years of experience.”

Author1: “Yeah that’s obvious that the pot is stirred when you...”

Jane (interrupts): “Yeah, yeah, but one thing is, yes still is, I can see that my way of teaching and thinking is not that stupid.”

The in-service training has (re-)affirmed Jane that her approach to teaching about science and nature is constructive and beneficial for the children. Jane’s actions in the classroom—and other educational settings—reflects a continued entanglement of her 32 years of experience of teaching, her long-lasting and continued emotional relation to natural settings such as forest and ponds, her devotion to communicating nature and natural phenomena to children, and her recent in-service education. She is and has constantly been involved in local nature conservation projects; she relates these experiences to her own emotional childhood experience in her approach to teaching nature and natural phenomenon to children. Jane is—in spite of her seniority— still developing her own teaching. She is—still—engaged in social activities with the pupils such as spending the night under open air. Jane is teaching enthusiasm for nature to the children using a series of bodily communicative actions and experiences.

#### Health education and ethics of knowledge on health condition

Some of the teachers are observed teaching topics relating to health or sex education. These topics are integrated in the Biology as well as the Natur/teknik curriculum in Denmark. Tina has the most elaborate reflection on her commitment to this topic. Tina is 35 years old; she has been a teacher for 9 years. She teaches Danish, Sports and Biology at year 7 to 10 in at the same school as Erik. Tina knew already as a child that she someday would like to be a teacher: “From 1<sup>st</sup> to 6<sup>th</sup> year I had a male class teacher, he was so nice, a very good newly educated male teacher. What he gave us I also wanted to give someone someday“. Tina has a relation to the health aspect of biology teaching,

which is initiated in high school when her mother got cancer, a significant event in her life that initiates her interest in biology:

“... perhaps I had a sense of it, I could fairly quickly smell a rat when my mother got ill, and about that time you have to choose study subject (high level study subject at high school), there was a lot of talk about some hereditary cancer. So I think that my motivation also was to learn some genetics, and try and see where the hell it all comes from, what it is and can it (...).”

Tina’s mother dies the year after she finishes high school. Based on her knowledge on genetics from high school Tina follows up on her mother’s death and contacts her own doctor in order to find out whether her mother’s breast cancer was hereditary—a braca 2 type cancer. Tina finds out that it was, but she has not inherited the disposition for cancer. But her knowledge leaves her with an ethical dilemma as her mother has two sisters who also have daughters—cousins to Tina.

“I was tested and don’t have it, but all of a sudden, my entire family was involved in it and they didn’t want to know anything (.) but I had a cousin who wanted to be tested, and she knew that if her showed up negative, then would her mother also have it and the mother didn’t want to know (.) and there she has walking around with a knowledge that the mother had it, then all of sudden we got, yes it became very messy; but the one aunt and my grandmother know nothing, and the other aunt and her daughter knows, the problem is however the aunt on the other side has two girls who each has two girls and they are all potential bearers of this gene. (.) So things have really been stirred up, but it is really my knowledge that over time has done it, no there really is trouble afoot.”

These primary experiences of the significance of information about health and disease, and the ethical side of such knowledge is part of the experiences that Tina brings to teaching and working with young people. Tina states her approach to teaching biology:

“I want to have a positive influence on the youth that they can go (...) go into the world and make some reasonable choices, because you have helped to make, not teach them, but made them able to think and go out. (.) So my approach is also that it is half subject matter half social work.”

Tina has developed a sex education curriculum in collaboration with colleagues from her own school and other schools in the municipality:

“But there is also pupils that when they leave school, then they don’t know how you get pregnant, really that I think that is also rather sad and they will never get a completely good grip of it. Yes, yes also that it gets a societal perspective right (.) that it is okay to say no and stuff like that, that is what this course has set the scene for, that there has to be made a continuity where it starts from kindergarten class, where it concerns much about me; and then in year 3, 4 and 5 it is me and the class and then in year 7, 8 and 9 it is me and the society and then go that way out, right (.) and that they all places learn that choices has consequences (.) both the one and the other in relation to yourself, right (...) and that I think is bloody exciting because the continuity that I think can add something to it, their knowledge.”

The sex education curriculum is implemented as the official curriculum for all schools in the municipality, it is very precise with regard to what topics to take up at what year and how to teach them. This work with a sex and health curriculum exhibits a significant coherence between Tina’s claim that she sees being a teacher as combination of communicator of subject matter and a social worker in order to get as she says: “whole human beings out of them, right”.

Tina embodies her emphasis on the social aspects of the teachers’ work in her daily contact and dialogue with the pupils. Author1 never once heard Tina raise her voice while Auhtor1 was observing her. She uses systematically a hand signal—a raised arm—when she starts the lesson. The pupils quiet down and she can start giving the instructions for the lesson. While the pupils are working autonomously, she circulates and is talking quietly to the groups as they work. If a group starts to argue loudly she slowly approaches them and places a hand on the shoulder of most noisy pupil, asking what the problem is. This was given an almost iconic depiction in an episode in the biology laboratory. The pupils in Tina’s class were admirably quiet and working in groups focused on written reports on Danish mammals, when suddenly a colleague of Tina’s were yelling VERY loud in the neighbouring classroom. Everybody including Tina and Author1 in the biology laboratory had a slight start and then broke into laughter.

Due to Tina’s life history she is aware of the beneficial significance of having a meaningful and significant relation to the subject matter in order to find it meaningful to work with. Her mother’s cancer disease has had decisive effect on the teacher that Tina has become and the professional choices she has made. This continuity between her life experience and her teaching is not only an advantage, as it also makes her somewhat selective in what topics in the biology curriculum that she

feels a commitment towards. She has to mobilise motivation when she is teaching lake ecology and fish gill ventilation, where other topics appeals more to her immediate understanding of biology. Her teaching actions in the classroom setting encourages dialogue and pupil activity, as she feels and has experienced that it engage the pupils better. Tina has great empathy in her relation to the teenagers she teaches and works with, and she uses personal experiences and distinctive actions for framing her relations to the children.

### **Primary science teachers lived experiences in the embodiment of teaching**

We now return to the introductory intention of understanding bodies as living organisms that are the subject matter as well as the site or vehicle of learning in primary science education. We have studied primary science teachers in a Danish context. We have focused on the implied entanglement between teachers' lived experience and their present embodiment of teaching.

Hwang and Roth (2011) bring in their study of students learning physics and mathematics to attention that being a human being means being in the flesh, acting in the world with feelings, emotions and corporeal forms of knowing (p. 1). This leads to an understanding of living bodies in educational settings that base itself on the actions, emotions and bodily forms of knowledge of teachers and pupils (Latta and Buck 2008). Contemporary studies in ontology of the body imply such general importance of understanding the body by focusing on empirical actors situated in time and space (Diana Coole and Samantha Frost 2010). Coole and Frost further stress that bodily processes and corporeal capacities are indispensable for an adequate appreciation of how living matter structures natural and social worlds. They along with Horsdal (2012) also point to the fact that bodies communicate with other bodies through their gestures and arouse visceral responses that do not necessarily pass through conscious awareness. In teachers' practice this means that teachers living bodies communicate subject matter as well as their spoken words (i.e. teachers' voice/vocal organ is also part of their body), their use of teaching materials, etc. Teachers relate to the subject matter and their pupils using their body, its motor functions and senses. Transposing Hwang and Roth's (2011) arguments on pupils' learning to teachers and teaching, they emphasise the close relation between feeling and being in contact with classroom, pupils, and the temporality of teaching for teachers to know about their teaching (see also Roth 2002). This temporality includes as well the present as the past. In order to address this we have built on Dewey's three principles of experience and stated three dimensions of experience: continuity, settings and relations. These three

dimensions help us analyse the entanglement of the teachers' bodily actions and verbally expressed experiences in accordance with Barad's focus on intra-actional relations as an inseparable unit.

The lived experiences in the three presented teacher stories are to a varying degree visible in their actions when teaching science subjects. Thereby we flesh out in real persons Sikes's summarizing remark:

Obviously, life experiences influence the sorts of teachers people become, and the sorts of teachers they want to be and be seen as being. (1992, p. 40)

The teachers' actions express their knowing about and priority given to teaching different science topics and their experiences with different teaching approaches.

In the presented teaching sequence with Erik, there is a very direct overlap between the human body as taught subject matter and Erik's living body illustrating biological knowledge. Erik's teaching and work is generally very level-headed. The continuity in Erik's teaching is based mostly on his 29 years of teaching. He is very deliberate in his downplaying of his vast knowledge on nature; his pupils shall not be burdened with his spare time passion of birds and nature conservancy. The settings of the observations of Erik are in line with this distance between his teaching job and his spare time passion. His teaching occurs in the biology laboratory, and he further adds in the interviews that he seldom uses field trips in the teaching, he finds the educative outcome of them not being worth the effort and time spend on them. Erik has an ease over him when teaching and relating to the pupils, he is liked and respected by the pupils as seen from the very few disciplinary actions he takes. His use of embodied demonstrations of biological phenomena contributes to him as a teacher where the entanglement of experience and embodiment consist of relations to the taught subject matter and the relation to the pupils. This case is in line with several studies on gestures and embodiment (e.g. Candia Morgan and Jehad Alshwaikh, 2012), that discuss and illustrate the benefits for pupils learning, when the teachers uses gestures when teaching. Our addressing embodiment from a phenomenological perspective show that intra-action of actions and experiences in the presented teaching sequence entangles Erik's teaching experience and his bodily gestures in primarily teaching biological concepts and explanations to the pupils.

In the presented teaching sequence of Jane the subject matter indirectly refers to the body through human navigation and Jane engages as well her own body as the pupils' bodies in investigating the

phenomenon of magnetism in human navigation. The continuity in Jane's teaching and lived experience is reflected in the way her own long-lasting enthusiastic relation to nature and natural phenomenon are used directly into the classroom. Jane extends her classroom settings to include among other things overnight stays in forests. Jane very directly expresses her own lived embodied experiences with nature in her teaching about nature and natural phenomenon. Jane engages pupils directly in using their bodies in the teaching she enacts be that in the primary science laboratory or during field trips. Jane's relation to the pupils draws on her relation to nature. Jane exhibits an entanglement of experience and embodiment, that consists of own childhood relations to nature and natural phenomena, recent in-service training, teaching experience and continued enthusiastic relation to nature and natural phenomenon. This complex intra-action of actions and experiences in the presented teaching sequence shows how Jane teaches enthusiasm and empathy towards nature and natural phenomenon.

In the presented case of Tina the subject matter of health and sex education directly addresses the human body and Tina refers to the importance of the pupils acquiring a relevant understanding of their own body. There is a significant continuity between Tina's life experiences on how knowledge on hereditary diseases in a family has ethical consequences and her teacher work. Tina has adapted parts of her lived experiences into educative settings such as a curriculum at municipal level on sex and health education, and other parts into her daily relation with the pupils in the classroom. This gives her an awareness of the relation between biology subject matter and social and societal dimensions of this subject matter that she uses in her relation with the pupils. Tina exhibits an entanglement of experience and embodiment, which consists of knowledge on genetics and ethics of a specific cancer disease along with a dedication to do good for others and intent to work with the whole persons of the teenagers. Tina's empathy towards the youth she teaches and works with is an intra-action of her classroom actions and her life experiences.

Our analysis of the teaching, work and lives of Jane, Erik and Tina reveals that the directly observable primary science teaching is shaped by several entangled and intra-acting actions and experiences. The entanglements and intra-actions are unique for each teacher's knowing, being and becoming as a teacher. Such understanding of teachers' work is not essentially new (see Goodson and Sikes 2001). Our emphasis on the significance of the teacher's body (entangled with his/her mind) as *a* living and evolving organism has however allowed us to discuss bodily communication of teachers as having a past as well as a present. This has been made possible to us by addressing

living organism as subject matter as well as site or vehicle of learning, because this approach forced us look closely at relations between subject matter, teacher and pupils in primary science and what role the continuity and setting of teachers' bodies played in that relation.

### **Entanglement of setting, continuity and relation**

We set out to investigate the connection between primary science teachers lived experience and their embodiment of teaching, by focusing our attention on 2 questions 1) how science teachers refer to the lived and living body in teaching and learning, and 2) how science teachers tap into past experiences of body when they teach about living organisms. Analysing interviews and observations of Danish primary science teachers we found how lived and gained experiences are entangled into the teachers' actions in their work and teaching. A common characteristic of the analysed teachers is that they all embody a continuity between their past lived experiences and present teaching actions. We find that science teachers refer to the lived and living body through their use of embodied gestures when demonstrating scientific concepts and explanations in the classroom settings. This gives them an ease when teaching biological and scientific phenomena. Such use of the body entangles teaching experience and subject matter illustration. We find that science teachers tap into their past experiences when they use their own joy of natural settings embodied in their childhood spreading enthusiasm to include pupils in investigating natural phenomena. This indicates a relation to science teaching that is continuous with the teachers own empathy towards nature and teaching of such empathy towards nature to the pupils. We also see how experiences with embodied ethical considerations create a holistic approach to teaching sex and health education that is continuous with a general empathic relation towards the pupils in science teaching settings.

The teachers' knowing about teaching science subjects is visible in their bodily actions and in the way they include references to bodily actions when they talk about their teaching. The teachers becoming the science teachers they appear as in the observations and interviews include embodied experiences and actions. In understanding the entanglement of the roles of body and experience in teachers' actions Barad help us to keep focus on all three dimensions of experience (continuity, setting and relation) including their entanglement in our analysis. Our analysis illustrates how the teachers' actions are an entanglement of their knowledge and experience on nature, natural phenomenon and teaching as well as the way they gained this knowledge and experience. Our



results thus indicate that the reflections by Radford that pupils' learning is about being as well as doing is also applicable to teachers' teaching. Furthermore it seems that the findings by Hwang and Roth on the significance of bodily communication, actions and experiences in understanding students' learning also to a certain amount is applicable to understanding teachers' teaching. Barad's philosophical reflections on the entangled nature of being, becoming and knowing remind us to be cautious when looking for decisive single factor explanations to observed teachers actions.

Without due respect to the entanglement of continuity, setting and relation for a given teacher in a given teaching situation, we are likely to misinterpret the observed actions and the experiences behind them.

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## Listening to nature: Life histories of Danish biology teachers

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### Abstract

This chapter uses life history research methodologies to study biology teachers' reasons for teaching biology. We discuss particular theoretical and methodological aspects of life history research and narrative inquiry, and argue for the relevance of this kind of research in exposing the socio-cultural framing of teacher experiences in schools. We then argue that research fictions (Clough, 2002) serve as powerful narrative tools for highlighting particular thematic elements found in life history data. Based on life history narrative data collected from ten Danish biology teachers, we offer two corresponding research fictions that explore how emotions pictured as a listening to nature influence their choice of the teaching profession and of biology as a teaching subject. A sustained commitment is based on many reasons and apparent lack of one can be set off by excess of other reasons.

### INTRODUCTION

Teachers' reasons for choosing teaching as a profession are often studied in terms of recruitment, retention, motivation and commitment (e.g. Guarino, Santibañez & Daley 2006, Nordisk Ministerråd, 2009). Such studies find motivation driven by underlying social recruitment patterns (Stage Petersen, 2010; Persson, 2009), and retention driven by distinct types of commitment (Day, Sammons, Stobart, Kington, and Gu, 2007). Yet much of this research fails to get under or beyond teacher cover stories (Clandinin & Connelly, 2000), and doesn't shed adequate light on the specificities of science teachers' individual motivations and commitments. Studies by Traianou (2007) and Day and Gu (2011) show that the stories of individual teachers reveal a richness of significant details. These details, however, are often omitted when the research purpose is to uncover more general societal trends. Although such societal trends represent human activity as situated in cultural, historical and institutional settings, syntheses of large scale research cannot adequately reveal the complex and sometimes contradictory reasons by which teachers enter and stay in the profession. The particularities of a life are more often captured in the life history of the individual. This chapter discusses the need for life history research in the study of teacher motivation and commitment. We discuss particular theoretical and methodological aspects of life history research and narrative inquiry, and argue for the relevance of this kind of research in exposing the socio-cultural framing of teacher experiences in schools. We then argue that research fictions (Clough, 2002) serve as powerful narrative tools for highlighting particular thematic elements found in life history data. We focus on biology teachers and their reasons for teaching

biology. Based on life history data collected from ten Danish biology teachers, we offer two corresponding research fictions that explore the important theme of the influence of nature on their choice of profession. We explore the influence of nature in terms of outdoor life and animals because of its recurrence in the data. The relation between nature and biology is complex, and the two concepts are not congruent or coinciding. Biology as a scientific practice is the rational study of living organisms in their natural environment and in the laboratory. Nature apart from being the habitat of living organisms also is a place where we as humans encounter emotional experiences. A recent issue of the Danish educational journal 'Unge Pædagoger' (2011) (Young Educators) address different approaches to nature in education in Denmark by presenting articles on the more rational approach of Inquiry Based Science Education (IBSE) and the more emotional approach of Outdoor school. The article on IBSE focus on invoking children's interest and getting their minds engaged in the learning process. The editorial introduces the articles on outdoor school by referring to Rousseau's notion that children learn through their body as well as their minds using all their senses. Cornell (1979; Cornell and Hendrickson 1987) has in writing and in practice tried to raise the awareness of teachers on the benefits of listening to nature in work with children. His theme of listening to nature points to how attention, perception, experience and activity in nature are essential to teaching in and with nature. His approach is systematically to start with an emotional – often individual - relation to nature and later on applying rational scientific notions and systematic or writing poetry in order to understand the experience.

However it is rarely examined how experiences with nature, outdoor life and animals function in shaping the teachers own motivation and commitment. Cornell's theme of listening to nature will be pursued in terms of outdoor life and animals in the life history narratives in order to trace the way feelings and emotions towards nature function for individual teachers in complex and sometimes contradictory ways.

### **A sociocultural approach**

Sociocultural studies acknowledge the complexity of human activities and introduce methods and concepts that make it possible to handle this complexity. Applying a sociocultural approach in science education research introduces unfamiliar methods and concepts from linguistics and anthropological research that are strangers to the natural sciences and often resisted by the dominant cognitive science tradition of education research (Anderson, 2007). This calls for a clarification of what a sociocultural perspective in science education is. Lemke (2000) gives some notion about how interactions between the individual and the community can be understood in science education:

“A sociocultural perspective on science education is sceptical and critical. Its most basic belief is that we do not know why we act as we do; we only know a few local reasons on a certain time scale and within a limited range of contexts. We do not know all the other reasons that arise from the functioning of our actions in far larger and more distant contexts and on longer time scales. As a research perspective this view seeks to elucidate the problems that arise from our limited view of the larger systems we inhabit, and to

identify just how our actions do also function on many larger scales.” (Lemke, 2000, p. 297).

Lemke points to how activity operates on both large and small scales, and that any study of educational experiences must look for the ways micro and macro contexts and trends intersect. Traianou (2007, p. 37) uses Roth (1998) to make a distinction between cognitive and sociocultural approaches to education research, pointing to how these two approaches differently study the interactions between the individual and the community. The cognitive approach focuses on development of cognitive structures of novices, whereas the sociocultural approach focuses on the novices’ ability to carry out successfully (or not) the activities of the relevant community. This latter approach leads to an understanding of teacher knowledge that emphasises the communities and interactions through which the teacher develops, while broadening our understanding of what it means to learn. Thus the sociocultural approach, broadly conceived, directs our attention to aspects of education that have been traditionally explained away as effects of cognitive alignment (or misalignment). In doing so, it allows researchers to attend more rigorously to the political framing of educational experiences, and demands, accordingly, that we leverage innovative strategies for representing this kind of research. Traianou (2007), for instance, emphasises the importance of studying teachers actual teaching practice, in addition to their performance on isolated tasks: “...sociocultural theorists argue that the assessment of an individual’s knowledge should be based on how this person performs, and not on what this person says about his/her own performance or what he/she can and cannot do in artificial situations” (p.40). Thus, rather than simply recounting verbatim their own accounts of their practice, nor confining one’s study to their performance in content-related artificial situations, we need to devise a research methodology that brings together diverse observational data and presents these teachers in all their complexity.

The holistic approach of sociocultural researchers does not mean that they claim to grasp the entire truth, for as Kirschner and Martin (2010) put it “sociocultural theorists are more likely to envision their purpose as the achievement of an increasingly adequate (though never perfect, timeless or completely unambiguous) understanding of phenomena of interest” (p.15). This might seem lacking in ambition as a research approach, but such a partial perspective may prove to be, in fact, more reliable and sound as a research practice, as it involves recognizing the complexity and challenges of investigating human activities and their interactions with and within communities (Lave 1988).

### **Teacher life history and narrative research**

In this chapter, we draw on methods from life history research as a way of collecting data and representing experiences and events of individual teacher’s life and work. Goodson (1992) suggests six sources of life history data: (1) life experience and background, (2) life style, (3) life cycle, (4) career stages, (5) critical incidents and (6) ‘Life histories’ of schools, subjects and the teaching profession. As this list implies the field is diverse, and work in this area has focused on a diverse set of notions, such as: Teachers lives (Lortie 2002, Huberman 1993, Day and Gu 2010), Life and Work of teachers (Day et al, 2000; Day et al 2007; Goodson, 2008), Teachers Life History (Goodson and Sikes, 2001; Goodson and Numan, 2003), and Teachers careers (Ball and Goodson,

1985; Fessler and Christensen, 1992; Bayer et al 2009). Most of these studies try to deduce general trends such as life stages or phases in the lives and work of teachers. One important example of this is Day and Gu (2010), who define “the notion of professional life phase – rather than career phase – [as it] also helps encapsulate not only the impact of psychological and sociological factors on teachers’ work and lives (as does the concept of career), but also that of personal, emotional and organisational factors.” (p.45). This emphasis on the personal and emotional facets of teachers’ experiences is crucial here, as it points to a neglected area of research, and underscores the power of life history research, that being its potential to tap into the emotions that shape teachers lives, work, motivation and commitment (Day and Lee, 2011).

Riessman (1993, p. 70) stresses the power of narrative research in understanding experience because it allows for systematic study of personal experience, meaning and an understanding of how events have been constructed by active subjects. Riessman (1993) outlines aims and methods in narrative analysis:

“The purpose is to see how respondents in interviews impose order on the flow of experience to make sense of events and actions in their lives. The methodological approach examines the informants’ story and analyses how it is put together, the linguistic and cultural resources it draws on, and how it persuades a listener of authenticity.”  
(Riessman, 1993, p.2)

Huberman (1993) has focused on the pedagogical career of classroom teachers to study the teachers own perception and feeling of contentment in their career and to “explore the trajectory of individuals in organizations” (p.4). We focus here on Huberman’s insights because of the way they shed light on the two research fictions we present in this chapter. Huberman (1993) presents key elements regarding professional satisfaction: “enduring commitment, good relations with pupils, good colleagues and balance between school, home life and personal interest” (p.149). Huberman (1993) finds that teachers who have felt significant freedom in designing interactive activities, either inside or outside of classrooms, have felt deep professional satisfaction (p. 250).

The challenge in the present study is how to communicate the lives and work of biology teachers in all their richness without either publishing the entire transcripts of the interviews and the observations notes or reducing the individual teacher to a quote, a stage or a phase. This challenge raises questions on how to develop a mode of communication that balances the need for overview with the need to respect the contributions of the individual teacher.

## **Research fictions**

Maclure (2003) asks researchers to recognize the ways in which their research texts are “fabrications”, pointing to the ways that both qualitative and quantitative social science research always involves some degree of rhetorical artfulness (p. 80). When a research text fails to name its own artfulness, and claims to be a transparent representation of that which it aims to capture, readers often submit to the authority of the text rather than engage in critical reading. Narrative and life history research, according to Maclure, are often taken up and read as though they were realist



depictions of both internal emotional states and external circumstances. Maclure asks that qualitative researchers attend more rigorously to the ways in which their narratives are fabrications. Lather shares a similar concern, arguing that:

“Narrative realism, hence, is but one of many textual strategies with its assumption of the transparency of description which is, in essence, an uncertainty about what constitutes an adequate depiction of social reality. Nancy Zeller (1987), for example, argues that we actively select, transform and interpret “reality” in our inquiry, but we usually conceal our structuring and shaping behind masks of objectivity and fact. She goes on to argue that, as the filters through which experience is shaped and given meaning, we might find that fictive forms or strategies could enlarge the appeal, understandability, and possibly the authenticity of empirical work.” (Lather, 1991, p. 91)

Scholars in educational research have begun to explicitly embrace the art of evocation by employing arts-informed practices in writing life history research, using tools and writing devices from fiction (Barone & Eisner, 2011; Diamond & Mullen, 1999; Ellis & Bochner, 2000; Kilbourne, 1999). Fluck (2003) suggests that fictional texts have always functioned as sites to explore “experimental epistemology”, in that fiction has the power to attend to the structuring of truth claims. The power of fiction is often its capacity to open up interpretive possibilities that undermine that which is taken as self-evident (Cohn, 1999). Through fiction we are able to hear the voice of those who had previously been silent, or to hear the hesitation and the traces of affect in a voice that would otherwise be represented as cohesive. Particular narrative devices found in fiction allow us to explore the ways that voice itself is conditioned and confined by various contexts and past experiences.

Clough (2002) argues for new strategies in social science research that leverage these devices, suggesting that *research fictions* might blur the borders between literary and social science discourses, naming a location that thereby troubles or breaches the legitimacy of research texts as transparent realist tales. He offers a set of short research fictions as sites of critical awareness regarding the socially constructed notion of empirical data. Clough creates characters who are embedded within the educational system – teachers, researchers, superintendents – and generates research fictions that invite the reader to dwell on the complex power relations between these characters. Clough uses fiction as a medium to address the lived experiences – the “rawness of real happenings” – in ways that could not be accomplished through realist narrative alone. Clough accentuates that this “calls for a methodology which can deal analytical justice at the same time as experiential truth” (Clough, 2002, p. 88). Clough’s research fictions illustrate how the crafting of powerful narratives is a central aim of life history research. A well crafted narrative is precisely what constructs the reader’s sense of authenticity in taking up the research, an authenticity that demonstrates what Pinnegar and Daynes (2007) call: “the Power of the Particular” (p.21).

The fictionalisation of educational experience offers researchers the opportunity to import fragments of data from various real events in order to speak to the heart of social consciousness - research fictions can make visible that which was buried within the cover stories, while also acknowledging the researcher’s contribution in the fabrication. Of course, like all other

methodologies, this one is not innocent. Writing research fictions, like the art of writing life history research, demands a fundamental ethical commitment to do research as an act of social justice.

In this chapter we will take on the challenge of communicating coherent stories of biology teachers' experience that are in Clough's words: "woven from an amalgam of raw data, real details and (where necessary) symbolic equivalents" (Clough, 2002, p. 9). We focus on the recurring theme of outdoor life and animals in the life history data, and point to pivotal points in teacher's experiences when these concepts functioned powerfully to motivate them in their teaching. Most of the spoken data presented in the research fictions comes from transcript data, although we have woven it together in new ways. We invite the reader to consider the ways that various related concepts (nature, outdoor life, animals) are embedded in these stories. In particular, we ask that the reader question these stories in terms of how these related concepts function in the lives of teachers to (1) impose a utopian view on nature as that which is free, (2) construct a nostalgia for an outside of the classroom, (3) perform a legal, paternal or maternal position in relation to nature and animals, and (4) imagine outdoor life as a site beyond the realm of the known.

## **The research context**

### **Science teaching in Danish primary and lower secondary school**

In Denmark the pupils follow the same cohort of peers from year 0 (kindergarten class) until year 9. During these 10 years of schooling the pupils meet 4 different science subjects. From year 1 to 6 they have a primary science subject called 'Natur/teknik' (Nature/Technique) and from year 7 to 9 they have Biology, Geography and Physics/Chemistry as three independent science subjects.

For biology in lower secondary school in Denmark the purpose in force is to give the pupils knowledge on organisms, nature, environment and health. Emphasis is on biological concepts, relations and applications. In teacher education the stated identity of biology in force is the teacher students' use of knowledge on living organisms and their surrounding environment in order to teach biology and develop biology teaching.

A science teacher in Denmark can teach one or several of the science subjects depending on the local school organisation and his/her pre-service and in-service education. In Denmark teachers' teach different subjects and different years. This study has focused on biology teachers, but includes also teachers in other science subjects in the Danish public school.

### **The Biology teachers**

The two research fictions presented below are based on life history research of ten Biology teachers (table 1). Data collection was made by the first author from August 2010 to November 2011. It involved life history interviews, class room observation, year class data and teacher produced materials. The interaction with the ten biology teachers was inspired by Goodson and Norrie (2011) and Brickhouse and Bodner (1992). Semi-structured interviews were followed by observations of each teacher for 2-4 entire workdays at their schools. The second interviews were based on themes and questions that appeared from preliminary analysis of the first interview, the collected material and the observations. We have fused the data from the ten participants into two research fictions so

that we might better address the theme of nature and experiences with animals. Such an approach resonates with that of Davies et al (2006) who suggest that “collective biographies” - whereby linked and intersecting life history narratives are woven into one story – offer powerful insights into experience.

The analysis and coding is performed using the Nvivo8 qualitative analysis software. The coding framework is constructed in accordance with the recommendations by Saldaña (2009) and Richards (2008) using a mixture of free nodes and tree nodes in Nvivo8 – for more details see appendix 1. We offer this brief synopsis of the data so that the reader can get a better sense of the variety of teachers involved in the study.

Teacher alias	Gender	Birth year	High school or similar finished	Other training or employment prior to teacher training	Start of teacher education	Graduation as teacher
Jane	♀	1954	1974		1974	1978
Erik	♂	1957	1977		1977	1981
Lars	♂	1956	1976	Clerk	1982	1986
Diana	♀	1970	1990	Shop assistant	1992	1996
Linda	♀	1956	1994	China Painter, shop owner	1994	1998
Simon	♂	1971	1990	Laboratory worker	1997	2001
Tina	♀	1975	1995	Kitchen assistant, Videoshop manager	1997	2001
Frank	♂	1973	1997	Farmer, Nursery assistant	1999	2004
Karen	♀	1966	1985	Industrial worker	2001	2005
Ruth	♀	1972	1992	Nursery assistant, Occupational therapist	2002	2009

Table 1: Basic biographic data of the Biology teachers

The two research-informed fictions provide teachers’ perspectives on biology teaching in contemporary Danish lower secondary school. The fictionalised teachers are primarily constructed over the two most densely coded teachers Jane and Ruth. Jane and Ruth furthermore represent very different experiences with teaching. The fictions are saturated with various kinds of data from all the ten teachers. The research fiction of Beth tells the story of a dedicated teacher late in her professional life, where early childhood experiences in nature played a decisive factor in her approach to teaching biology. This dedication is combined with an early loss of a parent that affects her relationships to pupils. The research fiction of David tells a story of a teacher early in his professional life, where interest in animals is a motivating factor for teaching biology. This motivation is to be balanced with a busy and young family and a self-employed wife.

## Beth

It is a grey day, the weather forecast has promised occasional rain, but Beth is anyway taking her 7<sup>th</sup> year biology class for a field trip to a local forest to look for tracks and traces of animals. The pupils are all dressed for such weather conditions in rainwear, but not all of them in proper footwear. One of the boys, Allan, is frequently seeking Beth's attention because his new Converse shoes are soaked. Beth repeatedly reminds him of the agreement they made to wear footwear according to the weather forecast. In spite of the weather conditions – the forecasted showers turned out to be intense but short – it is a successful trip, the pupils find owl pellets with mouse bone in it; they find tracks of roe, fox and hare and see excrements of different kinds. The latter not being the most popular find among the adolescents. Beth enthusiastically praises every pupil who finds a relevant track or trace. She takes all the finds with her home, so pupils can work with in following lesson back at school.

Driving home at the end of the workday, Beth can smell the box of forest finds in the backseat. Taking these traces of nature back into the classroom is one small way of sustaining a link with the forest. Beth remembers that she has to make an appointment with the local rangers from the forest; she has some ideas on how to make the forest an even better place for the pupils to have good experiences with biology in nature. She starts reflecting on why she persists on taking the pupils out of the classroom to learn biology. She recollects her own growing up in a house in the forest, where her father worked as a forest worker. Her mother took care of Beth, her younger sister and the household. Her father was inventive and very skilled with his hands. The whole family went picking berries in the berry season and the father had invented a berry-cleaning machine. They sold the berries and made a little income from this and other natural products from the forest. Tragically her father was killed in a working accident in the forest when Beth was 14 years old. The loss was sudden and devastating, and although she might have blamed nature for stealing him from her, instead she was somehow drawn back to the forest, back to this place of quiet abundance and family memories.

Beth went to high school even though it was not common for a daughter of a forest workers widow. During high school Beth took a biology class with great enthusiasm. Her primary experience with and knowledge of animals, plants, fungi and nature in general made it easy for her to learn and study biology. She remembers considering whether she should go to university to study biology as this was and still is her true passion. Her mother turned sick during the last year of high school. The nearest university was located 150 km away, so a study there would have meant leaving the home and abandoning the mother and the little sister. She didn't go.

And yet she felt relieved, glad to remain close to home and the places she had come to love. Beth started at a local teacher education college in 1974, straight after finishing high school, as her first choice of education, in spite of her devotion to biology. She graduated as a teacher in 1978 with Sports and Biology as her major teaching subjects. She feels no regrets about these choices. The day in the woods with the children is the kind of thing that reminds her of how her passion for biology is lived and felt.

When she drives into the yard of the small farm where she lives, she notices that her husband isn't home as his van is not in the yard. She enters the house through the utility room. Her youngest daughter is sitting in the kitchen doing homework; the two older children have left home. Like many other in their generation, they have moved to the city. She wonders whether at some point in the future their lives will loop back and bring them back to their childhood farm country. She kisses the daughter on the forehead: "we have to eat early today, as father and I have to go and direct folk dance this evening." "Again?" asks the daughter without looking up. "Yes!" replies Beth and starts to prepare for supper.

She looks in the fridge and sees the store-bought berries. She tells herself that she needs to take the class back to the forest for some food foraging. Vaguely addressing her daughter, she speaks into the fridge:

"The nearby forest is such a beautiful little place if only more would use it more. It is so full of opportunities. I even stayed overnight up there with a group of pupils once. We had a wonderful evening, a clear sky and lots of stars. Children nowadays don't see stars; they don't sleep outdoors. It's a shame. You see other sides of the pupils under such conditions."

Her daughter gladly turns away from some mundane worksheet, and asks "like what?"

Beth replies as she moves some vegetables from the fridge, "Allan – that pupil I told you about - organised the bonfire, and made his comrades take watches through the night to keep the fire going. The next morning we made pancakes on the glowing charcoal. Allan normally has many conflicts with other pupils and teachers, but here there was something he really mastered."

"Is he the one who lives on the hill behind the Miller farm?"

"Yeah. I have a weak point for Allan. He is the oldest boy of 3 children, the family is divorced, and there is only his mother..." Beth's voice trails off as she begins peeling the deep purple beets. There is a long silence in the kitchen, as her daughter returns to her homework, and Beth is lost in thought. She mumbles slightly to herself, her mind moving back to the forest and her appointment with the rangers.

"Have you been in the woods recently? You never seem to go anymore"

Her daughter shakes her head. Beth turns around, her eyes resting momentarily on her daughter before she turns back to the vegetables.

The next day Beth has an appraisal interview with her headmaster. The headmaster wants to talk to her about how the school could profit from her many years of teaching experience. She arrives at his office, and sits opposite the big wooden desk. He smiles at her while he quickly signs a series of documents. She decides that she won't tell him that Neil – the other biology teacher – cancelled at the last minute, and she took the students to the forest without him. The other teachers want to participate, she thinks to herself, but they get ...distracted.

The headmaster closes his folders, takes a short breath, and asks her to talk about what motivates her about teaching.

“That’s obvious,” she says, almost humorously, “nature and the children. I was never happier than the times we picked berries, when I was a child. The whole process was so meaningful: picking, cleaning and selling. I feel sad that children don’t get this kind of experiences today. My work with teaching in nature, it is like breathing.” She pauses, and then adds, “I don’t think about it, I just do it.”

## David

David comes rushing into the staff room in the morning. He addresses the deputy-headmaster who is sitting at a table right next to the door: “Sorry I’m a bit late, but my daughter has injured her knee during sports in the weekend. I had to collect my mother from the train this morning, so that she can be with her at home. I start with biology in year 8 right away.”

He rushes upstairs, the class is taught in the physics laboratory. The pupils are waiting outside the laboratory. David unlocks the door, and the pupils enter the room. It’s a room filled with apparatus, test tubes, and chemicals; that signals physics and chemistry rather than biology. In the back corner there is some tanks filled with decomposition experiments, experiments that David is doing with another class. David takes the word right away.

David: “Okay today we are to start on new subject Ecology, any idea what that’s about?”

A boy: “My uncle runs an ecological farm; he has cows and doesn’t spray his fields.”

Another boy: “That kind of food is too expensive.”

A girl: “But it is healthier.”

David (flicks back and forth in the text book): “Any other ideas.”

Some of the pupils start to turn pages in their books as well. David looks around in the class room: “Anyone?”

The first boy takes the word again: “It has to do with making food in a better way.”

David: “Yes, but what does ecology actually mean?” (The text book is lying open on the desk in front of him; he has his finger pointed at an illustration on a page in the book). “Look at page 26 in the text book, there is an introduction to ecology. You see eco means household and logy means to learn, and it has to do with learning about the relations between animals and plants in the nature – the household of nature so to speak. I will make some notes on the blackboard, you put them into to your notebooks, and this is gold. Okay which relations do you know between animals and plants.”

Another girl: “My rabbit eats carrots.” (Some of the boys laugh).

David: "Good Janice, what does that make your rabbit? Now look at page 26-27." (The pages have illustrations of food chains, an herbivore food chain and a decomposer food chain). "Where does the rabbit fit in?"

Another boy: "The fox eats it?" (Some of the boys laugh again, a few giggle. Janice looks down in her text book.)

David: "Yeah right Ben, but not funny. Let's try and use the terms from the illustrations. What is an herbivore in plain language?"

The other girl looking angrily at Ben with a sharp voice: "It is an animal that eats plants, or a plant eater, it is part of the herbivore food chain."

David starts drawing an herbivore food chain on the blackboard.

...

After the class David goes back to the staff room. A colleague addresses David in the corridor outside the staff room: "Have you heard that Ben was caught smoking on the school premises yesterday."

David sighs: "Has anybody talked to his parents?"

"Yes, the headmaster phoned his mother yesterday, she said that we are bullying him", answers the colleague.

"Ben is such a troublemaker sometimes; actually he is a good kid, but.... Do I have to do anything?", asks David.

"Ask the headmaster" says the colleague and walks on. David scratches his head. He looks disturbed. David walks quickly into the staffroom, picks up some copies from his shelves. He walks quickly down the corridors to another class.

"Good morning year 7, my very best math-students", says David as he enters.

"Hi David", replies several of the pupils.

"Do we get our tests back today?" a girl asks

"No not today, I spend all yesterday afternoon and evening at the casualty department, my daughter had hurt her knee, so we waited to have taken x-rays and doctors and what not", explains David.

"Too bad, had she broken anything?", asks the girl back.

"I once broke an arm", interrupts a boy

"Take your seats please everybody". The pupils sit down. "My daughter is fine nothing is broken, but she can't walk without crutches, so my mother is with her today, and because of this entire

disturbance I have not had time to correct your tests. BUT today we will continue with working on percentages, and I have these problems that you will work with. You will work in groups as last time, and I will be here to assist you.”

David circulates and helps the pupils with their problems.

...

At the end of the day David walks to the office of the vice-head, the door is open. David knocks at the door frame. The vice-head look up, “Hi David, how is your daughter.”

“Fine I have just talked to my mother, she doing fine. I understand there was a problem with Ben yesterday.”

“Oh, yeah he was caught smoking again, the headmaster has talked with his mother. We don’t seem to get anywhere with her.”

“No I know, I’m thinking back, do you remember the case with the girl shortly after I started in 2009. We called upon the mother and said we were worried and we would report our concern to the social authorities. I had as a new teacher to write a contribution to this report; it is the worst task ever. I remember thinking; is this really a job for me. I learned a lot, you can’t save the whole world, but you can make a difference. (..) We never send the report; the girl came back after some weeks ‘Damn it was good that you talked to my mother’. There was progress, not success, but progress. If we just could get to Ben’s mother the same way. Anyway I have suggested Ben to get some nicotine plaster, so that he could apply to the non-smoking rules of the school.”

“That was perhaps a good idea.”

“One of my wife’s employees uses it, this way she can work in our shop without smelling of tobacco.” David holds his breath.

“How is she doing with the shop these days of recession and all?”

“She has long days in the shop, I’m the one who takes care of cooking and the kids. My wife takes care of cleaning and laundry on Sundays, so we have our life organised. My parents had a flower shop, so I grew with busy parents. I don’t complain it is just (.) you know, hard sometimes.”

The vice-head look at him: “What’s on your mind, David?”

“Don’t get me wrong I like teaching, but the intensity in the job is high sometimes (.) all the time.” They both laugh.

“I really question; whether I’m doing the right thing. I find it important that the pupils learn stuff they can relate to and that makes sense to them. We want them to be able to make decisions later in life; then they have to know. Children are eager to learn; just it is delivered in the right way. I sometimes feel I spend too much time at the blackboard, but when I ask the pupils they say no, it is



Ok. We use much time talking about the topics and concepts, sometimes I find myself thinking, where did we start, it becomes a lot of talk, and I think the pupils love it. In biology they have to know the photosynthesis, such general stuff. They are interested, you shall not underestimate them.”

“Anything else on your mind David?”

“Yes,” David sighs, “perhaps it seems wrong especially today when I was late and ill-prepared.”

“We all have such days,”

“I have been contacted from the department of education at the zoo; they would like me work part-time there. What do you think, can this be arranged?”

“Is that what you really want?”

“I would like to give it a try, but I wouldn’t like to lose my established job here though. But I’m not decided yet. It’s just more or less right down my alley, as you know I have been a farmer, and I had frogs, slugs and insects in aquaria in my room as a boy. I have always been very interested in animals. I find them fascinating. My interest for animals was what made me choose teaching biology in the first place. I’m dedicated to communicating my subject, and I have concern for children in need. I don’t know how to explain it. Perhaps it is not wise saying it but (.) I’m not very interested in this general classroom pedagogy.”

The vice-head takes in air and pauses, he looks firmly at David: “Okay listen here, I can’t make the final decision; it is for the head to decide. I understand that it’s tempting especially with your background. Have you talked to your wife about this, two part-time employments is not necessarily easy.”

“Yeah I know that, but there will be less corrections work as I will have less teaching hours here. I haven’t talked to wife yet.”

“Okay, talk to your wife, make a decision and we will talk with head, okay.”

“Thank you it was nice talking to you.”

### **Reason in/for teaching biology**

The present study tries through research fictions to provide more emotionally rich backgrounds for the subject matter interest of biology teachers. The research fictions illustrate how the significant reason is composed by the interaction of a mixture of factors in the individual teacher’s life and work. Comparing with Huberman’s (1993) key elements presented earlier, it is noteworthy how lack of reason from one element in professional satisfaction can be compensated by excess of other reasons. The phrase from Beth about ‘teaching in nature is like breathing’ is a symbolic equivalent that represents our interpretation of a very direct approach to teaching in and with nature told by Jane and other of the biology teachers. In Beth (based on data from Jane and Frank) this is

contrasted by her frustration of her colleagues not finding the same ease in teaching in nature. Such narratives give clues to how emotions and interests in a Biology teacher's life and work interact in more general terms. Urhahne (2006) has called for such research:

"Following research should take into consideration the emotional components of subject matter interest and research how key experiences, role models or other factors are decisive for the choice of biology teaching as a profession." (Urhahne 2006, p. 123, translated by first author)

Urhahne (2006) presents a questionnaire study on teacher students' motives for choosing a job as biology teachers. His study provides some understanding of the factors that create motivation and interest. The most significant factors are found to be 1) intrinsic pedagogical or educational motivation from the work with children, 2) extrinsic factors as family and 3) interest in nature and animals. Urhahne explains the significance of nature and animals with the fact that taking care of animals and plants and excursion in the nature is related to positive and caring emotions by most humans. Such positive emotions influence the choice of biology as teaching subject and the teaching of it (Urhahne 2006, p.122). The enthusiasm of Beth and the pupils during the field trip tells a story of how an activity of discovery can emotionally commit pupils to investigating nature for hidden tracks and traces, an approach that is in accordance with the recommendations of Cornell (1979). Urhahne's analysis of the questionnaires indicates that the subject matter interest in biology is somehow integrated in the intrinsic motives for choosing teacher profession. But he finds no relation between on the one hand the extrinsic factors and on the other hand intrinsic factors and subject interest. David's research fiction illustrates how the three motivation factors indirectly can interact, conflict and lead to considerations of leaving school teaching. The extrinsic factor of the self-employed wife is in conflict with his planning and correction work. Huberman (1993) finds the balance between home-life and professional interest as a key element in professional satisfaction. David is furthermore in doubt of his vocation to be a lower secondary teacher and doesn't feel any support from colleagues; the latter is also one of Huberman's key elements. Doubt is a feeling that increases the vulnerability of teachers (Kelchtermans, 2011, p. 79). David is attempting to shelter his vulnerability by changing his work-life conditions and take on the challenge of being part-time employed at two places. This way he feels, he can stay committed to his interest in and experience with caring for animals that originally led him to teaching biology.

The narrative from Beth on Allan illustrates how an alteration of the school context sets a boy free to behave more constructively in social relations, than he does in ordinary school context. The ten teachers generally have a high awareness of the significance of teacher-pupil relation. Not only in relation to children with specific problems as the two in the research fictions, but also in the ordinary and daily classroom dialogue. David's statement: "I'm not very interested in this general classroom pedagogy" is unique, but a verbatim of one of the teachers.

The UK study on ‘Variations In Teachers’ work, lives And Effectiveness’, abbreviated: VITAE (Day et al 2006, 2007; Day and Gu 2010) focus on teachers’ commitment, retention and resilience. Day and Gu summarises their findings regarding teacher commitment:

“Commitment for teachers in the earlier VITAE study (Day et al, 2007) was both a condition for teaching and an outcome of their experience. The research revealed, also, a clear association between teacher commitments, their sense of vocation, wellbeing and the support they received from colleagues.” (Day and Gu, 2010, p. 134)

Beth has, despite unclear support from colleagues, a strong sense of vocation and commitment towards the pupils and the teaching. Beth’s research fiction illustrates how early happy experiences in nature has led her to teach biology. The positive emotions of hope and happiness, however fragile, can support each other and make it possible for teachers to overcome disappointments (Bullough Jr., 2011). Beth’s early experiences create an ease in outdoor life, which makes it possible for her to free the pupils to engage in investigations of the unknown in nature.

The theme of listening to nature appears in different ways in the two research fictions. The appearance in both, however illustrates how nature, outdoor life and animals creates motivation for recruitment as well as motivation and retention in teaching biology.

The use of research fictions for exploring biology teachers’ reasons for teaching biology has in the present study been found very important to communicate the emotional aspects of the reason. The emotional aspects could have been communicated through direct use of quotes, but not without comprising the interviewees in some way as it is sensitive and personal data that communicate the emotions of the teachers. The presented research fictions indicate that attention to teacher motivation and commitment might release resources for development of local teaching facilities from the individual teacher as in the research fiction of Beth or help clarify career choices or changes as in the research fiction of David.

## Conclusion

The present study has used life story narratives of ten biology teachers to develop two research fictions that illustrate primarily emotional aspects of teachers’ choice of profession and teaching subject. The research fictions provide a tool to expose doubt, care, stamina, etc. in a biology teacher’s life and work. The research fictions present an amalgam of interview transcripts, observations and symbolic equivalents for the sake of clear communication of the complexity of teachers’ lives and work. The complexity entails work vs. home life balance, a passion for, grounded learning experiences of biological core knowledge, and a recurring commitment to center and celebrate pupil experiences with nature and animals. The research fictions illustrate how listening to nature through outdoor life and a positive relation to animals is a significant reason for choosing biology as a teaching subject. We hope that the research fictions have shed light on the ways in which this particular reason operates in complex ways. Ultimately, a sustained commitment is based on many reasons and apparent lack of one can be set off by excess of other reasons.

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## APPENDIX A

### ANALYTICAL focus points and coding

The coding framework is constructed in accordance with the recommendations by Saldaña (2009) and Richards (2008) using a mixture of free nodes and tree nodes in Nvivo8. The tree nodes were building upon factors contributing in teacher effectiveness from Day et al (2007 p. 40) and factors having critical influences on teachers professional lives developed by Day & Gu (2010 p. 51). Leading to the following 8 categories where interaction between life and work can be of significance:

- a. Leadership
- b. Colleagues
- c. Pupil relations
- d. Pupil behaviour
- e. Personal events
- f. Work-life balance
- g. Professional development
- h. Educational policies

These 8 categories were the only tree nodes, which were used from start of analysis. During the analysis there was developed more tree nodes. The tree nodes were dedicated to work related data and the free nodes were developed during the analysis phase and dedicated to the life related data.

The 5 most coded work-related nodes (tree nodes) turned out to be:

- view of science (104 references, 40 sources),
- colleagues (82 references, 24 sources),
- pupil relations (80 references, 28 sources),
- professional development (53 references, 21 sources)
- approach to teaching (49 references, 18 sources)

The 5 most coded life-related nodes (free nodes) turned out to be:

- choice of science (50 references, 19 sources)
- spouse (17 references, 13 sources)
- major teaching subjects from teacher education (17 references, 12 sources)
- employment prior to teaching (16 references, 11 sources)
- own children (16 references, 12 sources)

In this particularly study emphasis was on narrations that illuminate how the 6 sources of Goodson illustrate the interaction between life and work. The interactions will be classified in relation to the quality of the interaction was it: direct, indirect, prolonged, brief, instant, continuous, suspended/paused, interrupted, etc.



This kind of thematic analysis has been decisive for the further analysis and re-presentation of the life-histories of the teachers. In the following the results are not presented directly but are reinterpreted and re-represented as research informed fictionalised life stories of re-presentative science teachers.



## Co-author statement in connection with submission of PhD thesis

With reference to Ministerial Order no. 18 of 14 January 2008 regarding the PhD Degree § 12, article 4, statements from each author about the PhD student's part in the shared work must be included in case the thesis is based on already published or submitted papers.

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**Paper title:**

Kvaliteter ved reformer af Naturfags-undervisning i Danmark – læreres ressourcer og roller i reformprocesser (Qualities of reforms in science education in Denmark – Teachers resource and roles in reform processes.)

**Publication outlet:**

*Mona*, 2011, 1, p. 39-56.

**List of authors:**

Sillasen, M. K. (PhD student)  
 Daugbjerg, P. S., (PhD student)  
 Schmidt, J. (PhD student)  
 Valero, P (Main supervisor for the three PhD students)

**Scientific contribution of the PhD students (all participating PhD students) to the paper:**

The paper was an equal, collaborative effort of the three PhD students of defining the research problem of the paper, collecting the empirical documental material, reading the papers used for formulating and constructing a theoretical framework, interpreting the material, and writing the paper. The work was done in series of collective meetings for discussion. The writing was carried out in rounds of draft discussion and adjustments.

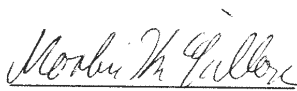
**Martin K. Sillasen** especially focused on theoretical elements about school reform and change from an actor perspective. In the analysis he concentrated on the teacher education (30 % contribution in total).


**Peer S. Daugbjerg** especially focused on developing the theoretical approach regarding resources and the analysis regarding the teachers' in-service education (30 % contribution in total).


**Jette R. Schmidt** especially contributed with the analysis regarding curricular aims and in sharpening the conclusion (30 % contribution in total).

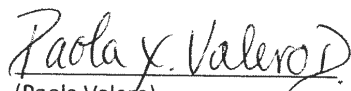
**Paola Valero** discussed the overall structure of the paper and theoretical ideas and suggested improvements and made adjustments and clarifications to the text (10 % contribution in total).

Signatures, PhD students

  
 (Martin K. Sillasen)

  
 (Jette R. Schmidt)

  
 (Peer S. Daugbjerg)

  
 (Paola Valero)

### Co-author statement in connection with submission of PhD thesis

With reference to Ministerial Order no. 18 of 14 January 2008 regarding the PhD Degree § 12, article 4, statements from each author about the PhD student's part in the shared work must be included in case the thesis is based on already published or submitted papers.

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**Paper title:**

The neoliberal utopia and science education in Denmark - From education for citizenship to education for work life.

**Publication outlet:**

Submitted December 2011 to book on "Networks of practices in mathematics and science education", SMERG, AAU.

**List of authors:**

Schmidt, J. (PhD student)  
Daugbjerg, P. S. (PhD student)  
Sillasen, M. K. (PhD student)  
Valero, P. (Main supervisor for the three PhD students)

**Scientific contribution of the PhD student (all participating PhD students) to the paper:**

The paper was an equal, collaborative effort of the three PhD students of defining the research problem of the paper, collecting the empirical documental material, reading the papers used for formulating and constructing a theoretical framework, interpreting the material, and writing the paper. The work was done in series of collective meetings for discussion. The writing was carried out in rounds of draft discussion and adjustments.

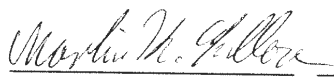
**Jette R. Schmidt** focused on specifying the analysis of the neoliberal developments in the educational system, and on designing and performing the detailed discourse analysis of the curricular aims and how it relates to the characteristics of neo-liberality (30 % contribution in total).

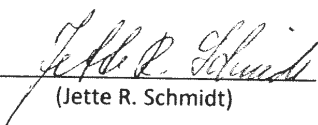
**Peer S. Daugbjerg** focused on developing the characteristics of the contemporary restructuring in education and on analyzing how competence and accountability relate in this (30 % contribution in total).

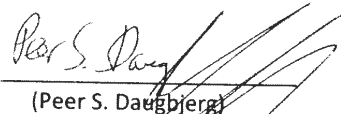
**Martin K. Sillasen** focused on analyzing the series of expert reports on science education in Denmark and on how accountability and individualisation relate in the educational restructuring (30 % contribution in total).

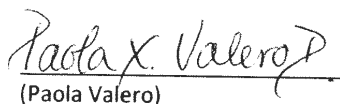
**Paola Valero** discussed the overall structure of the paper and theoretical ideas and suggested improvements and made adjustments and clarifications to the text (10 % contribution in total).

Signatures

  
(Martin K. Sillasen)

  
(Jette R. Schmidt)

  
(Peer S. Daugbjerg)

  
(Paola Valero)

## Co-author statement in connection with submission of PhD thesis

With reference to Ministerial Order no. 18 of 14 January 2008 regarding the PhD Degree § 12, article 4, statements from each author about the PhD student's part in the shared work must be included in case the thesis is based on already published or submitted papers.

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### Paper title:

Lærerarbejde under social omstrukturering (Teacher work under social restructuring)

### Publication outlet:

*Social Kritik*, 2010, nr. 124, p. 99-112.

### List of authors:

Daugbjerg, P. S.,  
Lyhne, K.  
Olesen, S. G.

### PhD student:

Daugbjerg, P. S.,

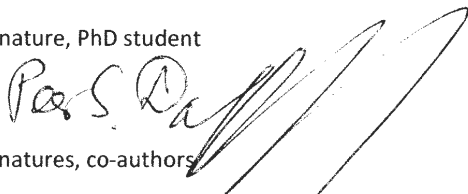
### Scientific contribution of the PhD student to the paper:

The Ph D student made half of the interviews and the majority of the data analysis regarding the teachers' life histories generating analytical categories, and the majority of writing the paper. (50% contribution in total).

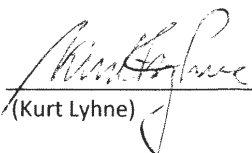
Lyhne, K. made half of the interviews and the data analysis regarding the history of the local area and minor parts of writing the paper. (30 % contribution in total).

Olesen, S. G. contributed with the core layout of the investigation plus theoretical points on social positioning in the final editing of the text. (20 % contribution in total).

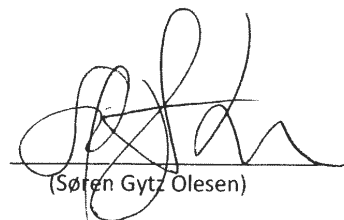
Signature, PhD student



Signatures, co-authors



(Kurt Lyhne)



(Søren Gytz Olesen)

## Co-author statement in connection with submission of PhD thesis

With reference to Ministerial Order no. 18 of 14 January 2008 regarding the PhD Degree § 12, article 4, statements from each author about the PhD student's part in the shared work must be included in case the thesis is based on already published or submitted papers.

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Paper title:

Mapping the entangled ontology of science teachers' lived experience.

Publication outlet:

Under review at the journal Cultural Studies of Science Education (submitted march 2013)

List of authors:

Daugbjerg, P. S. (PhD student)

de Freitas, E. (Co-supervisor)

Valero, P. (Supervisor)

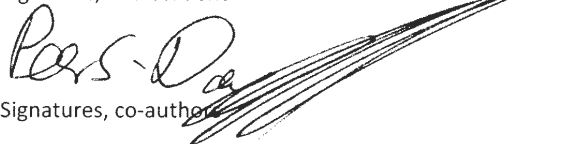
Scientific contribution of the PhD student to the paper:

PhD student made all the empirical and analytical work generating the analytical focal points, plus the theoretical development regarding the experience perspective, which is central in the discussion as well as in the conclusion of the paper. PhD student made the majority of writing the paper (70 % contribution in total).

de Freitas, E. contributed with the theoretical perspective regarding embodiment and ontology that helped sharpen the conclusion. Elizabeth de Freitas contributed to a minor part of the writing of the paper (20 % contribution in total).

Valero, P. contributed with minor part of the theoretical development and writing. (10 % contribution in total).

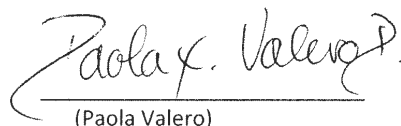
Signature, PhD student



Signatures, co-author



(Elizabeth de Freitas)



(Paola Valero)

## Co-author statement in connection with submission of PhD thesis

With reference to Ministerial Order no. 18 of 14 January 2008 regarding the PhD Degree § 12, article 4, statements from each author about the PhD student's part in the shared work must be included in case the thesis is based on already published or submitted papers.

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Paper title:

Listening to nature: Life histories of Danish biology teachers.

Publication outlet:

Submitted to the book "Networks of practices in mathematics and science education", SMERG, AAU (January 2012).

List of authors:

Daugbjerg, P. S. (PhD student)

de Freitas, E. (Co-supervisor)

Scientific contribution of the PhD student to the paper:

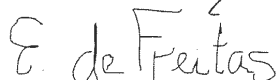
PhD student made all the empirical and analytical work of the teachers' life histories, plus the positioning of the paper in a socio-cultural research approach, the basic construction of the presented research fictions, the discussion and conclusion of the research fictions. PhD student contributed with the major part of the writing of the paper. (70 % in total).

de Freitas, E. made the theoretical development regarding research fictions and helped on the construction of the presented research fictions. Elizabeth de Freitas contributed to a minor part of the writing of the paper. (30 % in total).

Signature, PhD student



Signature, co-author



(Elizabeth de Freitas)











## SUMMARY

This thesis focuses on science teachers' lived experience, their social position and their teaching. The guiding question for the documented research has been: How is science teachers' work related to their lives? The aim was to situate the voice and body of science teachers in the contemporary era of educational restructuring. The teachers' work and lives in the contemporary school settings are based on the continuity of their experiences and the relations that have formed them. The interaction between critical influences and tensions shapes the personal and professional experiences, and further produces negative or positive outcomes in terms of teachers' sense of commitment, resilience, well-being and capacity to teach. Personal and professional events constitute and shape a teacher's past and present experiences. The experiences may not be conspicuous at first glance, but they somehow affect the way the teacher relates to the children and also how she or he plans, performs and evaluates her or his teaching. Science teachers' work relates to their lives in an entangling manner that makes it impossible, and even a mistake, to try to separate the two.