



Utbildning & Lärande

EDUCATION & LEARNING

2/2012

TEMA: ETT VIDGAT PERSPEKTIV
PÅ ÄMNESDIDAKTIK

EN TIDSKRIFT SOM UTGES AV AVDELNINGEN BARNNS, UNGAS OCH
VUXNAS LÄRANDE VID HÖGSKOLAN I SKÖVDE

A faded background image of two women walking on a paved path outdoors. The woman on the left is wearing a dark jacket and dark pants, holding a white folder or book. The woman on the right is wearing a patterned dress and dark boots, carrying a light-colored bag. They appear to be in a university or campus setting with trees and a building in the background.

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Redaktion: Maria Olson (huvudredaktör), Urban Carlén (redaktör),

Redaktionsråd: Anders Jakobsson, professor, BUVL, Högskolan i Skövde; Kenneth Orlenius, professor, Högskolan i Skövde/Högskolan i Borås; Monica Johansson, lektor, Göteborgs universitet; Sara Irisdotter Aldenmyr, lektor, Högskolan Dalarna; Agneta Bronäs, lektor, Stockholms universitet; Ulrika Jepson Wigg, lektor, Mälardalens högskola; Ninni Wahlström, professor, Örebro universitet; Andreas Fejes, professor, Linköpings universitet; Ann-Marie Markström, docent, Linköpings universitet; Magnus Dahlstedt, docent, Linköpings universitet; Lisbeth Lundahl, professor, Umeå universitet; Johan Liljeström, lektor, Högskolan i Gävle; Silvia Edling, lektor, Uppsala universitet.

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GEIR SKEIE, MATS LUNDSTRÖM

ADRESS:
UTBILDNING & LÄRANDE
ATT: MARIA OLSON
INSTITUTIONEN FÖR KOMMUNIKATION OCH INFORMATION
BOX 408
541 28 SKÖVDE

E-POST: UTBILDNING-OCH-LARANDE@HIS.SE

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FRÅN REDAKTIONEN

I detta temanummer av tidskriften *Utbildning & Lärande* presenteras artiklar som med sina skilda infallsvinklar bidrar till att belysa ämnesdidaktik som ett öppet och brett forskningsområde. Artikelbidragen innefattar empiriska studier, orienterande forskningsöversikter och kritiska konstruktiva resonemang som belyser ämnesdidaktik som forskningsfält i ett vidgat perspektiv.

Den pågående diskussionen i Sverige kring detta forskningsfält utmärker sig av flera intresseväckande spänningar. Dessa spänningar bidrar inte sällan till att befrukta och utveckla diskussionen. Spänningarna aktualiseras i relation till olika universitetsämnen, forskningsämnen och skolämnen, vilket de olika artikelbidragen i temanumret visar. Ambitionen i temanumret är att värna om och utveckla bredd i den pågående diskussionen kring dessa spänningar snarare än att söka reducera eller snäva in dem. Vår förhoppning är att detta temanummer svarar an mot detta, enligt vår mening, betydelsefulla ärende.

/Redaktionen

TEMAPRESENTATION: ETT VIDGAT PERSPEKTIV PÅ ÄMNESDIDAKTIK?

Temaredaktörer: Anders Jakobsson och Maria Olson

I föreliggande temanummer av **Utbildning & Lärande** presenteras bidrag som berör, beskriver och diskuterar begreppet *ämnesdidaktik*, samt utgör exempel på *ämnesdidaktiska studier* och översikter. Syftet med att välja denna tematik är att hålla liv i och utveckla en utbildningsvetenskaplig diskussion som förts under decennier i Sverige såväl som i våra nordiska grannländer och i andra delar av världen.

En central frågeställning i detta sammanhang är om ämnesdidaktik och ämnesdidaktiska studier endast kan förstås som ämnesområden som undersöker människors förståelse av de vetenskapliga disciplinernas uppbyggnad, begreppsvärldar och teorier, eller om de framför allt kan ses som studier vilka belyser hur elever i förskolan och skolan förstår skolämnenas innehåll och begrepp i ett mera strikt tillämpat ämnesperspektiv. I kontrast till denna polariserande frågeställning framhåller flera utbildningsvetenskapliga forskare riskerna med att beskriva ämnesdidaktik utifrån ett alltför spänningsfyllt, snävt eller selektivt perspektiv. För att ge ett exempel på denna invändning kan hänvisas till ett temanummer i tidskriften *Utbildning & Demokrati* (Almqvist, Kronlid, Quennerstedt, Öhman & Östman, 2008). I detta nummer, som har rubriken 'didaktiska undersökningar', lyfts olika aspekter på dessa risker utifrån ett pragmatistiskt perspektiv. I flera av artiklarna pekar författarna på att en traditionell eller disciplinstyrd syn på ämnesdidaktiken riskerar att förlora de kommunikativa, språkliga och interaktiva dimensionerna av ett (skol)ämnesrelaterat utbildningssammanhang och lärande. De menar att detta i slutändan innebär att komplexiteten i förståelsen för hur människor utvecklar ny kunskap inom ämnesområdena reduceras (se t.ex. Jakobsson, Mäkitalo & Säljö, 2009; Klaar, 2013; Wickman, 2006; Östman, 2008).

ANDERS JAKOBSSON

Professor med inriktning mot de naturvetenskapliga ämnenas didaktik, Malmö Högskola
Lärande och samhälle, 205 06 Malmö
E-post: anders.jakobsson@mah.se

MARIA OLSON

fil. dr i pedagogik/postdoktor i ämnesdidaktik
Institutionen för information och kommunikation,
Högskolan i Skövde/Stockholms universitet
Box 408, 541 28 Skövde
E-post: maria.olson@his.se

Mot bakgrund av dessa och andra försök att vidmakthålla en bred diskussion om ämnesdidaktik blir det relevant och betydelsefullt att diskutera relationen mellan vad som definieras som universitetsämne, forskningsämne och skolämne, samt hur dessa ämnen eller ämnesområden kan uppfattas i ett bredare och mer allmänt utbildnings- och samhällsperspektiv. Det är här möjligt att uppfatta ett tydligt spänningsfält mellan, å ena sidan, en uppfattning där skolämnen i princip endast utgör 'skolanpassade' kopior av akademiska disciplinernas traditioner och definitioner, och å andra sidan en uppfattning där skolämnen har en mer självständig roll i relation till dessa traditioner och definitioner. Ur den förstnämnda aspekten tilldelas skolämnen en roll som 'leverantörer' av ett visst innehåll, teoribildning och begreppsflora. En roll som kan sättas i direkt relation till och värderas i förhållande till rådande akademiska ämnen på nationell och internationell nivå. Ur den senare aspekten blir det inte möjligt att uppfatta skolans ämnen som enbart relaterade till bakomliggande akademiska vetenskaper. De utgör snarare situerade och kontextkänsliga praktiker som tar form, får mening utifrån och ger upphov till delvis andra frågor än de akademiska vetenskapernas ämnen. Detta utesluter givetvis inte att företrädare för denna uppfattning ofta uppfattar kopplingen till akademiska ämnen som stark och grundläggande.

Redan under 1990-talet fördes en intensiv debatt om just denna spänningsfyllda relation i Sverige. Exempelvis kan här nämnas Englund (1996) artikel *Undervisning som meningserbjudande* där han ur ett läroplansteoretiskt perspektiv analyserar relationen mellan skolämnesinnehåll och universitetsämnesinnehåll. I artikeln diskuteras relationen ur flera olika perspektiv; ett begreppsmässigt, ett ämnesstraditionsriktat, ett historiskt och ett socialisations- och innehållsorienterat. Englund framhåller att de meningsskapande, demokratiska och emancipatoriska perspektiven bör inkluderas i ämnesdidaktiken. Sedan dess har flera inspel gjorts som på olika sätt berör eller behandlar denna diskussion. Utan att göra anspråk på att vara heltäckande eller ens skänka rättvisa åt dessa betydelsefulla resonemang vill vi nämna några aktuella exemplifierande referenser i sammanhanget. Alla dessa gör på olika sätt inspel i den svenska forskningsdiskussionen om just detta förhållande mellan universitetsämnen, forskningsämnen och skolämnen, samt hur dessa ämnen eller ämnesområden kan uppfattas i ett bredare och mer allmänt utbildnings- och samhällsperspektiv (se t.ex. Hartsmar, 2011; Ljung, 2009; Karlsson, Tornbjör & Rosengren 2010; Kroksmark, 1994; Olofsson, 2011; Olson, 2013, kommande; Sandahl, 2011; Wibaeus, 2010) för att nämna några.

Om vi ser till forskningsfältet ämnesdidaktik i ett större perspektiv så har dess kunskapsfält och forskningsfrågor traditionellt förknippats med de klassiska frågorna *Vad? Varför? och Hur?* Vad- och Varför-frågorna diskuteras framförallt utifrån skolämnenas innehållsaspekt medan Hur-frågan ges, och har getts, en mer metodisk innebörd. De tyska didaktikerna Werner Jank och Hilbert Meyer (1996) utvidgar de didaktiska frågorna genom att hävda att ämnesdidaktik förutom Vad- Varför- och Hur-frågorna också bör belysa frågor som *Vem? När? Var? Med vem? Genom vad?* Enligt dessa författare blir ämnesdidaktik därmed en disciplin som inte endast handlar om skolans undervisning och lärande utan också ett ämnesområde som inkluderar frågeställningar om hur läroprocesser i övriga samhället uppstår och konstitueras. I detta perspektiv synliggörs didaktik inte endast som ett teoretiskt ämnesområde i en akademisk tradition utan också som ett ämnesområde som är intimt invävt med de praktiska handlingar som utförs av lärare och elever varje dag i skolan. Didaktik innefattar i detta perspektiv även handlingar som äger rum på andra pedagogisk-kommunikativa arenor bortom skolans räckvidd. Vidare argumenterar Jank och Meyer (1996) för att en lärares kunskaper i och om ämnesdidaktik utvecklas i en dialektisk relation mellan didaktisk teorikunskap och en praktisk handlingskompetens, vilket flera forskare i det svenska ämnesdidaktiska forskningsfältet också lyfter fram som centralt (se t.ex. Arfwedson & Arfwedson, 1991; Bronäs & Runebou, 2010; Falkevall, 2010; Jakobsson & Davidsson, 2012; Johnsson Harrie, 2012; Löfstedt, 2011; Schüllerqvist, Ullström & Ullström, 2009).

I föreliggande nummer av **Utbildning & Lärande** lyfts begreppen didaktik och ämnesdidaktik både från ett praxisperspektiv och i relation till ett forskningsfält. Att vi väljer denna förhållandevis breda ingång hänger samman med syftet med temanumret; att bidra till kontinuitet i en vid diskussion och debatt om vad ämnesdidaktik är, kan och bör vara. Förhoppningen är att tidskriften även i framtiden kan utgöra en av flera röster i denna diskussion, vilket innebär att resonemangen om vad som innefattas i ett vidgat perspektiv på ämnesdidaktik på intet sätt är avslutade. Ambitionen i detta temanummer kan därför sägas vara att ge några forskare möjlighet att diskutera dessa frågor och ge exempel på forskningsstudier eller översiktstudier som kan inrymmas inom ett vidgat ämnesdidaktik-begrepp idag.

Mot bakgrund av denna introducerande skrivning presenteras här artikelbidragen i temanumret. *Erik Andersson* argumenterar inledningsvis för en utvidgning av ämnesdidaktikbegreppet genom att diskutera lärandets Rum och Plats. Författaren menar att det finns ett stort behov inom svensk ämnesdidaktisk forskning att på ett mer systematiskt och ingående sätt studera didaktikens Var-fråga. Inte minst eftersom informationstekniken och digitala medier spelar en allt större roll i människors liv. Den har idag en avgörande betydelse för hur vi lär oss, utvecklar nya kunskaper och förstår världen. Vidare menar författaren att det virtuella rummet fått nya innebörder genom att de fysiska rummens kommunikativa aktiviteter kan fortsätta in i den digitala världen, men att detta sker under nya förutsättningar. Didaktikens Var-fråga kan därmed diskuteras både ur ett informellt och ett mer formellt institutionellt perspektiv. Dessutom menar författaren att en digitalt

baserad undervisningssituation kan förstås i termer av 'det tredje rummet' som då utgörs av en hybridisering och utvidgning av klassrumskommunikationen. Detta kan i sin tur beskrivas som ett slags mellanrum i vilket undervisningens innehåll kan fördjupas och problematiseras utanför lärobokstexterna.

Även i artikeln av *Eva Davidsson* berörs informella perspektiv på lärande. Artikeln utgör en noggrann och internationellt inriktad översiktsartikel om forskning och lärande på så kallade Science centers och museum. Författaren visar att forskningsfältet som studerar det informella lärandet har expanderat kraftigt under senare år, men att den svenska forskningen inom området fortfarande är relativt sparsam. I artikeln problematiseras också frågan om hur man kan bedriva forskning om lärande i denna typ av miljöer och vilka metodologiska problem som uppstår när man undersöker människors lärande i informella sammanhang. I detta perspektiv framhåller Davidsson också möjligheterna att förstå och undersöka lärande ur sociokulturella perspektiv genom att definiera en analytisk enhet bestående av utställningens innehåll, dess artefakter och de mänskliga interaktionerna. Ett annat förslag är att undersöka hur olika utställningar förmår att aktivera graden av interaktivitet hos besökarna, samt i vilken utsträckning de använder de tillgängliga artefakterna och kulturella produkterna i sina samtal. Vidare diskuteras även internationell forskning om skolbesök på Science centers och museum, och hur lärare kan vidga elevernas möjligheter till lärande vid dessa besök.

I den tredje artikeln undersöker *Mirella Forsberg Ahlcrona* hur en språkutvecklande ämnesdidaktik i förskolan kan utvecklas med hjälp av handdockor som medierande redskap i verksamheten. I en språklig och semantisk analys av den medierande potentialen i interaktionen mellan handdockor, barn och förskollärare beskrivs dockorna som ett aktivt redskap och möjlighet när det gäller att utveckla barnens språk och begreppsförståelse. Dessutom diskuteras handdockans relationella potential, vilken enligt författaren innebär att barn i förhållande till dockan utvecklar affektiva värden, konstruerar kommunikativa handlingar utifrån kunskapsmässiga och känslomässiga motiv samt överskrider gränser mellan faktiska och föreställda världar. Samtidigt visar analysen att förskollärare inte alltid tar tillvara de situationer som erbjuds när det gäller möjligheten att problematisera eller vidareutveckla barnens språkliga kompetens i och genom barns överskridanden av sin aktualiserade potential. Studien visar dessutom att barns kommunicerande med dockan sker på ett planerat sätt; barnen uppmärksammar, undersöker, samtalar, berättar och delar med sig av sina kunskaper och erfarenheter från olika kontexter i kommunikationen.

I den fjärde artikeln reser *Laurence Delacour* frågan; hur gestaltas och kommuniceras matematik för små barn? Mot bakgrund av denna fråga undersöker författaren hur en utvidgning av ämnesdidaktik i förskolan kan gestaltas i matematik. Artikeln analyserar framförallt hur förskollärare preciserar och konkretiserar ett matematiskt innehåll och målen i förskolans läroplan. Författaren visar också hur dessa mål förhandlas och omformas i praktiken, i relation till skolformens speciella tradition och praktik. I artikeln används en metafor i form av ett didaktiskt kontrakt som brukas som fond för implicita och explicita regler och normer för vad som kan

vara ett möjligt innehåll i ett matematiksamtal i en barngrupp i förskolan. Analysen visar att förskollärarna i studien visar gott självförtroende och goda kunskaper när det gäller att kommunicera matematik med barnen, men att tolkningar och förståelser av läroplansmålen i matematik skiftar i relativt hög utsträckning mellan olika förskollärare. Studien problematiserar dessutom relationen mellan 'den fria leken' och andra aktiviteter i förskolan i förhållande till utvecklandet av barns förståelse i och om matematik.

I den näst sista artikeln diskuterar *Geir Skeie*, i relation till religionskunskapsämnet i skolan, relationen mellan kunskap och fostran i ett nordiskt perspektiv. Artikeln utvecklar med detta ett sätt att förstå ämnesdidaktik, framför allt religionsdidaktik, som en fråga om att både lära om ämnet (religion) och att lära av ämnet (religion) i skolan. Författaren framhåller möjligheten i att se denna dubbla och spänningsfyllda relation som outhärlig i sammanhanget. Denna möjlighet lyfts vidare fram i anslutning till ett annat laddat förhållande; det mellan pedagogik/(allmän)didaktik och ämnesdidaktik. Med hjälp av begreppet bildning tydliggörs och problematiseras detta förhållande som nödvändigt. Skeie argumenterar för att ämnesdidaktisk forskning har mycket att vinna på att fördjupas i ett mer pedagogiskt/(allmän)didaktiskt perspektiv, och att ämnesdidaktik i religion har mycket att tillföra den allmänna pedagogiska debatten i Norden. Slutligen framhåller författaren att religionsämnet, liksom andra ämnen inom humaniora, många gånger marginaliseras i dagens skolor i de nordiska länderna då skolpolitiken vanligen fokuserar läsning, skrivande, aritmetik och naturvetenskap. Genom att utgå ifrån ett vidgat perspektiv på ämnesdidaktik kan detta forskningsfält bidra till en fördjupning av forskning om hur religionsundervisning kan bidra till att utveckla elevers kunskapssyn.

I den sista artikeln analyserar *Mats Lundström* och *Anders Jakobsson* gymnasieelevers förståelse av olika förklaringsmodeller som är relaterade till människokroppen och begreppet hälsa. Det övergripande syftet med artikeln är att undersöka gymnasieelevers uppfattning om och användning av begreppen trovärdighet och tillförlitlighet. Detta studeras genom att analysera vilka epistemologiska resurser eleverna använder när de löser problem inom detta ämnesområde. Resultatet indikerar att eleverna använder flera olika typer av argumentativa resurser för att underbygga sina uttalanden beroende på vilka specifika frågeställningar de svarar på. Mot bakgrund av detta resultat resonerar författarna i diskussionsavsnittet kring i vilken utsträckning de olika epistemologiska resurserna kan uppfattas som situerade och innehållsrelaterade. De menar dessutom att ramverket kring epistemologiska resurser kan skapa gynnsamma förutsättningar för den naturvetenskapliga ämnesdidaktikens praktik och forskningsfält.

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RUM OCH PLATS I DIDAKTIKEN. OM VAR-FRÅGAN I SVENSK DIDAKTISK FORSKNING OCH UNDERVISNING – EXEMPLET DIGITALA MEDIER

Erik Andersson

ABSTRACT

The purpose of the article is to argue for a systematic research approach on space and place, the WHERE-question in the Swedish research field of didactics. Two research traditions in subject and general didactics, focusing the WHAT- and the HOW-question, dominate the field. The educational situation of today is highly digitally driven which motivates the relevance of a more thorough and systematic analysis of the WHERE-question. It is argued that Swedish didactical research, and teaching in school in general, has to amplify the attention to the WHERE-question. Space and place are not empty containers in which social life happens to unfold. Space and place determines the communication, interaction and meaning making of individuals – individuals are always claimed by space and place.

Keywords: didactics, space, place, digital media, education

INLEDNING: DIDAKTIKENS VAR-FRÅGA OCH DIGITALA MEDIER

I flertalet forskningsinriktningar inom skilda ämnesdiscipliner har rum och plats tagits för givna och systematiska analyser av rummet och platsens betydelse för mänsklig kommunikation, interaktion, identitetsskapande, relationsbyggande, lärande, socialisation och så vidare har lyst med sin frånvaro. Mot bakgrund av den svenska didaktiska forskning som bedrivits så här långt står det klart att forskningen behöver rikta mer fokus på didaktikens fråga om rum och plats – det vill säga det jag kallar didaktikens VAR-fråga. I artikeln argumenterar jag för att i ökad omfattning beakta och systematisera analyser av rum och plats, att synliggöra dess relevans i svensk ämnes- såväl som allmändidaktisk forskning.^[1] Artikeln ska läsas som ett argument och en diskussion om VAR-frågans relevans i svensk didaktisk forskning och skolundervisning. Syftet med artikeln är således att visa på relevansen av att beakta VAR-frågan i svensk didaktisk forskning och undervisningsverksamhet.^[2] Den innehållsliga preciseringen för detta syfte är digitala medier eftersom dessa i allt högre grad har kommit att 'invadera' den svenska skolan (Erixon, Marner,

ERIK ANDERSSON

*fil. dr i pedagogik
Institutionen för information och kommunikation,
Högskolan i Skövde/Örebro Universitet
Box 408, 541 28 Skövde
E-post: erik.andersson@his.se*

Scheid, Strandberg & Örtegren, 2012) samtidigt som användningen av de digitala medierna påtagligt synliggör betydelsen av rum och plats. Digitala medier – elektroniskt baserade förbindelser och artefakter vilka är socialt och kulturellt inbäddade och som gör digital kommunikation möjlig – bryter upp ett traditionellt sätt att se på rum och plats när det kommer till frågan om lärande, socialisation och kommunikation (Edwards, 2000). Användningen av digitala medier kan helt enkelt öppna för nya utbildningsrum.

Det digitala (virtuella) rummet kan bli en plats genom att de kommunikativa aktiviteterna i det fysiska rummet fortsätter där men med delvis andra förutsättningar än i den materiella platsen. Elza Dunkels konstaterar träffande att: 'För de flesta unga är det ingen större skillnad mellan det fysiska och det virtuella rummet, annat än att man inte kan ta på varandra i det sistnämnda' (2009, s. 56), och Patrik Hernwall gör gällande att det virtuella rummet är 'den digitala förlängningen av den fysiska vardagen och har som fundament den digitala tekniken' (2005, s. 138). Didaktiskt kan de digitala mediernas möjligheter förstås i termer av hybridkommunikation och hybridlärande (Bretag, 2006, s. 983). Det vill säga när digital kommunikation blandas med ansikte-mot-ansikte-kommunikation uppstår förändrade kommunikationsmöjligheter och mönster vilka torde bli alltmer påtagliga i skolan eftersom användningen av digitala medier ökar. Att de digitala medierna har didaktiska implikationer och att VAR-frågan i detta blir relevant att beakta ska jag visa längre fram i artikeln men innan det görs en inplacering av VAR-frågan i svensk didaktisk forskning.

Artikeln behandlar alltså inledningsvis svensk didaktisk forskning och dess inriktning mot VAD- och HUR-frågan vars dominans tillsammans med förändrade villkor i utbildningen motiverar behovet av att i ökad grad beakta VAR-frågans existens i didaktisk forskning och undervisning. Efter detta följer en utläggning kring begreppen rum och plats vilket följs av preciseringen mot de digitala mediernas användning i skolans undervisning. Artikeln avslutas med en sammanfattande didaktisk utblick i vilken rum och plats betonas som framtidsrelevanta aspekter i en utbildningssituation som kommit att bli alltmer digitalt baserad. Artikeln kan uppfattas som ambitiös i sina anspråk, särskilt mot bakgrund av de två svenska stabila didaktiska forskningsansatserna som på ett fruktbart sätt tagit sig an frågan om innehållsval och hanteringen av innehållet. Likväl är artikeln befogad eftersom

didaktikens VAR-fråga, inom ramen för en alltmer digitalt baserad livssituation, gör människan än mer uppmärksam på betydelsen av rum och plats. Artikeln ska därför inte läsas som en kritik mot hur det didaktiska forskningsfältet sett ut eller ser ut. Artikeln ska snarare läsas som ett försök till synliggörande av VAR-frågans relevans inom svensk didaktisk forskning.

VAR-FRÅGANS RELATION TILL TVÅ SVENSKA DIDAKTISKA FORSKNINGSAKSATSER

Didaktisk forskning i Sverige har de senaste årtiondena prioriterat VAD- och HUR-frågan (och till viss del VARFÖR-frågan) vilket potentiellt skymt sikten för andra didaktiska grundfrågor. Den svenska didaktikens två huvudsakliga problemområden, VAD och HUR, kan härledas till Johan Amos Comenius (1999) hos vilken didaktiken ses som en undervisningslära som ska behandla frågor om val och behandling av undervisningsinnehåll. Innan 1980-talet saknades det i den svenska undervisnings- och utbildningsforskningen ett fokus på innehållet i undervisningen och på själva lärandet. Men när didaktikbegreppet på allvar introducerades i Sverige på 1980-talet kom en vändning (Englund, 1990). Vad som kom att växa sig starkt var två kraftfulla didaktiska forskningsansatser: *didaktisk forskning på läroplansteoretisk grund och fenomenografisk didaktik* (Englund, 2007). Den läroplansteoretiska forskningen som på ett betydande sätt tagit *innehållsfrågan* på allvar och den fenomenografiska forskningen vilken framgångsrikt tagit sig an *ämnemetodik- och metodfrågan* (Achtenhagen, Bjerg, Entwistle, Popkewitz & Vislie, 1997) har sedan 1980-talet väglett den svenska didaktiska forskningens inriktning mot VAD-frågan (och till viss del VARFÖR-frågan) och HUR-frågan (se även Englund, 1990). Båda dessa forskningsansatser samspelar tidigt med skilda ämnesdidaktiska ansatser (Englund, 2007) och en under 1990-talet ökande betoning på kommunikativa aspekter i undervisningen gör att två perspektiv utvecklas ur den läroplansteoretiska respektive den fenomenografiska forskningsansatsen: *sociopolitiskt perspektiv på undervisning* (läroplansteoretisk bas) och *sociokulturellt perspektiv på lärande* (fenomenografisk bas) (Englund, 2007). Dessa två utvecklingslinjer har inom den didaktiska forskningen kommit att kallas för den *kommunikativa vändningen* och som försett didaktikens grundfrågor med en delvis ny resonansbotten.

I den kommunikativa vändningen betonas betydelsen av ömsesidig kommunikation för att skapa mening i klassrummet. Konkret innebär detta en förändrad begreppsanvändning och sätt att se på kommunikativa skeenden: en förflyttning från inlärning till lärande och från lärande till meningsskapande. Inom den ämnesdidaktiska forskningen har den kommunikativa vändningen kommit att utmana så kallade *selektiva traditioner* – ett viss förankrat och bestämt innehåll som undervisningsmässigt behandlas på ett specifikt sätt i ett specifikt ämne, det vill säga ämnets dominerande förgivettaganden. I flera skolämnen har de selektiva traditionerna, nära förbundna med en syn på läraren som innehållsförmedlare och elever som lyssnande mottagare satta att återge och redovisa det förmedlade kunskapsinnehållet (Englund, 2007), kommit att utmanas. Även om didaktikbegreppet satt innehållet mer i fokus och problematiserat detsamma så finns det tendenser

(exempelvis utbildningspolitiska men även införandet av digitala medier i undervisningen) som tyder på ett fortsatt behov av att problematisera skolämnenas undervisningsinnehåll inom ämnesdidaktiken. Men VAD- och HUR-frågans dominans, och tendenser till frånvaro av VAR-frågan, synliggörs inte bara av de två nämnda didaktiska forskningsinriktningarna.

Tendensen är även synlig i läromedel som har använts inom ramen för landets lärarutbildningar och som kan exemplifieras med Gerd B Arfwedsons bok *Undervisningens teorier och praktiker* (1998) i vilken författaren uppehåller sig vid innehållsfrågan (VAD) och metodfrågan (HUR). Boken illustrerar tydligt frånvaron av analytiska resonemang kring betydelsen av rum och plats, det vill säga didaktikens VAR-fråga. I samma bok återfinns den didaktiska triangeln (Elever – Lärare – Innehåll), ett illustrativt och konkret exempel på hur rum och plats stängs ute som en relevant dimension i undervisningssituationen. Vidare ger en läsning av boken *Didaktik – teori, reflektion och praktik* (Uljens, 1997) ett andra exempel i vilken skilda didaktiska forskningsinriktningar presenteras av dess föreläsare och som syftar till att ge en inblick i den nordiska forskningen gällande relationen didaktisk teori och praktik. Författarna väljer att betona antingen VAD- eller HUR-frågan inom sina respektive inriktningar. VAD- och HUR-frågan dominerar, som didaktiska utgångspunkter i forskningsansatser, och tenderar därför att skymma sikten för andra didaktiska områden. En samtida innehållsanalys av de didaktiska forskningsprojekt som Vetenskapsrådet (2012) beviljat medel visar att VAD- och HUR-frågan är fortsatt starka i svensk didaktisk forskning.

I nutida svensk didaktisk forskning finns det tendenser som tyder på en fortsatt betoning av VAD- respektive HUR-frågan. En innehållsanalys av rapporten *Forskning pågår 2012 didaktik* har gjorts i syfte att synliggöra tendenser i nutida svensk didaktisk forskning och som kan användas för att diskutera relevansen av VAR-frågan. En grov kategorisering⁽³⁾ av den didaktiska forskning som beviljats medel av Vetenskapsrådet år 2012 ger att 22 projekt av 24 (anslag till forskarskolor och nätverksbyggande borträknat) antingen fokuserar HUR-frågan (vilket är vanligast), VAD-frågan eller bådadera. VAD-frågan exemplifieras av projektet *Nationella prov i biologi, fysik och kemi* som använder sig av en läroplansteoretisk inriktning (identifiera selektiva traditioner). Ett projekt med fokus på HUR-frågan exemplifieras av *Lärares gemensamma kunskapsproduktion* med Learning Study som grund. Ett projekt med fokus på HUR- och VAD-frågan exemplifieras av *Skolämneparadigm och undervisningspraktik i skärmkulturen* som använder sig av Bernsteins teoretiska ramverk. Endast två projekt tar, i viss utsträckning, VAR-frågan som central utgångspunkt. *Immersiv Utbildning: Interaktivt Byggande och Lärande av Grundläggande Vetenskapliga Begrepp i Virtuella Nanoteknikmiljöer* är ett projekt i vilket VAR-frågan får en bärande relevans i termer av virtuell lärandemiljö, klassrumsmiljö och science-center-miljö. En del av studien syftar helt enkelt till att undersöka de olika miljöernas påverkan på de studerandes förståelse för 'fundamentala aspekter av nanovärlden'.

REMAKE. Representation, resurser och meningsskapande. Medeltiden som kunskapsområde i olika lärmiljöer är det andra projektet i vilket VAR-frågan får en

bärande betydelse i termer av olika miljöer 'innanför och utanför skolan' men med betoning på representation i de aktuella miljöerna och representationens betydelse för det som uppfattas som kunskap och förståelse av medeltiden. Den teoretiska utgångspunkten i detta forskningsprojekt är designteoretisk (didaktisk design/design för lärande). Av totalt 24 forskningsprojekt vilka beviljats medel för att bedriva didaktisk forskning år 2012 är det alltså bara två som använder sig av VAR-frågan som en, till viss del, betydelsefull ingång och utgångspunkt. Övriga projekt är fortsatt inriktade på det svenska didaktiska fältets två dominanter – VAD- och/eller HUR-frågan. Men även VAR-frågan är en betydelsefull ingång och utgångspunkt för didaktisk forskning vars objekt är 'undervisning i alla dess former' (Kansanen, 1999, s. 39) – det vill säga en intersubjektiv medveten och riktad praxis som alltid är relaterad till framtiden. 'Grundtanken i didaktiska visioner är vilken utbildning den växande generationen behöver och hur undervisningen bör organiseras i framtiden' (s. 42). En fundamentalt viktig aspekt i organiseringen av undervisningen nu och i framtiden, i en alltmer digitalt bemängd utbildningssituation, är frågan om rum och plats.

RUM OCH PLATS

All verksamhet människan företar sig försiggår i rum och platser i vilka mening kan skapas och relationer uppstå. Rum och plats är omtvistade begrepp och används på olika sätt inom skilda akademiska discipliner (Escobar, 2001; Kyle & Chick, 2007; Van Patten & Williams 2008). Enligt Yi-Fu Tuan (1977/2008) är relationen mellan rum och plats en fråga om skilda abstraktionsnivåer:

In experience, the meaning of space often merges with that of place. 'Space' is more abstract than 'place'. What begins as undifferentiated space becomes place as we get to know it better and endow it with value (s. 6).

I den samhällsvetenskapliga forskningen har rum och plats länge tagits för givna: "Often construed in simple physical terms, places typically feature as mere passive containers in which social life happens to unfold" (Hopkins & Dixon 2006, s. 174). Men rum och plats har stark inverkan på människan och hennes relationer: 'they affect how people are included or excluded from public spaces, and they shape the ways in which people relate to each other' (Hopkins & Dixon 2006, s. 174). Rum och plats bör därför, enligt Rohkrämer och Schulz (2009, s. 1341), betraktas som en mångfald av heterogena influenser och krafter, relationer, förhandlingar, faktiska engagemang och makt i alla dess former. Rum och plats gör alltså anspråk på människan och påverkar därmed den mening och de relationer som människan skapar.

Begreppsligt förstår jag *rum* som något i huvudsak abstrakt och kollektivt orienterat, ett utrymme för något att 'äga rum' och 'ta plats' vilket kan ske genom skapandet av relationer, innebörder och mening. Inom humangeografin har rum (space) ofta förståtts i sociala termer. 'At its simplest, the term "social space" can be seen as a way of recognizing that space is produced by people (rather than pre-existing), and that spaces in turn shape people (rather than being inert or neutral)' (Gallagher 2006, s. 161). *Plats* ser jag som något konkret och skapat, en belägenhet

där något sker och kan ske. Platstillhörighet, en tillhörighet som genom platsen binds samman av minnen, erfarenheter och tillgivenheter kan exempelvis ha följande betydelse (Sanderth, Werner & Båth, 2009, s. 57-58):

- medverka vid skapande, underhåll och bevarande av en persons, grupps eller kulturs identitet
- stödja individuell, kollektiv och kulturell självkänsla, egenvärde och stolthet

Samtidigt som platsen i huvudsak är konkret i en materiell mening är den också abstrakt och föränderlig, beroende av människans subjektiva erfarenheter och handlingar. Människan formas av platsen och platsen formas av människan. Det vill säga, de händelser som sker i platsen omformar platsen – något 'äger rum' och 'tar plats'. En plats är beständig (genom exempelvis minnet) och föränderlig genom det liv som där utspelas – en rörelsens stillestånd (Løvlie, 2007). En plats begränsas och möjliggörs inte enbart genom att vara en konkret materiell och geografisk sådan utan kan lika väl vara abstrakt, som i tänkandet, samtalet eller minnet. Var befinner sig exempelvis den unga människan som sitter och drömmer i skolbänken med en internetuppkopplad laptop på bänklacket? Individens helt enkelt befinna sig i en plats och samtidigt, genom exempelvis tänkandet, vara i en annan plats.

Rum, för att summera, är alltså en holistisk och abstrakt kategori medan plats är partikulär, subjektiv och konkret. Platser har betydelse för individens känsla av mening, tillhörighet, identitet, och att höra hemma vilket har bärande relevans i det mänskliga livet var än det utspelar sig. I svensk didaktisk forskning har rum och plats, VAR-frågan, hanterats men inte på ett systematiskt och genomgripande sätt i likhet med HUR- och VAD-frågan.

VAR-FRÅGAN I SVENSK DIDAKTISKT ORIENTERAD FORSKNING

VAR-frågan har givetvis hanterats och hanteras i svensk didaktisk forskning. Exempel på didaktiskt orienterade studier i vilka betydelsen av rum och plats tas på allvar är: Alerby, Bengtsson, Bjurström, Hörnqvist & Kroksmark (2006), Andersson (2010a, 2010b, 2013), Bliding, Holm & Hägglund (2002), Frödén (2012), Grannäs (2011), Gustafsson (2006) och von Wright (2011). Dessa bidrag, och fler, är enskilda studier vilka låtit VAR-frågan utgöra en central analytisk ingång men utan att tillhöra en forskningsansats eller ett forskningsprogram i likhet med VAD- och HUR-frågan vilka systematiskt och genomgripande behandlats som didaktiska problemområden. Möjligen kan Staffan Selanders och Gunther Kress (2010) forskningsinriktning – didaktisk design/design för lärande – förstås som en forskningsinriktning eller ett forskningsprogram inom vilken rummet och platsens betydelse (i termer av att designa lärmiljön vilken delvis inkluderar rum och plats) uppmärksammas och analyseras som en relevant fråga i dagens multimodala, ofta digitalt baserade, lärprocesser. Vidare kan Løvlies begrepp, platsens pedagogik, betraktas som en reaktion och en upplysning om rummet och platsens, det vill säga VAR-frågans, betydelse i forskning som har med utbildning och undervisning att göra. Løvlie (2006) skriver att 'pedagogy is also the concern for children's growth in

their existential, social and material habitat' (s. 1) samt att 'All teaching requires a setting and all learning is bound to situations – the places where experiences come into being and leave their traces' (s. 1). Exemplet digitala medier och den alltmer digitalt grundade utbildningssituationen förstärker ytterligare denna anslagston – relevansen i att analysera betydelsen av rum och plats i didaktisk forskning.

VAR-frågan: exemplet digitala medier

Med en markant ökning av digitalt medierade samtal i undervisningen (Wang & Woo, 2007) genom att fler lärare experimenterar med digitala samtal (Rossi, 2006) och därmed upprättar nya rum för undervisningen skapas också nödvändigheten i att förstå och didaktiskt kritiskt undersöka de digitala mediernas utbildningsmässiga potential (Andresen, 2009). Forskning visar så här långt att det sker ett antal förändringar i klassrummet när digitala medier tillförs undervisningen. Klassrummet kan exempelvis bli ett öppet samtalsrum i vilket de studerandes röster ges möjlighet att ta plats och få en egen röst i lärandet med möjligheten att lyfta in undervisningsinnehåll som annars hade varit exkluderat (Rossi, 2006; Kim, Anderson, Nguyen-Jahiel & Archodidou, 2007; Andresen, 2009). En påtaglig förändring är också turtagningen i klassrumssamtalet i vilket IRE-mönstret (Initiation, Respons, Evaluering) tenderar att försvinna till förmån för en mer dynamisk samtalsstruktur (Xu, 2008). Det digitalt medierade samtalet, när det används i klassrummet, har också visat sig möjliggöra, från de studerandes sida, en mer utvecklad tankeelaborering samt genomtänkta val av ord, utvecklade argument och kritiska betraktelser av dessas premisser (Kim et al., 2007). Den kritisk analytiska förmågan gynnas (Guiller, Durndell & Ross, 2008) och en avancerad kunskapskonstruktion tillsammans med ökad autonomi i det egna lärandet har identifierats (Wang & Woo, 2007). En förklaring till dessa resultat är de didaktiska frågorna NÄR och VAR, det vill säga tid, rum och plats. Schallert med flera (2009, s. 724) menar att de studerande kan engagera sig i diskussioner på ett mer genomtänkt sätt (tidsaspekten) genom att exempelvis förklara sina idéer och dela erfarenheter samtidigt som fler kan delta då utrymmet inte är begränsat av talande röster som i klassrummet (rumsaspekten). Vidare visar det sig också att deltagarna mer sannolikt fokuserar på undervisningsinnehållet och fördjupar detta genom att citera mer litteratur och inlemma egna synpunkter och erfarenheter (Wang & Woo 2007, s. 273). Användningen av digitala medier för samtal i utbildningen ger dock att samtalet förlorar de dimensioner som ansikte-mot-ansikte kan ge (kroppslig närvaro, minspel, ljud, doft osv.) varför hybridiseringen av kommunikationen i klassrummet kan anses önskvärd. Young Min Baek, Wojcieszak och Delli Carpini (2011) konstaterar att

Face-to-face settings might generate empathy and increase perspective taking ability to greater extent than online settings, because interlocutors are physically present and interact on an interpersonal level (s. 367).

Exemplet, det digitalt medierade samtalet, illustrerar vissa förändringar i klassrummets undervisningssammanhang. Det som förändras är samtalsstrukturen; innehållshanteringen; användningen av egna erfarenheter; djupet och kvaliteten i argumentationen; samarbete och möjligheten att göra sin röst hörd. Men det är

inte enbart samtalets möjligheter som förändras vilket Erixon, Marner, Scheid, Strandberg & Örtegren (2012, s. 268) visar genom sin undersökning av de digitala mediernas didaktiska konsekvenser inom ramen för skolämnena bild, musik och svenska. Forskningsteamet identifierar fyra tematiker som beskriver skolämnens relation till de digitala medier: 1) lärarna vill använda digitala medier i större utsträckning än vad som är fallet (behov av kompetensutveckling), 2) den analoga tekniken betraktas oftast som mer autentisk (den analoga tekniken blir mer värdefull), 3) digitala medier anses fördelaktiga att använda i fallet mindre motiverade elever, 4) lärarna upplever att de digitala medierna främjar kollektivt arbete framför individuellt arbete. I en tidigare studie konstaterar Demetriadis, Barbas, Molohides, Palaigeorgiou, Psillos, Vlahavas, Tsoukalas & Pombortsis (2003) att digitala medier assimileras in i den traditionella undervisningen utan att lärare gör någon nämnvärd didaktiskt effektiv användning av det nya mediets möjligheter:

the assumption that the use of ICT is something simply transferable into schools after appropriate teachers' training, is rather misleading. The way a tool is used is not a matter of applying some abstract and decontextualized tool capabilities but a matter of mediating meaningful human activities satisfying human needs in specific contexts (Demetriadis et al., 2003, s. 34).

De digitala mediernas didaktiska potential är alltså i behov av kritisk analys samtidigt som lärare, enligt författarna, behöver förändra synen på skolämneshåll och skolkunskap genom att vidga och omfatta multipla kontexter för lärandeaktiviteter vilka behöver praktiseras tillsammans med en mer medveten och utökad användning av digitala medier. Mark Warschauer som inom ramen för ett omfattande skolutvecklingsprojekt i vilket en dator per elev (en-till-en) införts i skolor har identifierat tre utmärkande förändringar i klassrummet: de studerande får mer stöttning i att ta sig an utmanande undervisningsinnehåll (scaffolding); de studerande blir aktivt involverade i den egna kunskapsprocessen; samt att det sker en ökad onlineläsning på skärmen. I det svenska klassrummet konstaterar Susanne Kjällander (2011) liknande resultat. Kjällander, som för övrigt tillämpat didaktisk design/design för lärande, har undersökt användningen av digitala resurser i det samhällsvetenskapliga klassrummet med fokus på studerandes (6 till 17 år) interaktion och meningsproduktion. Den elektroniska skärmen, och dess innehåll, visade sig bli en gemensam angelägenhet – ett tredje element (a third element) – i de studerandes interaktion som skapade en samarbetsbetonad undervisningssituation. Det tredje elementet, eller skärmen, som ett nytt rum för interaktion och kommunikation sätter fingret på relevansen i att fortsatt beakta VAR-frågans didaktiska relevans. De digitala mediernas möjlighet att vistas i fler rum och platser än vad som tidigare var fallet har didaktiska implikationer. Men dessa har inte i dagsläget kritiskt undersökts och analyserats, i termer av rum och plats, i någon större omfattning. Uppenbart är att valet av undervisningsinnehåll (VAD) och behandlingen av undervisningsinnehållet (HUR) påverkas av VAR och NÄR detta sker. Vidare påverkas lärarens status och roll vilket inom skolämnen med en stark selektiv tradition påkallar nödvändigheten i att hantera den kommunikativa (och digitala) vändningen (jfr Hylén, 2010) i den svenska skolans undervisning.

SAMMANFATTANDE UTBLICKAR: RUM OCH PLATS I DIDAKTIKEN

Rum och plats i didaktiken, didaktikens VAR-fråga, kan inom en digitalt baserad utbildningssituation förstås i termer av det *tredje rummet* – en didaktisk tanke-skiss som tar vara på hybridiseringen av kommunikationen i dagens klassrum. Det tredje rummet blir ett slags gränssnitt, ett mellanrum, i vilket undervisningens innehåll kan fördjupas och problematiseras genom innehåll som sträcker sig utanför lärobokstexten. Undervisningsinnehållets politiska dimension blir genom detta synligt samtidigt som de studerande kan komma att inta en mer aktiv roll i sitt eget lärande vilket görs möjligt genom en förändring i synen på kunskapande från överföringsprocess till konstruktions- och kommunikationssituation. I det tredje rummet kan de digitala mediernas och det traditionella klassrummets didaktiska styrkor komplettera varandra genom att lärare och forskare medvetet förhåller sig till VAR-frågans relevans för de studerandes lärande, socialisation och kommunikation. Det tredje rummet i vilket de studerande och lärare interagerar och kommunicerar – själva skärmen – blir ett tredje rum genom att vara det gränssnitt i vilket de studerandes röster och erfarenheter explicit möter undervisningens innehåll och förväntningar.

I svensk didaktisk forskning tycks VAD- och HUR-frågorna fortsatt dominera inriktningen vilket potentiellt begränsar möjligheten för systematiska analyser av didaktikens andra grundfrågor. Denna artikel är tänkt som ett bidrag inom den ämnes- såväl som den allmänna didaktiska forskningen. Jag har implicit argumenterat för ett fortsatt nödvändigt fokus på kommunikativa aspekter i undervisningen, både forskningsmässigt och som undervisningspraktik i skolan. Jag har dessutom, explicit, argumenterat för relevansen av att beakta VAR-frågan och dess betydelse i svensk didaktisk forskning. Denna argumentation har innehållsligt preciserats genom de digitala medierna, didaktiska tendenser i ett alltmer digitalt klassrum, och mynnat ut i den didaktiska tankeskissen *det tredje rummet* som genom fortsatt utveckling kan bidra till att förstå de digitala mediernas didaktiska konsekvenser med betoning på rum och plats. Didaktiska implikationer av rum och plats, oavsett om det handlar om digitala medier eller så grundläggande aspekter som de studerandes placering i klassrummet och valet av möblering, är en didaktiskt relevant fråga att systematiskt ta sig an eftersom rum och plats alltid gör anspråk på dess deltagare.

REFERENSER

1. Didaktiken, som forskningsfält och undervisningspraktik, närmar jag mig med utgångspunkt i pedagogiken. Ämnesdidaktik betraktar jag, utan att gå in på relationen ämne och didaktik, som en inriktning inom didaktiken i vilken ett specifikt ämnes innehåll utgör ramen för den forskning och den undervisning som bedrivs i det aktuella fallet. Med didaktik avser jag, i bred mening, sammanhängande idéer och skeenden inom utbildnings- och undervisningssammanhang i vilket kommunikativa situationer med ett specifikt och icke givet meningsbärande innehåll kan läras, socialiseras, undersökas, planeras, värderas och diskuteras.
2. Artikeln gör varken anspråk på att redogöra för det didaktiska fältets historiskt skilda inriktningar (se exempelvis Uljens, 1997 eller Bengtsson, 1997 för detta), att begreppsutreda didaktikbegreppet eller att djupanalysera det didaktiska forskningsfältets relation till och frekvensanvändning av VAR-frågan som analytisk huvudingång.
3. Jag har i innehållsanalysen av rapporten valt att utgå från de tre didaktiska grundfrågorna HUR, VAD (inkluderande VARFÖR) och VAR i syfte att kvantitativt få ett mått på hur den didaktiska inriktningen i dessa frågor ser ut. Analysfrågan som användes formulerades: Är forskningsprojektet i huvudsak inriktat mot didaktikens HUR, VAD eller VAR-fråga? Analysen har skett på textnivå genom att söka efter ord i beskrivningen av forskningsprojektet, dess forskningsfrågor och syfte vilket signalerar dess didaktiska inplacering. När det gäller kategoriseringen HUR, det vill säga bestämningen av forskningsprojekt som HUR-projekt, är följande ord vägledande i identifikationen: hur, utförande, metoder, användande. När det kommer till VAD-projekt: vad, innehåll, vilken, vilka, faktorer. Kategoriseringen av VAR-projekt: var, lärmiljö, rum, plats.

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INVESTIGATING VISITORS' LEARNING RELATED TO SCIENCE CENTRE EXHIBITS – A PROGRESS REPORT OF RECENT RESEARCH LITERATURE AND POSSIBLE FUTURE RESEARCH FOCI

Eva Davidsson

SAMMANFATTNING

Forskningsfältet som rör lärande i informella miljöer växer ständigt och under den senaste tiden har antalet artiklar som fokuserar lärande i relation till ett besök på ett science center eller museum ökat kraftigt. Men vilka slutsatser kan man dra när det gäller utställningar och besökarens lärande? Vilka metodologiska trender kan man se och vilka framtida forskningsområden kan tänkas utgöra intressanta fält? Denna forskningsgenomgång analyserar och diskuterar olika forskningsstudier som fokuserar besökarens lärande och deras interaktioner med utställningar samt studier som utvärderar utställningsmiljöer. Vidare diskuteras trender med avseende på olika metodologiska ansatser samt föreslår framtida forskningsfokus inom fältet.

Nyckelord: Informellt lärande, science center, museer, sociokulturellt perspektiv

INTRODUCTION

The area of research concerning learning and informal settings is constantly growing and has developed further during the last decade. This means that an increasing number of studies aim to explore, for example, visitors' learning and interactions when attending exhibitions, staff members' ideas about exhibit design, or the interaction between formal institutions and informal learning environments. In order to summarise this research, several reviews have been published. For example, Rennie and McClafferty (1996) examine the role of Science and Technology centres (STC) in relation to when and how visitors learn and understand science. The authors conclude that a large number of studies indicate positive attitudes towards visiting STCs and that exhibition environments have educational potential. However, they emphasise the need for improvement when it comes to research focusing on the relation between visitors' learning and exhibition design as well as for broadening the research design and methods, in order to approach the complexity of variables under study.

EVA DAVIDSSON

*fil. dr och lektor i utbildningsvetenskap,
Malmö Högskola
Lärande och samhälle, 205 06 Malmö
E-post: eva.davidsson@mah.se*

Hofstein and Rosenfeld (1996) conducted another review, which focuses on the relation between learning science in informal and formal environments and, in particular, how experiences from STC visits could be integrated into school science. The authors conclude that there is a need for further research focusing on how to *effectively blend experiences* from informal and formal settings in order to significantly enhance science learning. A third review by Pedretti (2002) focused on the discussion about how science should be re/presented in exhibitions, particularly with regard to socio-scientific issues and the nature of science. Four key factors in exhibit design, which could enhance visitors' engagement and learning, were recognised: considering visitors' motivation and context, using a constructivist framework, considering multiple intelligences, and the affective domain.

Yet another example of a review is provided by the Committee for learning science in informal environments (National Research Council [NRC], 2009), where the authors identify six different strands of science learning as a means to define appropriate learning outcomes. The authors argue that the strands *Experience excitement, interest, and motivation to learn about phenomena in the natural and physical world and Think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science* are particularly relevant to informal learning environments. In addition the committee provides research-based recommendations for how to organize, design and support science learning.

These examples of reviews highlight, in turn, the role of STCs for learning science, the relation between STCs and school science, how science should be presented in order to enhance learning from exhibitions and, different strands of science learning. A common thread in these reviews is the focus on visitors' learning but they also approach exhibition content and design in relation to visitors' learning. This article continues the discussion of our understanding about visitors' learning by highlighting and discussing research studies that aim to describe how visitors' learning is developed when attending exhibitions at science centres and museums. Furthermore, the article aims to analyse these studies with regard to research foci and methodological approaches. This means that research studies aiming to ex-

plore other areas in relation to exhibition environment such as visitors' agendas when visiting exhibitions, profile of the visitors or impact on the environment are not included in this article. Finally, it also outlines possible future research areas within the field of learning and informal settings.

LEARNING AND SCIENCE EXHIBITIONS

The most common approach to research within the field of learning and informal settings is probably the one related to visitors' learning, particularly cognitive learning outcomes, from exhibitions. A number of studies aim to explore what visitors recall, memorize and learn from exhibitions or how students and teachers use the exhibition as a tool for cognitive learning. This approach also includes questions about what impacts the exhibition setting could have on, for example, visitors' ideas about scientific concepts and phenomena or how certain features of the exhibition enhance visitors' learning. According to Rennie (2001), most studies concerning visitors' learning are either *exhibit-related* or *visitor-related*. Exhibit-related studies often seek to explore and evaluate the effectiveness of exhibit content and design in relation to visitors' learning, such as how different exhibit features affect visitors' cognitive learning outcomes. Examples of these studies are discussed in a later section of this article. Visitor-related studies mainly focus on the visitors' behaviour, actions and dialogues, but are usually related to the specific context of the exhibition. The following section explores visitor-related research studies, including both family visitors and visitors in school groups.

Visitor-related research

With regard to school trips, Griffin (2004) argues that (1) the overall educational value of school visits to museums, (2) the impact of preparing for such visits and (3) early studies into the complexity of how different elements may influence students' learning have received the most research attention. In her review, she concludes that the educational value of field trips is equivocal and context specific, but also that preparation significantly enhances learning. Furthermore, she argues that earlier studies usually do not fully address the *complexity of the context* nor do they adequately consider students' and teachers' perceptions and expectations of field trips. Griffin concludes, however, that recent research seems to focus to a greater extent on adult and student conversations.

In contrast, earlier research about family learning explored, to a large extent, visitors' behaviour in the museum setting and concluded, for example, that they tend to behave in predictable patterns during their visits, but also that these patterns are influenced by the physical and social setting (Crowley & Callanan, 1998; Hilke, 1989). One methodological approach in this area involves observing visitors' behaviour in terms of what they are doing and time spent at different exhibits (e.g. Chiozzi & Andreotti, 2001; Korn & Jones, 2000). An assumption in these kinds of studies seems to be that if visitors spend a long time interacting with an exhibit, their learning would be influenced positively (e.g. Sandifer, 1997). From this reasoning it is possible to judge visitors' learning by studying the amount of time spent

in the exhibition and at individual exhibits. However, visitors' own preferences and learning experiences are seldom explored in these studies, nor are their conversations while interacting with exhibits.

Thus, exploring visitors' learning by using observations of time spent at an exhibit and what they do seems to be insufficient for increasing our understanding of visitors' learning. More recent research has instead studied visitors' conversations in connection with their actions and interactions while interacting with exhibits. Studies that have investigated the content of the conversations include research by Allen (2002). She concludes that over 80% of the conversation content among 49 pairs of adult visitors could be classified as *learning talk*. Learning talk refers to discussions containing conceptual, perceptual, connecting, strategic and affective talk. Other research by Crowley and Jacobs (2002) focuses on the family group and notes the way in which *parent mediated talk* influences the children's learning. Their results show that more complex discussions, involving explanations, inferences about scale or connections to children's previous experiences enhanced children's factual knowledge.

Siegel, Esterly, Callanan, Wright and Navarro (2007) also investigate parent-child conversations and relate parents' *explanatory talk* and *styles of interaction* with their children to their educational levels. The results reveal that families show similar and rich explanatory conversations independent of the parents' education, but parents with higher levels of education tend to have more directive interaction styles than parents with basic schooling. Another study (Crowley, Callanan, Terebaum, & Allen, 2001) highlights a gender difference in parent-child conversations. Through observations of families with pre-school children, the authors found that boys and girls were equally initiating and engaged in interacting with exhibits, but the parents were more likely to explain casual connections to boys than to girls. This means that the boys heard three times more explanations than the girls.

Several studies since then have explored visitors' conversations and dialogues, but some studies also included other forms of interaction when studying visitors' learning from exhibitions. For example, Rahm (2004, 2012) points to the importance of including *non-verbal forms of interaction* when exploring students' meaning making. She argues that a rich description of students' knowledge development is dependent on both verbal and non-verbal interactions simultaneously.

Ash (2002) argues that one way of increasing visitors' interaction and encouraging learning conversations could be to display complex scientific issues. This means that socio-scientific dilemmas are highlighted from different perspectives, which enhance argumentation rather than giving correct answers. In her research, Ash relates the family conversation to the scientific content of the exhibits and reveals that a *powerful thematic content* is the underpinning for meaning-making conversations. This suggests that providing families with interesting and complex issues to discuss could both enhance learning and bridge differences in ages and expertise. Furthermore, Ash (2004) concludes that, in addition, such family conversations have the potential of enhancing the family members' scientific literacy.

Robertson (2007) also investigates, through interviews and observations of fourth and fifth graders, different factors that could affect and enhance students' shared experiences. According to Robertson, there are several factors which significantly impact and reinforce progress towards a *shared vision* among the group members, including time, communication, understanding others' perspectives, dedication and ownership and the collaborative environment. In her study, students both expressed enhanced scientific learning and developed their views about teaching and learning through negotiations with their peers. This discussion has focused on studies that investigate the significance of enhancing visitors' conversation to support learning. But how do staff members and exhibit designers consider issues about visitors' learning?

Staff members' ideas about visitors' learning

A small part of the research literature examines staff members' ideas about visitors' learning. For example, what approaches or strategies do the staff members use when designing and constructing new exhibitions and what ideas do they express about visitors' learning? Several studies imply that when staff members design new exhibitions, they tend to consider visitors' learning only from the perspective of their own experience and only slightly rely on what is known from research. This is explicit, for example, in the study of Astor-Jack, McCallie and Balcerzak (2007), who explore views of effective professional development by comparing staff members' *language use* at four higher education institutions with the language use of staff at four informal science institutions. Their results suggest that the use of language tends to be more informal, experience-based and individualistic among the staff members at the informal institution and more formal, theory-based and consistent among higher education staff. The authors argue that the informal and experience-based language use of the informal institution staff members could be a result of their personal experiences and discovery of what had worked in communicating with visitors in the past.

The results of this study are in line with the conclusions of Davidsson and Jakobsson (2009), who explore in what ways STC staff members consider visitors' learning when interacting with exhibits. Furthermore, they investigate what *references to knowledge* the staff members use when considering learning, and also what references they employ related to the scientific content of exhibitions. The results from semi-structured interviews reveal that the staff members refer to learning processes differently by distinguishing, for example, organized from non-organized learning and theoretical from practical hands-on learning. A majority of the staff members state that they do not have scientific knowledge about learning, but instead refer to their own personal and professional experiences. However, when discussing the scientific content of the exhibitions, all staff members use references from the scientific community.

According to Davidsson and Jakobsson (2009), there is a risk that an experience-based approach leads to a view where learning is seen to occur only in specific situations. This means that learning may be viewed only as formally organized

and that staff members do not consider enjoyment as learning. Another consequence could be that educational issues are seen as an aspect to be considered only after the exhibit is constructed. This is evident when Knutson (2002) ethnographically explore staff members' negotiations and decision-making when planning a temporary art and science exhibition. Her results reveal tensions between the different team members in terms of how to integrate educational material into the exhibition. For example, the curators' vision was to complete the project and then invite educators to add educational material. This vision is also evident in work by Tlili, Cribb and Gewirtz (2006), where exhibit constructors argued that certain aspects, such as equality and diversity policies and practices, could be added by the educators and were not considered as part of exhibit design.

Yet another consequence of an experience-based perspective on learning among staff members can be seen in various studies of guided tours in museums. For instance, Tal and Morag (2007) observed 42 guided student visits at a national history museum and conclude that the tours tend to be curator-centred and the questions are, to a large extent, rhetorical. The guides use a good deal of scientific language but explain scientific words only to a limited extent. Furthermore, the accompanying teachers are involved or used as educational resources to a very low extent. Cox-Petersen, Marsh, Kisiel, and Melber (2003) come to similar conclusions, as the museum staff members in their study tend to present the exhibition content in guided tours in a didactical and authoritarian way. In contrast, Tran (2006) gives a more nuanced image of the work of museum educators. She concludes from her observational study that the educators, while engaged in school group lessons, tend to adapt their pre-planned lessons to the needs, interests and abilities of the students. However, the educators communicate, to a large extent, with the students through initiate-response-evaluation (IRE) patterns (Sinclair & Coulthard, 1975; Lemke, 1990; Mortimer & Scott, 2003) and often fail to let the students articulate their thoughts and ideas.

From this discussion, it seems that staff members tend to consider the scientific content of the exhibitions from a scientific perspective, but refer to learning mainly based on personal experiences. Furthermore, studies imply that exhibit designers tend to regard exhibit content and visitor learning as independent or as separate things, where learning risks being viewed only in terms of how to transfer the scientific content to the visitors. Research also indicates that staff members seem to present exhibitions in guided tours in a monologist and didactic way (e.g. Ash, Lombana & Alcalá, 2012). But in what ways is science constituted in exhibitions and how do staff members consider and decide what to include or exclude when constructing new exhibitions?

Exhibit-related research

An important aim of STCs is, according to Association of Science and Technology Centers (ASTC) that visitors will encounter hands-on, interactive exhibits and first-hand experiences with scientific phenomena. Furthermore, the goals of different science exhibitions are educational. Errington, Stocklmayer and Honey-

man (2001) argued that museums and centers, of all kinds, play a key role in the educational infrastructure as they provide learning resources for schools as well as citizens. In order to promote visitors' learning Pedretti (2002) suggests integrating socio-scientific issues into exhibitions. Based on a review, she argues that the scientific content of exhibitions has changed during the past decades from being object-centred and displaying "the wonders of science" towards a more provocative display of science, focusing to a greater extent on socio-scientific issues. Janousek (2000) argues that museums have undergone several major shifts when it comes to the content of exhibitions (e.g. from structures to processes, from parts to the whole, and from 'exact truths' to approximative descriptions and the use of metaphors). He furthermore argues that a new generation of museums will be *context museums*, which will mediate voyages in the history of humanity, and use technical artefacts to explain the development of civilization in order to reveal human knowledge. Bradburne (1998) also stresses the importance of changing the characteristics of exhibitions towards enhancing visitors' creativity, collaborations, and skills of finding, appropriating and using new knowledge.

However, these notions of the *context museum* or *displaying a more provocative image of science* do not seem to have had an impact on exhibitions generally. Davidsson and Jakobsson (2007) conclude that the most common image displayed at Nordic STCs is *the usefulness of science*. They found that staff members in these institutions, above all, tend to choose to display the scientific aspects of science in society, science in a technical perspective, how modern science is generated and scientific facts, which together serve to emphasise the benefits and use we have of science in our society. Aspects such as controversial issues, values or gender issues were represented to a very low extent in contemporary exhibitions. Similarly, other research (Alfonso & Gilbert, 2008) has also found that science tends to be exemplified through technology and that risks, benefits or ethical considerations are rarely discussed. A possible explanation for these results can be found in Tlili, Cribb and Gewirtz (2006). This study explored staff members' ideas about incorporating equity and diversity politics and practice into science exhibitions and found that this area was not considered to belong to exhibit design. Instead it was considered to be an educational area and consequently should belong to the education department. Another explanation for why exhibitions tend to disregard provocative aspects of science could be the staff members' beliefs about what science an informed public needs to know. Macdonald (1998) argues that staff members' choices of what to include in exhibitions creates *particular kinds of science for the public*, who consequently attribute certain artefacts or activities as belonging to science. But how do staff members, who work with planning and creating new exhibitions, consider the scientific content? Why do they choose to display certain scientific aspects in favour of others?

Davidsson (2009) shows that the staff members in her study, above all, tend to view the scientific content of exhibitions in organisational terms. They focus on the content in relation to their exhibition area, available material or what would be considered as enjoyable. Furthermore, she found that aspects such as the relations-

hips between science and society, politics, and economy, as well as non-consensus explanations in contemporary science, risk being absent or implicit to the visitors. In the study, staff members argue that displaying different explanatory models or ambiguous issues to visitors could lead science institutions to question the credibility of the museum. Along similar lines, Macdonald (1998, 2002) explores staff members' approaches to the content of an art and science exhibition and reveals that not only are staff members' rationales and assumptions not explicit to the visitors, but also that relations between science and societal and political contexts tend to be overlooked by the staff members.

In order to circumvent the tendency of displaying a strongly product-oriented and uni-dimensional view of science, Pedretti (2004, 2012) advocates for issues-based exhibitions. She argues that such exhibitions could serve as a means to address socio-scientific issues, issues related to the nature of science, and, in addition, can promote visitors' dialogue, reflexivity and argumentation. She defines issues-based exhibitions as containing different societal dilemmas, in which visitors are confronted with social issues with scientific content and are asked to suggest solutions (Pedretti, 2012).

Staff members' choices of what to include or exclude in an exhibition thus seems to have an impact on how science is constituted in exhibitions and what *images of science* are communicated. However, there are also indications that sponsors may have an impact on the scientific content of exhibitions. For example, Davidsson and Sørensen (2010) show that sponsors, in many cases, create prerequisites for exhibitions at STCs, and that they also often influence the work of developing new exhibitions both directly and indirectly. Staff members in the study experienced explicit interference by sponsors in the content and design of the exhibitions, who also expressed a demand of being visible in it. The curators also tended to consider implicit demands for what they believed were views of the sponsors.

Exhibitions, artefacts and design

In order to explore visitors' engagement and learning from exhibitions, several studies focus on evaluation of exhibits or describing theoretical starting points for exhibit design. This research focus concerns overall ideas about exhibit design, but can also involve certain specific exhibit features, such as the use of new technology, audio-guides or labels. Concerning overall ideas, Allen (2004) discusses four aspects of exhibit design, which could potentially influence visitors' learning and engagement with exhibits: immediate apprehendability, physical interactivity, conceptual coherence and diversity of learning models. The first factor, immediate apprehendability, refers to a direct understanding of the exhibit's scope, purpose and properties. This factor is essential, according to Botelho and Morais (2006), as exhibits with explicit goals facilitate interaction and, in addition, enhance students' learning. Also Csikszentmihalyi and Hermanson (1995) consider this factor as crucial for activities in the exhibition setting, as it may generate a *flow experience*. A flow experience refers to a situation where a person engages and is completely immersed in tasks without any extrinsic rewards (e.g. good grades

or salary). Accountability and feedback also increase the likelihood of a flow experience (Csikszentmihalyi & Hermanson, 1995).

The characteristics of flow are closely related to other characteristics of exhibits that can also affect visitors' attention (Sandifer, 2003). Sandifer (2003) explores how different characteristics of 61 exhibits affect the attention and holding time of 47 visitors. The results show that technological novelty and open-endedness significantly increase the holding time of interactive exhibits. Technological novelty refers to an exhibit which contains state-of-the-art devices or which illustrates phenomena impossible or laborious for visitors to explore on their own.

However, it seems that it is not only the novelty of technology, but also technology per se, that could have an impact on visitors' learning. Lindemann-Matthies and Kamer (2006) explore, through pre- and post-tests as well as interviews with more than 600 visitors, how the use of interactive touch screens and touch tables affect and enhance visitors' learning. The results are compared to the learning outcomes of a group of visitors who only had access to traditional posters and labels. The authors conclude that a test group of zoo visitors, who were engaged in activities related to indigenous species using touch tables, seemed to experience increased learning compared to those who did not use the touch table. Furthermore, the experimental group scored higher on a post-test both immediately after the visit and after two months. One explanation for these results, the researchers suggest, could be that the specific topic, in this case rare indigenous species, is specifically attracting and exciting. Another explanation could be the inclusion of entertaining interactivity.

This explanation is supported by Swanagan (2000), as the results of his study suggest that zoo visitors who were engaged in interactive exhibits were afterwards more likely to support conservation than visitors who were only passive spectators. The personal backgrounds or interests of the engaged visitors are, however, not thoroughly discussed. Another study, which investigated computer-based exhibits in a science centre, suggests that such exhibits may encourage visitors to turn their activities into performances and thereby attract other visitors and, in turn, constitute shared experiences (Meisner, vom Lehn, Heath, Burch, Gammon & Reisman, 2007).

Audio guides are another feature used to improve interactivity. Their use, however, is contested. Brown (2002) argues that audio tours could be a major drawback by limiting interactions between visitors and thereby impeding learning. But Heard, Divall and Johnson (2000), who investigate students' learning outcomes in relation to the use of audio-guides, show benefits of their use. Their results indicate a gender difference, as the girls who used the audio-guides seemed more able to facilitate their activity and so improved their result on a post-test, compared to the girls who did not use the audio-guides. In contrast, the boys who used the audio-guides did not show any statistically significant difference on the post-test compared to the non-user boys. However these results are not consistent with Novey and Hall's study (2007) of learning outcomes of audio-guided tours in a cave. Their results do

not reveal any statistically significant differences between the 123 audio-guided users and the 131 non-users, on knowledge post-test. Nor do they find any evidence that audio-guides impede social interaction between the visitors as Brown (2002) argues. However, drawing on observations of 700 visitors at seven different sites, Novey and Hall conclude that the non-audio user visitors in the cave tend to consider signs and labels to a large extent, in line with other studies pointing to the positive effect of careful labelling on visitors' learning. For example, Borun (2002) concludes that carefully labelled hands-on exhibits tend to enhance visitors' learning compared to unlabelled exhibits.

Bradburne (2002) argues that differences in visitors' interactions could be contingent on the language used in museum labels. He provides an overview of different label types, such as textual authority, observations, games and problems. Hohenstein and Tran (2007) use this framework as a starting point when studying how different labelling affects visitors' conversations. They employed different information and questions on labels, finding that the question 'why is this here?' seemed to promote more open-ended discussion involving both additional questions as well as explanations among visitors.

There are thus several features that could affect and improve visitors' interaction with exhibits in order to enhance visitors' learning. But there are, according to Allen and Gutwill (2004), risks in designing exhibits with overly complex interactivity and adding too many features, which could impede visitors' learning. They identify five common pitfalls and possible effects on visitors' learning: (1) multiple options with equal salience risk overwhelming the visitors, (2) interactivity by multiple simultaneous users can lead to disruption, (3) interactivity, even by a single visitor, may disrupt the phenomenon being displayed, (4) interactive features can make a critical phenomenon difficult to find, and (5) secondary features can displace visitors' attention from the primary one. It seems that there is a risk of "overloading" exhibits with too many interactive features, but these authors do not discuss whether an exhibit with several possibilities for interaction also may also attract a larger audience. Davidsson (2008), and Jakobsson and Davidsson (2012) takes a theoretical approach starting in a sociocultural perspective on learning (e.g. Cole, 2003; Kozulin, 2003; Säljö, 2005; Vygotsky, 1986; Wertsch, 1991, 1998) and discusses the possibilities of creating exhibits for a diverse audience. By providing the exhibits with several mediational factors it is possible to create rich exhibits that may mediate different thoughts and handle different actions by the visitors.

Whereas Allen (2004), Allen and Gutwill (2004) and Davidsson (2008) concern exhibition design in general, some studies focus on design in relation to teachers and school groups (e.g., DeWitt & Osborne, 2007; Griffin, 1998, 2004). The Framework for Museum Practice (DeWitt and Osborne, 2007) aims to provide staff members with a tool, consisting of a set of factors that could enhance school students' learning from museum visits. The framework contains largely practical guidelines, but it is also possible to find similarities with those provided by Allen (2004) and

Davidsson (2008). For example, DeWitt and Osborne (2007) also emphasise the importance of clearly defined and open-ended exhibits and of personal relevance.

This discussion has taken the exhibition as its starting point and explored what there is to be learnt from research about exhibitions, focusing on both their content and design. It seems that features such as accessible technology and labelling could enhance visitors' engagement and support their conversations when they are interacting with exhibits. The exhibitions' artefacts and design hence constitute important prerequisites for learning. Next, I turn to a consideration of what theoretical assumptions about learning and informal settings are evident in the research literature, and in what ways these theoretical starting points affect methodological approaches. Is it possible to discern methodological trends during the last decade within the area of learning and informal settings?

THEORETICAL AND METHODOLOGICAL APPROACHES TO STUDYING LEARNING AND INFORMAL SETTINGS

As seen in the previous discussion, research within the field of learning and informal settings comprises many different ways of collecting data in order to increase our knowledge of, for example, visitors' learning, staff members' ideas about exhibit design or visitors' purposes in attending exhibitions. In order to approach these kinds of issues, questionnaires, interviews, observations, diaries and focus group interviews constitute crucial tools for researchers. However, these matters of methodological designs involving a theoretical approach to learning and the associated implications for data collection methods seem to be implicit or only vaguely addressed in a large number of studies. Several researchers also highlight and criticise this shortcoming and argue that much research is only descriptive and lacks a theoretical base. For example Schauble, Leinhardt and Martin (1997) and Paris and Ash (2000) emphasise the risk of not being able to make comparisons between different research projects or generalisations. In order to circumvent this problem, several researchers suggest or adopt different theoretical approaches when studying learning and informal environments, such as activity theory (Martin, 2004; Rahm, 2012) or ethnography (Macdonald, 1998).

It does seem, though, that when learning is explicitly addressed through the use of a theoretical framework, a constructivist or a sociocultural perspective is often adopted. For example, Anderson, Lucas and Ginns (2003) suggest the use of a constructivist framework and argue that this approach has merits because of its recognition of prior knowledge and as well as subsequent life experience, which contribute to the transformation of the individual's knowledge. Hein (1999) also advocates a constructivist perspective on learning and informal settings, arguing that the viewer constructs personal knowledge from exhibits and that learning is a constructive act. Based on Hein's framework, Stocklmayer and Gilbert (2002) have designed a theoretical model of visitors' learning from exhibits called 'personal awareness of science and technology' (PAST). To change a visitor's PAST, the exhibit needs to be personally engaging, evoke powerful recall of current understand-

ing and demonstrate an evident relationship with a concept or a phenomenon.

The constructivist perspective on learning also has consequences for choice of research methods. Anderson, Lucas and Ginns (2003) suggest using open-ended questions and concept maps to identify visitors' prior knowledge and knowledge developed from museum visits. Stocklmayer and Gilbert (2002) use interviews in order to reveal learning outcomes from exhibits. However, Davidsson and Jakobsson (2008, 2012) argue that learning, from a constructivist perspective, risks being seen as only intramental (Wertsch, 1998) and individual and not accounting for the social and cultural situations where learning occurs. Furthermore, they argue that there is a tendency for only studying learning outcomes and not taking into account visitors' actions and dialogues. But, Ellenbogen, Luke and Dierking (2004) argue that there is an on going shift of research paradigms towards a sociocultural approach when studying family learning in museums. According to those authors, research, to a greater extent, is focused on conversations, which highlight not only an individual's learning, but also learning at the *family level*, and gives insights into how families construct meaning. But what can be seen as the core of a socio cultural perspective on learning and what implications does this approach have for research methods focusing on learning and informal settings?

One starting point in this approach to studying learning is the importance of considering not only the individual learner, but also the individual in interaction with other individuals (e.g. Cole, 2003). This perspective is evident in several of the research studies reported in this article (e.g. Ash, 2004; Leinhardt, Crowley & Knutson, 2002). However, learning from a socio-cultural perspective also comprises interaction with available tools and artefacts (e.g. Jakobsson & Davidsson, 2012; Piqueras, Wickman & Hamza, 2012; Wertsch, 1998). This perspective is evidenced in Packer and Ballantyne (2005), who observe and compare how 40 solitary and 40 paired visitors engaged in exhibits. They also explore, through interviews, how the visitors consider their learning gains. The results show that both the solitary and paired visitors refer to learning benefits gained from visiting the exhibition, and the authors argue that these findings challenge the supposition that social interaction is more beneficial than a solitary experience for learning from museum visits. However, they do not discuss the potential for learning offered by interaction with artefacts. The solitary visitors presumably interacted with the available tools and artefacts in the exhibition and thereby experienced learning gains.

Davidsson and Jakobsson (2009) take this relationship between the visitor and the exhibit as a starting point for studying learning in exhibitions and suggest that this relationship could constitute the core of a model of how learning arises at STCs. Furthermore, Davidsson (2008) and Jakobsson and Davidsson (2012) argue that the concepts of mediation and appropriation could constitute important tools for increasing our understanding of visitors' learning. They suggests a *model of successive appropriation*, where factors such as the learners' previous experiences as well as exhibit features are considered in order to explore and explain visitors'

interactions with exhibits, curators, and with each other. The exhibit features include, for example, explicating the artefacts' cultural-historical background and intentional introduction of the artefact.

The choice of approaching learning from a sociocultural perspective also brings consequences for data collection methods. If considering that learning occurs during interactions, learning must be explored through actions and dialogues. For example, Ash, Crain, Brandt, Loomis, Wheaton and Bennett (2007) argue that the content of the conversation and dialogic processes need to be studied in tandem in order to fully understand collaborative scientific sense making. They have developed a theoretical framework in order to explore *biological talk over time* to be able to identify different science discourses. The results describe visitors' knowledge development concerning, for example, adaptation or reproduction. Also Evans, Mull and Poling (2002) emphasise the importance of studying visitors' dialogues in relation to displayed objects in museums. They argue that an object-based discourse could play a central role as it focuses on the participation of the object in the cultural and lived history of the visitor. This means that instead of assuming that objects somehow speak for themselves, visitors' actions and voices come to play a central role.

This discussion has mainly highlighted the paradigms of constructivist and sociocultural approaches to learning, although there of course exist other fruitful perspectives. It is, however, possible to conclude that there is increased awareness of the importance of using a theoretical perspective on learning when studying visitors' learning and informal settings. This also means that the relationship between the research questions and the choice of methodological approach tends to become more explicit. There seems to be an increase of studies during the last decade exploring visitors' dialogues and actions within the frame of a sociocultural perspective on learning. But what consequences could this shift of research paradigm bring and how will it affect our understanding of visitors' learning?

CONCLUSIONS: POSSIBLE FUTURE APPROACHES TO RESEARCH IN INFORMAL SETTINGS

The aim of this article has been to discuss research focusing on visitors' learning from exhibitions and the exhibition setting. Furthermore, this article has highlighted research paradigms and methodological approaches within the field of learning and informal environments. From the reviews by Rennie and McClafferty (1996), Hofstein and Rosenfeld (1996), Pedretti (2002) and NRC (2009), it is obvious that visitors hold positive attitudes towards STCs and the authors highlight the educational potential exhibitions carry. They furthermore point to several agendas for future research, such as exploring how science should be represented, what images of science are presented, how visitors perceive science in exhibitions, and how learning experiences from STC visits and school science could be blended effectively.

But in considering this paper as a progress report, it becomes apparent that some of these areas have been under scrutiny and debate during the last decade. For instance, the scientific content in exhibitions and different images of science has been explored by researchers such as Davidsson and Jakobsson (2007, 2012), Davidsson (2008) and Pedretti (2002, 2004), visitors' perception of the exhibition content has been studied by, for example, Rennie and Williams (2002, 2006). Furthermore, a number of studies have focused on school students' learning, in relation to field trips (e.g. Griffin, 2004; DeWitt & Osborne, 2007). But what trends can be seen in research about learning and informal settings? What possible future research agendas can be discerned from the different studies discussed in this progress report?

This article has discussed several problems springing from having an implicit, rather than explicit, methodological approach when exploring learning experiences from visits to STCs and museums. These problems are increasingly highlighted and there seems to be a rising awareness of these shortcomings. Looking forward, there is a continuing need for the adoption of an explicit theoretical starting point, as well as a need to build on and develop theoretical frameworks and analytic tools, in order to come closer to and increase our understanding of visitors' learning from exhibitions. From this review, there also seems to be a trend towards increasing usage of sociocultural frameworks and towards exploring visitors' actions and dialogues (e.g. Allen, 2002; Crowley & Jacobs, 2002). There remains, however, a shortage of studies, which include exhibition content and available artefacts in the analytic unit of visitors' actions and learning. A possible approach to include exhibition content, design, visitors' use of artefacts, interactions and dialogues could be that of studying the STCs' *learning ecology* (Bronfenbrenner, 1979; Rogoff, 2003).

In future studies, this could mean exploring how interaction affects visitors' learning and, in more detail, exploring how *the level of interactivity* influences learning. This may, for example, involve examining how visitors make use of available artefacts and to what extent and in what ways exhibits mediate actions and dialogues. It could also include investigation of how visitors make use of different language genres and discourses in order to create meaning about the exhibition content and appropriate scientific ideas. There is, furthermore, a need for a wider discussion about what constitutes visitors' learning outcomes. As early as 1990, Semper pointed out that exploration and play in learning processes are essential but often overlooked, and it seems that this remark is still valid today. What different forms of knowledge could be important for visitors' learning? How may we explore and evaluate experience-based, tacit, heuristic, sensitive, or action-based knowledge? How are visitors' agendas and preferences related to different forms of knowledge? What analytic tools do we need?

This article has also emphasised and discussed issues related to school trips and it is possible to conclude that there is still a need for more explicit communication between formal and informal institutions. In order to come closer to and circumvent these gaps, several studies have explored interactions between staff members, students and teachers (e.g. Kisiel, 2005; Tal & Morag, 2007). Other researchers

(e.g. DeWitt & Osborne, 2007) discuss frameworks that may serve as tools for increasing the interactions between schools and STCs. However, Griffin (2004) highlights the dilemma of unprepared field trips in relation to cognitive outcomes. That is, although teachers state that they prepare students for, and follow up after, the visits, these activities, to a large extent, tend to focus on logistical issues only. Thus, an important question for further investigation must be what constitutes this seemingly insufficient communication between STCs and schools? How do staff members perceive the work of teachers and what role does the teacher ascribe to the staff members before, during and after the visits?

Another area for future research concerns the scientific content of exhibitions, what images of science are communicated, and how visitors perceive science and socio-scientific issues in exhibitions. But, as seen above, this is not a new research field, as several scholars have discussed and explored these issues for several years (e.g. Davidsson, 2008; Janosek, 2000; Pedretti, 2002; Rennie & McClafferty, 1996). There are, however, on going disagreements around decisions about the development of an exhibition's characteristics and scientific content. For example, is there really an on going shift from displaying *the wonders of science* towards a *context museum*, or is *the usefulness of science* still a prevailing image? A future research agenda could therefore aim to develop analytic tools to describe and analyse the scientific content and design of exhibitions. Furthermore, it could also attempt to investigate underlying assumptions and explanations of the presented images of science.

This review has discussed recent research literature and pointed to some possible research agendas within the field of learning and informal settings. It is clear that science exhibitions carry educational potential and STCs have come to constitute important societal arenas for science communication and lifelong learning. However, if research about learning at STCs and museums is to contribute to increased understanding, there seems to be a need for deeper discussion about theoretical and methodological issues related to research in this field.

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”SPINDLARN I FALKÖPING” – EN STUDIE OM HUR DOCKAN SOM MEDIERANDE REDSKAP BIDRAR TILL UTVECKLING AV FÖRSKOLANS KOMMUNIKATIVA MILJÖ

Mirella Forsberg Ahlcrona

ABSTRACT

This article illustrates different communicative contents based on children's motivation and intention that through the puppet play speak and act linguistically. In the empirical section, the puppet consists and functions as a starting point for children's interaction and narratives. The research interest is directed towards children's ways of expressing the meaning of the puppet and motives that are generated in the interaction between the puppet and the children in their mutual play. The study result shows that children in interaction with the puppet broaden the linguistic environment in the preschool when they express their knowledge and experience belonging to other contexts than preschool.

Keywords: the puppet as a tool, communication, activity, narratives, mediation

STUDIENS BAKGRUND

Sedan 2007 har samtliga förskolor i Falköpings kommun ett språkombud på varje förskola. Under ledning av en specialpedagog och logoped från Specialpedagogiskt Centrum träffas språkombuden två gånger varje termin och behandlar ett språkligt tema genom föreläsningar, workshops eller besök på olika förskolor. Som ett led i detta arbete tillfrågades författaren att presentera sin avhandling *Handdockans kommunikativa potential som medierande redskap i förskolan* (2009). Föreläsningen introducerade olika typer av dockor ur ett didaktiskt perspektiv samt dockans kommunikativa potentialer i förskolans verksamhet. Efter presentationen, initierades förslaget att involvera språkombuden och andra intresserade kollegor i ett forskningsprojekt. Projektet skulle ha praktisknära förankring, ta utgångspunkt i förskolans reviderade läroplan och undersöka barns användning av dockan som ett sätt att utveckla sitt språk och olika former av kommunikation, exempelvis genom att berätta, sjunga eller dansa med dockan. Studien introducere-

MIRELLA FORSBERG AHLCRONA

fil. dr i pedagogik,
Institutionen för information och kommunikation,
Högskolan i Skövde
Box 408, 541 28 Skövde
E-post: mirella.forsberg.ahlcrona@his.se

rades under våren 2010 vid två tillfällen. Vid första tillfället deltog kommunansvariga och de intresserade lärarna. Vid andra tillfället deltog enbart de medverkande lärarna – då tillverkade varje lärare sin egen marionettdocka i form av en spindel samt instruerades i speltekniken och metoden. I studien medverkade 15 förskollärare samt 51 barn i åldrarna 2 till 6 år, varav 32 flickor och 19 pojkar.

SPRÅKUTVECKLING OCH KOMMUNIKATION I FÖRSKOLAN

Utveckling av barns språk och kommunikation är en viktig del av förskolans uppdrag. Dagens förskola, med sin verksamhet för barn i åldrarna ett till fem år, utgör en egen skolform som enligt Statistiska centralbyrån (2011), omfattar 94 % av alla barn mellan två till fem år i Sverige. Barn i förskolan utvecklar sina språkliga erfarenheter huvudsakligen genom verbala samspel och olika skapande former till exempel bild, musik, rörelse, drama och hantverk. Genom att barn i förskolan ingår i varierande sociala sammanhang som behöver beskrivas och förklaras, kan barn på så sätt systematiskt utveckla olika språkliga innehåll som ett led i sin språkliga socialisation – till exempel lär sig barn förstå vad frukost, samling, utelek, vila eller sagostund i förskolan är för något, vad som händer där men också på vilket sätt språket används och kommuniceras i dessa sammanhang (Gjems, 2006, 2009; Johansson & Pramling Samuelsson, 2003). Kommunikation och samspel i förskolan utvecklas genom innehållet i verksamheten och genom de förhållningssätt som innehållet mellan lärare och barn kommuniceras. Kommunikation och samspel är därmed beroende av lärarens medvetenhet när det gäller vilka språkliga miljöer barn behöver möta i förskolan för att kunna lära sig språk, eller på vilket sätt aktiviteterna organiseras som får barn att aktivt använda språket för att lära (Björklund, 2008; Gustavsson & Mellgren, 2005). Kommunikation i förskolan kan också betraktas som ett uttryck för demokratisk fostran eller som en möjlighet för barn att utöva demokratiska värden i vardagen – att ta ansvar, att visa omsorg och att visa respekt (Emilson, 2008; Karlsson, 2009). Barns språkliga förmågor, kunskaper och färdigheter utvecklas således i förskolan utifrån de möjligheter, relationer och normer som lärarna skapar i olika sammanhang och i olika miljöer (Alvestad, 2012; Bergöö & Jönsson, 2012; Nordin-Hultman, 2005; Sheridan, 2001). I denna

artikel riktas uppmärksamhet dels mot barns användning av en marionettdocka i form av en stor spindel, dels mot det innehåll som genereras och framgår av det verbala samspelet.

FÖRSKOLANS LÄROPLAN LPFÖ98/2010

Barns språkliga och kommunikativa förmågor och färdigheter grundläggs tidigt och därmed också de viktiga förutsättningarna för individens framtida språkliga och kommunikativa utveckling i förskolan och skolan. I förskolans läroplan Lpfö98/2010 (Skolverket, 2010) betraktas kommunikation som olika uttrycksformer, som tal- och skriftspråk men också som ett redskap för barns fostran, utveckling och lärande. Således utgör språk och kommunikation i förskolan på samma gång både mål och medel för individens lärande, kunskapsutveckling och socialisering. I samband med att läroplanen för förskolan reviderades, förtydligades målområden när det gäller barns språkliga och kommunikativa utveckling, matematik, naturvetenskap och teknik. Förskolans läroplan ger lärarna i uppdrag att utveckla barns språk och kommunikation genom skapande och olika samspeletsformer, dock utan vägledning för hur detta ska genomföras eller vad dessa former kan innehålla. Därmed lämnas ansvaret åt varje enskild lärare att i samverkan med andra lärare i arbetslaget utforma ett arbetssätt och söka ett innehåll som leder till att barn lär språk och kommunikation i olika sammanhang (Johnston, 2012; Sheridan & Pramling Samuelsson & Johansson, 2009).

Nedan presenteras en jämförelse mellan textens innehåll från tidigare Lpfö98 och den nuvarande Lpfö98/2010 där det som förtydligas efter revideringen är markerat med fet stil. Förtydligandet anger det 'nya' som förskolans verksamhet förväntas innefatta i de aktiviteterna som grundlägger och utvecklar barns språkliga förmågor, färdigheter och kompetenser.

Barns språkliga och kommunikativa utveckling i förskolan

Tidigare mål

Förskolan ska sträva efter att varje barn

..utvecklar sin förmåga att lyssna, berätta, reflektera och ge uttryck för sina uppfattningar..

..utvecklar ett rikt och nyanserat talspråk och sin förmåga att kommunicera med andra och att uttrycka tankar och..

..utvecklar sitt ord- och begreppsförråd och sin förmåga att leka med ord, sitt intresse för skriftspråk och för förståelsen av symboler samt deras kommunikativa funktioner.

Förtydligade mål

Förskolan ska sträva efter att varje barn

*..utvecklar sin förmåga att lyssna, berätta, reflektera och ge uttryck för sina egna uppfattningar och **försöker förstå andras perspektiv..***

*..utvecklar ett nyanserat talspråk, ordförråd och begrepp samt sin förmåga att leka med ord, **berätta, uttrycka tankar, ställa frågor, argumentera** och kommunicera med andra..*

*..utvecklar **intresse för skriftspråk samt förståelse för symboler och deras kommunikativa funktioner och utvecklar intresse för bilder, texter och olika medier samt sin förmåga att använda sig av, tolka och samtala om dessa..***

I sin helhet uttrycker den reviderade läroplanen ett perspektivbyte i synen på förskolans uppdrag och verksamhet – från det tidigare önskvärda till det nuvarande förväntade, det vill säga, en verksamhetsutveckling som inkluderar ett tydligare didaktiskt förhållningssätt i lärarnas vardagliga arbete. Detta innebär att lärarna i arbetslaget förväntas diskutera hur man exempelvis skapar och organiserar engagerande språkliga sammanhang där barn får möjlighet att argumentera eller öva sig att förstå olika perspektiv. Läroplanens förtydligade mål, när det gäller barns språkliga och kommunikativa utveckling i förskolan, riktar uppmärksamhet på betydelsen av att lärarnas ämneskunskaper i språk och kommunikation vidareutvecklas samt att innehållet i aktiviteterna utifrån frågeställningar *vad* och *varför*, fördjupas (Skolinspektionen, 2012).

DOCKAN SOM MEDIERANDE REDSKAP I FÖRSKOLAN

Betraktat ur ett historiskt perspektiv har dockans kommunikativa egenskaper brukats i olika syften och inom olika verksamheter, så som teater, utbildning, terapi och politik (Blumenthal, 2005; Hamre, 1992; Helgesen, 1999; Kaplan, 2005). I ett internationellt perspektiv är användningen av olika typer av dockor (handdockor, stavdockor, tråddockor/marionetter) i utbildningssammanhang en väletablerad didaktisk metod (Bernier & O'Hare, 2005; Brédikytè, 2000; Brown, 2005; Glibo, 2000; Max Prior, 2009). En docka som redskap är ett materiellt föremål, en artefakt, i vilken olika speltekniska tillvägagångssätt är inbyggda, men däremot inte innehåll eller mål med dockans användning. I jämförelse med andra föremål är dockan inte vilken artefakt som helst, eftersom den genom att visuellt agera som om den var en talande och tänkande varelse, i sin form och med sitt kroppsspråk, kan förmedla och mediera varierande betydelser. Mediering i det här fallet innebär 'förmedlad handling' och är länken med vars hjälp tänkande och föreställningar skapas och växer fram. Till exempel representerar en docka i form av en häxa inte enbart sig själv, utan samtidigt inbegriper i sin gestaltning också olika kulturella föreställningar om häxor. En clowndocka leder våra tankar till cirkus medan en robotdocka medierar andra föreställningsvärldar och därmed kan erbjuda andra kommunikativa innehåll och möjligheter. En docka som kommunicerar med betraktaren kan under spelets gång ge upphov till tankar, känslor och handlingar. Användning av dockan som redskap kan därmed skapa nya och utökade intellektuella och praktiska möjligheter för att förstå och handla i omvärlden (Wertsch, 1985; Vygotskij, 1978; Säljö, 2005). Min tidigare forskning har fokuserat på dockans användning och medverkan i förskolans vardag. Av resultatet i min avhandling om dockans kommunikativa potentialer i förskolan (Forsberg Ahlcrona, 2009) framgår det att dockan som redskap tillför följande kommunikativa möjligheter och potentialer för barns utveckling och lärande:

Dockans relationella potential innebär att barn i förhållande till dockan utvecklar affektiva värden, konstruerar kommunikativa handlingar utifrån kunskapsmässiga och känslomässiga motiv samt överskrider gränser mellan faktiska och föreställda världar.

Dockans språkliga potential innebär att barn i kommunikationen med dockan medierar egna kulturella och sociala erfarenheter, uttrycker sina föreställningar om kunskap och lärande samt utvecklar språkets indikativa, semiotiska och retoriska funktioner.

Dockans handlingsmässiga potential innebär utveckling av en tredelad relation som även kan beskrivas i termer av 'den närmaste utvecklingszonen' och 'ömsesidig assistans'. Dockans handlingsmässiga potential framträder också i barns lek genom nya sociala konstellationer och kreativa handlingar.

Användning av dockan i förskolan representerar på ett symboliskt plan en självständig konstform – dockteatern, vilken i sig inkluderar flera former och uttryckssätt så som monolog, dialog, dans, bild och hantverk. Berättande, poesi och dramatiserande med dockan i förskolan kan betraktas dels som former för sociala interaktioner, dels som olika språkliga innehåll och meningsskapande (Forsberg Ahlcrona, 2012a, 2012b). Denna artikel fokuserar på användning av en spindeldocka och hur den kan fungera som en utgångspunkt för barns spontana fysiska och verbala handlingar. Detta mot bakgrund av att läraren först presenterar och introducerar marionettdockans grundläggande speltekniska möjligheter.

GENREPEDAGOGIK OCH ETT SPRÅKUTVECKLANDE ARBETSSÄTT I FÖRSKOLAN

Genrepedagogik handlar om modern språkundervisning, mer preciserat om skrivpedagogik, och handlar dels om textens olika framställningsformer, dels om olika texttyper (Gibbons, 2006). Olika texttyper beskrivs av Kuyumcu (2010) som specifika språkhändelseformer:

- Berättande
- Återgivande (av händelser och egna erfarenheter)
- Beskrivande
- Instruerande
- Utredande
- Argumenterande
- Förklarande

Ovan nämnda språkhändelser utgör och representerar australiensisk modell kallad Sydneyskolan, utvecklad i samarbete mellan forskare och lärare. Denna pedagogiska inriktning definierar genre som en strukturerad, målinriktad och social process. Språket, som social process, ses som systematiskt relaterat till kontexten och ger upphov till olika textmönster/berättande/framställning, beroende på det sociala syftet – exempelvis börjar en saga vanligtvis med *Det var en gång för länge sedan*, medan en informativ text om fiskar kan börja med *Fiskar lever i vattnet, och andas med gälar*. Ett innehåll som handlar om att återberätta något som vi varit med om, börjar vanligtvis med *Förra veckan när jag åkte till landet då hände det att...* eller *I helgen när vi var på kalas glömde jag presenten hemma*. Textens framställning handlar således inte enbart om hur framställningen börjar utan inkluderar även vilket språk och berättandeform som ingår och passar in i sammanhanget. Att

barn tidigt lär sig urskilja olika texttyper/berättande i olika sociala sammanhang medför att läsande och förståelse av detsamma, senare i skolan, framstår för de som tydligare att kunna tolka, dra slutsatser och värdera innehållet (Nauclér, 2000; Olofsson, 2010). I skolan handlar genrepedagogikens språkhändelse om skrivpedagogik och om olika texttyper. I förskolans sammanhang skulle lärarnas kunskaper om detsamma kunna bidra till ett tydligare avgränsat berättandeinnehåll i verksamheten. 'Spindlarna i Falköping' är ett försök att upptäcka ifall innehållet i barns spontana samspel med dockan har formen av språkhändelser och i så fall identifiera vilka språkhändelse det handlar om.

SYFTE OCH FRÅGESTÄLLNINGAR

Studiens övergripande syfte har varit att initiera och undersöka förutsättningar för utveckling av den språkliga praktiken i förskolan, med hjälp av dockan som medierande redskap och utifrån ett didaktiskt perspektiv:

- På vilket sätt kan dockan som redskap utveckla den språkliga miljön i förskolan?
- Vilka språkhändelser kommer till uttryck i samspelet med dockan?

METOD OCH GENOMFÖRANDE

I samband med att förskolans läroplan Lpfö98/2010 reviderades och förskolan blev enligt Skollagen (2010) egen skolform, infördes *undervisning* som ett nytt begrepp i förskolans verksamhet. Lev Vygotskij (1986) betraktar utbildning som en möjlighet att skapa nya former av tänkande genom undervisningens sociala organisation där relationen mellan lärare och barn innebär en specifik form av samarbete. I denna studie gjorde det didaktiska perspektivet i dockans användning (*vad* barn ska göra med dockan, *hur* de ska göra det och *varför* ska de göra det), möjligt för lärarna att strukturera aktivitetens ramar, att utgå från barns visade intresse och stödja barn som aktiva aktörer.

Studiens dataunderlag består av inspelad kommunikation mellan barn och lärare. Varje barn spelades in vid tre olika tillfällen då studien genomfördes i tre steg för att på olika sätt undersöka innebörden av barnets eget samspel med dockan, det vill säga betydelsen av den egna erfarenheten för den språkliga produktionen och för utvecklingen av den språkliga miljön i förskolans verksamhet. Sammanlagt genomfördes 153 intervjuer/inspelningar. Efter varje avslutat steg transkriberades texten ordagrant av den medverkande lärare. Meningen med lärarnas aktiva del i transkriberingen var dels att lärarna på ett mer tillförlitligt sätt kunde urskilja, uppfatta och dokumentera respektive barns fysiska och verbala handlingar, dels att lärarna fick möjlighet att arbeta med sin dokumentation utifrån ett vetenskapligt förhållningssätt. Aktiviteter med samtliga steg skulle, om möjligt, genomföras under en och samma vecka med en dags mellanrum för att barnens upplevelser av spindeln skulle hållas sammanhängande och aktuella.

Varför en marionettdocka och varför just spindeln? En enkel marionettdocka med enbart en tråd är lätt att hantera för en nybörjare. Hanteringen av en mer avancerad docka, utan tidigare övning, tar vanligtvis spelarens fokus från själva skapandet av det potentiella språkliga innehållet. Av resultatet i min avhandling framgår det tydligt att barnens färdighet och förmåga att bemästra spelteknikens regler hade direkt betydelse för variation i spelet med dockan och för dockspelets innehåll. Valet av spindeln som en 'person' beror på att spindlar tillhör de djur som barn, på olika sätt, har konkreta erfarenheter av, men som också förekommer i ramsor, sånger och berättelser inom ramen för förskolans verksamhet.



STUDIENS TRE STEG

I det första steget fick barn titta på och beskriva ett fotografi med lärarens spindeldocka som motiv. Följande frågor ställdes till barnet:

Lärare: Titta noga på bilden en stund. Berätta om den. Vad kan du se i bilden?

Uppföljningsfråga: är det något annat som du kommer att tänka på när du ser spindeln?

I det andra steget presenterades spindeldockan av läraren och introducerades genom grundläggande spelteknik enligt följande:

Lärare: Här i lådan finns en spindel och när jag har sjungit klart en sång som spindeln gillar, då kommer den upp ur lådan. Du kan sjunga du med, om du vill: 'Spindel i lådan, spindel i lådan, vad har du för dig, sover du? Kokar du kaffe, borstar du skorna, spindel i lådan kom fram tjo hej!'

Spindel hoppar upp och landar framför lådan.

Lärare: Nu vill jag visa för dig vad den kan göra, vill du se det?

Spindeln hoppar in i lådan och ut ur lådan, framåt, bakåt, i sidled (höger och vänster sida), gungar i luften fram och tillbaka, lyfts upp och ner (landar i lådan) och den snurrar så här (lyfter ovanför lådan – snurrar- och sänks ner i lådan igen).

Lärare: Nu har jag visat för dig vad spindel kan göra. Vill du själv leka med spindeln?

I det tredje steget upprepades samma procedur som i steg ett – läraren visade samma bild med spindeln för barnet, och upprepade samma frågor.

Sammanfattningsvis, handlar steg ett och tre om en dialog där bilden av spindeln visas och barn frågas att berätta för läraren om sina associationer när de ser spindeln på bilden. Steg två handlar om att barn efter lärarens introduktion av speltekniken

själva använder dockan spontant och utifrån egna intressen. Kommunikationen som sker mellan barn och dockan är spontan och av improvisatorisk karaktär. I denna artikel redogörs för, och fokuseras på barns användning av dockan samt det verbala samspelet i den gemensamma kommunikationen, efter att läraren presenterat dockan, alltså det som händer och utspelar sig i steg två.

TEORETISK RAM OCH ANALYS

Studiens syfte har varit att initiera och undersöka förutsättningar för utveckling av den språkliga praktiken i förskolan med hjälp av dockan som medierande redskap, utifrån ett didaktiskt perspektiv, inspirerat av genrepedagogiken. Spindeldockans kommunikativa förutsättningar att utveckla förskolans språkliga miljö analyseras utifrån de verbala och de fysiska handlingar som genereras i samspelet mellan docka, barn och lärare. Olika motiv som uppstår i växelverkan och dynamiken mellan barn och dockan i den ömsesidiga kommunikationen analyseras med stöd i det verksamhetsteoretiska perspektivet (Leontiev, 1977). Användning av redskap ur ett verksamhetsteoretiskt perspektiv betraktas som en individuell verksamhetsprocess och en subjektiv handling. Leontiev menar att individen genom sin verksamhet skapar relation till omvärlden och sätter motiven i relation till varandra. Därmed skapas vissa *meningsgivande*, kunskapsmässiga motiv och vissa *stimulerande*, känslomässiga motiv. Det framgår av resultatet att dockans rörelsemöjligheter hade olika stimulerande inverkan på barnens eget sätt att fysiskt förstärka den språkliga kommunikationen. Vidare, att barn engagerades på olika sätt av spindeldockans fysiska egenskaper och kunde vidga berättarsammanhang genom att inkludera erfarenheter utanför förskolans kontext. Medan motiv skapar verksamhetens inriktning, skapar handling enligt Leontiev (1977) de målinriktade processerna, alltså vad som ska uppnås – den intentionella aspekten, och hur det kan uppnås – den realiserande aspekten. Leontiev påpekar att målinriktade processer inte handlar om att uppnå ett förbestämt mål, utan om de betingelser och tillvägagångssätt som handlingen upplevs och realiseras på. Efter lärarens introduktion av spelteknikens regler kunde barn använda dockan utifrån eget intresse men också fylla samspelet med olika innehåll. Först i kontakten med dockan upptäckte barn dockans dolda egenskaper och i den ömsesidiga speldynamiken uttryckte barnen sin personliga mening genom kunskapsmässiga och känslomässiga motiv. Beroende på att relationen som skapas i växelverkan mellan individen och föremålet är subjektiv, innebär målinriktade processer en dynamik som upplevs olika hos olika individer. Till exempel upplevde barn i studien användning av, i princip, samma spindeldocka på olika sätt beroende på vilken dynamik som uppstod i växelverkan i spelet med dockan.

Motiv utvecklas och förändras ständigt genom att individen samspelar med verkligheten och ju fler verksamheter individen ingår i, desto fler motiv kommer att uppstå och fler kunskapsmässiga och känslomässiga motivkedjor knyts samman, menar Leontiev (1977). I studien om förskolan och den pedagogiska miljöns betydelse för barns identitets- och subjektsskapande, uttrycker Nordin-Hultman (2005, s. 172) liknande tankar då hon säger att 'man får motiv och intentioner därför att

man handlar, inte bara att man handlar därför att man *har* motiv och intentioner'. Skillnaden mellan innebörden av att *få* motiv och att *ha* motiv borde vara en återkommande diskussionsfråga bland lärare i förskolan. Genom analysprocessen har det också varit möjligt att urskilja och kategorisera innehållet i barns samspel med dockan enligt genrepedagogikens språkhändelser (Kuyumcu, 2010). De språkhändelser som har identifierats utgör resultatdelens rubriker.

RESULTAT

Studien visar att barns kommunicerande med dockan sker avsiktligt, att de uppmärksammar, undersöker, samtalar, berättar och delar med sig av sina kunskaper och erfarenheter från olika kontexter. Nedan presenteras steg två där barns egna samspel med dockan ges största utrymme att improvisera och ge uttryck för kunskapsmässiga och känslomässiga motiv. Exempelen har valts utifrån att de även illustrerar olika språkhändelser i barns spontana och improviserade spel med dockan.

Steg två handlar om att genomföra uppgiften i tre etapper. I det första presenterade läraren spindeldockan genom en omarbetad sång. I det andra introducerades dockans rörelsemöjligheter genom spelteknik. I det tredje har barnet erbjudits att själv hantera dockan. Det framgår av presenterade exempel att barnen var aktiva och tog initiativet när det gällde att berätta, beskriva, förklara och agera utifrån sina intressen. Lärarnas roll var allmänt stödjande och uppmuntrande men inte språkligt utmanade eller vidareutvecklande. Barnens erfarenheter utanför förskolans ram fick större utrymme genom att barnen fick möjlighet att berätta fritt. Resultatet visar på att flera språkhändelser är representerade genom barns spontana berättande.

DEN FÖRSTA ETAPPEN - FÖRKLARA OCH ARGUMENTERA

När lärarna inledningsvis visade och presenterade sina spindlar, förklarade flera barn att det var spindel från bilden eller att den inte var på riktigt. Vissa ställde frågor om spindelns förmodade egenskaper eller associerade till annat som hade med spindelns rörelse att göra.

Det där är ingen riktig. Den där har du bara byggt. Jag vet att du har gjort den själv. Vet du vad jag har sett på tv, jag har sett något av spindel något väldigt roligt, han tog en det va en klubba från en (visar mig hur en bandyklubba ser ut) klubbpetaren (Skaft? Den som man håller i?). Ja och sen gjorde han nät och sen blev det en gunga (Smart spindel. Vet du vad, vill du prova spindel?). Jaa det vill jag. Men vet du mamma är rädd för spindlar. Vet du vad Wild Kids vågar, ha spindel på magen. Det vågar dem.

Det var den där spindel vi hade på kortet. Den kan springa xzxz i väggen och hoppa hit och gömma sig bakom lådan och hoppa i lådan. Den blir yr i huvet. Åksjuk! Om man pratar väldigt mycket och då blir man det.

I sina förklaringar och argumenteringar uttrycker barn erfarenheter från det tidigare konkret upplevda i kombination med det som de sett på tv. På samma gång delar de med sig av sina kunskaper som avser spindelns rörelse och andras känslor, till exempel att mamma är rädd för spindlar.

DEN ANDRA ETAPPEN - FÖRKLARA OCH AGERA

När det gäller situationen där barn förväntades berätta vad de själva gör med dockan, klarade flera barn inte av att förena handling och språk samtidigt. Barnen styrde dockan men lärarna fick beskriva vad och hur den gjorde. Till exempel nu hoppar den, snurrar, flyger, går, springer, eller nu är spindeln under bordet, i lådan, framför lådan, på soffan, på kudden, i fönstret osv. I den här etappen använder barn spindeln även som ett hjälpmedel för att illustrera, argumentera och understryka delar av sin egen berättelse.

Han gungar (gungar den fram och tillbaka). Han kan gå (går utmed bordet med spindeln). Han kan hoppa (hoppa upp och ner med ganska yviga rörelser). Nu studsollar han (för spindeln i jätterörelser upp och ner från bordet). Nu skall han klippa gräset (drar spindeln över bordet).

Han kan hoppa högt. Han kan hoppa lågt. Och han kan hoppa över bandspelaren till soffan och över igen. Han kan hoppa i. Han kan hoppa och snurra runt i lådan och dansa lite. Dans, dans, dans, dans, dans, dans, dans, dans, daans.

Och sen kan han hänga och göra spindelnet för att fånga flygor. Och det gör han nu (mumlar lite) sen hänger där nära marken och sen ner för spindelneten. Sen...sen snurrar runt på marken dunn, dunn dunn, dunn och sen kan den meta fisk med sin spindeltråd och han fångar väldigt stora fiskar till lunch för det är en stor spindel. Och sen kan den hoppa och snurra runt och hoppa så här högt upp (ställer sig upp och sträcker handen högt upp i luften) och hoppa ner så här och snurra runt. Han kan gunga mellan grenar så här...han kan se väldigt bra för han kan snurra runt och se och sen kan han fånga flugor. Det är väldigt, väldigt lätt för honom för han väver runt för han väver en spindeltråd så här...

Och sen han, ibland så går han till en lekplats och åker rutschelkana och gungar och klättrar i klätterställning (Vad mycket din spindel kan göra). Ja, och ibland så, så reser han i flygplan för han är rik, han har mycket pengar och ibland åker han till öknen och stannar där i två veckor. Sen kan han också åka båt till Tyskland men, för att han, för han tjuvkliver ombord båten och sätter sig på taket, för så där gör han ibland men ibland gör han spindelnet och gör så han hänger ovanför vattnet. Så här... Det är en busig spindel. Sen kan han inget mera än och, än och forma spindelneten till en vack, vacker tavla och, och sen ska han, och sen sätter han sig i sitt hus och nu hoppar han ner igen.

Exempelen visar på hur växelverkan mellan spindelns fysiska egenskaper påverkar den språkliga produktionen genom att kunskapsmässiga och känslomässiga motiv kompletterar varandra. Samtidigt som barn upptäcker och bekräftar spindelns speltekniska egenskaper skapas en förklarande berättelse som sträcker sig utanför förskolans kontext och synliggör erfarenheter som är en blandning av olika händelser – faktiska eller föreställda.

DEN TREDJE ETAPPEN - UTREDA OCH BERÄTTA

Då barnen fick prova på att själva använda spindeldockan följde de flesta rörelser som läraren tidigare presenterat. I kontakten med dockan blev dockans fysiska egenskaper föremål för barns fördjupade intresse på ett sätt som lärarna inte räknat med. I följande exempel undersöker barn dockans beskaffenhet verbalt och konkret och därmed initierar en omvänd situation i samspelet med lärarna där det är

barnet som ställer frågor, medan läraren förväntas svara och beskriva sitt kunnande. Det är barnens intresse för dockan som är både utgångspunkt för, och innehåll i det gemensamma samtalet.

Var det den du gjorde? Ja, den har jag gjort. Men hur har du gjort dom här benen? Dom har jag klistrat fast med en sån limpistol. Hur har du fått fast dom här? Och dom har jag klistrat fast också, dom här små träkulorna och så har jag målat dom. Är det hål här under också? Var det hål där? Jaha på kulorna. Jag tror inte det. Hur har man satt fast den? Den har man trätt upp igenom där och sen har man limmat lite. Med nål. Jaha, tagit den här nerifrån? Mmm och tagit upp den och klistrat lite så att den verkligen ska sitta fast. Ja det syns att det är en liten svart knut där. Ja och så har jag knutit där uppe med. Men var kommer den här bollen ifrån? Den bollen har jag fått av en kvinna som heter Mirella. Hon som tyckte att vi skulle göra dom här intervjuerna. Hon hade såna bollar. Fick du dom då? Mm. Tyckte hon att du skulle ha en spindel då? Ja. Hon tyckte att jättemånga skulle göra spindlar och prova.

Vad är huvudet gjort av? Kan du känna vad det är? Jag tycker det känns som det är gjort utav gummi. Ja det är det också Carl. Det är gjort av skumgummi. Skumgummi. Ja. Vad är fött... är fötterna gjorda utav små ... stora... små stora bräddor? Små stora bräddor? Ja... de är gjorda av trä. Vad är benen gjort av? De är gjorda av piprensare. Mm, det ser ut som det är gjort. Är ögonen gjort utav porslin? Nej, de är gjorda av plast. Plast! (knackar på ögonen) Det känns! Varför är det en tråd? Ja, hur kan det komma sig? Vad tror du spindeln har tråden till? Han kanske ska klättra upp. Ja, det kanske han ska! Ska du se om han kan? Ja! (Carl lyfter spindeln högt upp i luften, använder inte tråden). Det kunde den! Ja, det kunde den. Fast... det är ingen riktig spindel. Nä, det är ingen riktig spindel. Vi hittar ju bara på. Ja vi hittar ju bara på. Ja!

Exemplen illustrerar hur barn genom att specificera sina frågor söker förklaringar och kunskap. Frågorna är av utredande karaktär och i dialogen som uppstår fungerar dockan som en gemensam utgångspunkt för kommunikation. Genom att konkret undersöka spindelns fysiska egenskaper och i kombination med lärarnas svar får barn motivation att fråga vidare.

DISKUSSION

Studien visar att dockan som redskap har förutsättningar att utveckla den språkliga miljön i förskolan samt att olika språkhändelser kommer till uttryck i samspelet med dockan. På samma gång synliggör samspelet mellan lärare, barn och docka att lärarrollen behöver utvecklas när det gäller att kunna utveckla spontana kommunikativa sammanhang. Detta innebär bland annat att vara handlingsklar i möten med barnens erfarenheter, intresse och behov, en förmåga som Silwa Claesson (2009) kallar 'som-seende' det vill säga förmågan att fånga upp barns spontana uttryck och låta dessa utgöra en del av verksamheten. Lärarens medvetenhet och förmåga att organisera olika innehåll/språkhändelse blir därför betydelsefull för ett språkutvecklande arbetssätt. I sin licentiatuppsats *Nuets didaktik*, undersöker Agneta Jonsson (2011) hur förskolans lärare talar om läroplanen när det gäller de yngsta barnen. Resultatet visar att 'en omsorg om barnet går före och ibland går parallellt med vikten av att lära sig' (s.101). Små barn beskrivs som kompetenta men samtidigt behöver skyddas från sådant som exempelvis sker i skolan. Vidare

konstaterar Jonsson att barns omedelbara intresse och behov tycks mer styrande i verksamheten än de styrdokument som, mer eller mindre, finns närvarande i lärares medvetande. I denna studie framgår det att barnens spontana och improvisatoriska berättande har förutsättningar att utvecklas på ett mer strukturerat sätt genom att lärare exempelvis ställer nyfikna frågor. I följande dialog mellan en lärare och ett barn illustreras hur lärarens sätt att ställa frågor påverkade barnets motivation att använda spindeln.

- Vad vill spindeln göra tro?

Totte tar spindeln och försöker snurra den men lyckas inte få den att snurra som han vill. *Näää*. Han är inte nöjd över resultatet. Han börjar hoppa med spindeln istället på bordet upp och ner gång på gång under tystnad. Han är mycket fokuserad på rörelserna. Kan han hoppa någonstans? *In i lådan*. Totte hoppar in med spindeln i lådan. Totte tar locket och försöker lägga på det. Vad händer nu då? *Tänger lådan. Pindeln ska gå hem nu*. Skall spindeln gå hem nu? *Jaa*. Kommer inte spindeln ut mer nu? *Joo*. Totte lyfter ur spindeln och säger *Pindeln gör nu då. Han klättrar upp på trån*. Klättrar han upp för trån? *Mmmmm*. Du kanske kan sjunga för honom? *Mmmmm*. Totte tar spindeln och gör rörelser i form av någon slags klättring alltmedan han sjunger Imse vimse spindel. Han sjunger ordagrant hela texten för spindeln och ser nöjd ut.

Det framgår av den beskrivna situationen att dockans estetiska utformning har potentialer att med stöd och uppmuntran av lärarens vägledning, utveckla barnets språk och berättarstruktur – under förutsättning att barnet i sitt berättande får hjälp med att integrera egna idéer med förmågan att redogöra för dessa på ett begripligt sätt. I denna studie utgör barns spontana kommunikation i samspelet med dockan ett viktigt incitament för utveckling av den språkliga miljön i förskolan genom att barn uttrycker sina kunskapsmässiga och känslomässiga motiv i samspelet med dockan och läraren.

FÖRSKOLANS DIDAKTIK OCH DIDAKTISKT LEDARSKAP

Förskolans didaktik till skillnad från ämnesdidaktik, låter sig inte beskrivas på ett enkelt sätt eftersom verksamheten tar sin utgångspunkt i barnens erfarenheter, intressen och behov. Komplexiteten utgörs också av verksamhetens aktivitetsstruktur som består av övergångar mellan spontana och strukturerade aktiviteter, lek tillsammans, gruppens gemenskap och individens relation till gruppen. Förskolans didaktik handlar snarare om hur samspelet mellan teoretiska och praktiska kunskaper kommer till uttryck genom lärarens mer eller mindre medvetna handlingar. Till exempel uttrycks den i en medvetenhet om att det barn ska lära sig måste också vara integrerat med hur barn lär, det vill säga genom nyfikenhet, intresse och engagemang. Detta förutsätter en lärare som på ett medvetet sätt både planerar, inspirerar och motiverar barns spontana lärande, medverkan och delaktighet (Johansson & Pramling Samuelsson, 2003, 2006; Sheridan & Pramling Samuelsson & Johansson, 2009).

Ett didaktiskt förhållningssätt och ledarskap uttrycker således på vilket sätt läraren uppfattar och använder sitt handlingsutrymme – alltså vad man faktiskt gör i förhållande till givna ramar och resurser inom förskolans specifika sammanhang. Ut-

veckling av lärarens didaktiska ledarskap i förskolans praktik förutsätter, enligt min mening, en fördjupad diskussion om lärarrollens uppdrag och yrkets olika delar, nämligen om lärarens förtrogenhet med läroplanen, om aktiviteter och innehåll som den ansvarar för, om miljö och material som erbjuds till barn att ta del av och samspela med, samt om olika former av dokumentation (Forsberg Ahlcrona, 2012a).

I samband med att förskolans läroplan reviderades, diskuterades/befarades huruvida förskolan håller på att 'skolifieras' mot bakgrund av läroplanens förtydligade målområden och i kombination med begreppet undervisning. Enligt Skolverket ska dessa målområden inte betraktas som ämne utan som ett innehåll med mål att sträva mot. Förskolan, till skillnad från skolan, har enbart mål att sträva mot för sin verksamhet. Vad innebär detta i praktiken? Vad uppnår en verksamhet utan mål att uppnå? Och vad innebär detta för utveckling av förskolans didaktik?

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INTERPRETING THE CURRICULUM – MATHEMATICS AND DIDACTIC CONTRACTS IN SWEDISH PRESCHOOLS

Laurence Delacour

SAMMANFATTNING

Syftet med artikeln är att belysa hur en vidgad matematikdidaktik kan ta form på några svenska förskolor. För att analysera hur några förskollärare omformar, preciserar och konkretiserar de matematiska målen i förskolans läroplan, med fokus på didaktiska frågor rörande innehåll - vad är matematik för yngre barn? och form - hur kan matematik kommuniceras, placerar jag min studie inom ramen för ett läroplansdidaktiskt perspektiv. Matematikdidaktiskt influeras jag av situationsteori och didaktiskt kontrakt är ett huvudbegrepp i analysen. Termen didaktiskt kontrakt ses som en metafor för uppsättningen av implicita och explicita regler för social och matematisk interaktion i en barngrupp. Jag använder en vidgad definition av det didaktiska kontraktet för att belysa hur förväntningar på relationen mellan lärare, barn och matematik framträder i talet om och transformeringen av de matematiska målen, med fokus på de didaktiska frågorna vad och hur. Sammantaget samspekar huvudbegreppen transformation och matematikdidaktiska kontrakt i texten. Analysen är då inriktad på hur samhällsrelaterade förväntningar som uttrycks i nationella matematiska mål transformeras och framträder i form av didaktiska kontrakt i några förskolepraktiker.

Nyckelord: förskola, matematik, läroplan, didaktiskt kontrakt

INTRODUCTION

In recent years, both national and international comparative studies have emphasised mathematics. Moreover, several studies (Organisation for Economic Cooperation and Development [OECD], 2010) show that students in both Europe and the United States, have difficulties with mathematics. In particular, attention has turned to preschools. The Swedish government believes that the preschool has not fully made use of children's desire to learn (Cabinet Office, 2010). According to Tallberg-Broman (2012), there is a paradigmatic shift in Sweden today, and a new vision of children, parenting and the school's missions is emerging. Since preschool teachers are supposed to guide children in an increasingly complex reality, currently as well as in the future, the demands on their professional skills are increasing (Persson & Tallberg-Broman, 2002).

LAURENCE DELACOUR

*Licentiat i pedagogik,
Malmö Högskola
Lärande och samhälle, 205 06 Malmö
E-post: laurence.delacour@mah.se*

In 2011, a revised preschool curriculum was introduced, in which the objectives for children's mathematical development were made much clearer in both scope and content. Currently, preschools should strive to ensure that each child develops, expresses and uses his or her understanding of space, shapes, location, direction, sets, quantity, order, number concepts, measurement, time and change. Further each child should develop his or her ability to reflect, test solutions, and present and follow reasoning (National Agency for Education, 2010).

THE REVISED CURRICULUM FOR PRESCHOOL

In the mission of Swedish preschools, caring, education and learning form a whole. Although the emphasis on caring is unchanged, there is an increased focus on learning and knowledge (Vallberg-Roth, 2011). The purpose of the revision of the curriculum was to develop the quality of education and to strengthen the pedagogical work (Cabinet Office, 2010). The government commissioned the National Agency for Education (Cabinet Office, 2010) to make proposals for clarifying and supplementing some of the goals. Moreover, they were expected to clarify the preschool teachers' responsibility for the curriculum. How children should create, explore and use mathematics is not specified in the document, as it is goal-oriented, without suggestions on how to teach. According to the curriculum, learning should originate from children's development, experiences, interests and circumstances and take place in a playful manner. While the objectives are formulated as goals for preschools to strive towards, there are no goals for the children to achieve because pre-schoolers should not be assessed based on established standards and should not be compared to anyone other than themselves.

THE ROLL OF THE PRESCHOOL TEACHER

According to Doverborg and Pramling-Samuelsson (2011), everyday life at preschools provides many opportunities for children to encounter basic mathematical concepts, but teachers may not have sufficient knowledge about early childhood mathematics to be able to take advantage of these opportunities. Some preschool teachers prefer to focus on areas of language and literacy, where they feel safe; hence, they have no time for mathematics (Lee & Ginsburg, 2009). The uncertainty about the subject might partially be attributed to the fact that there are different conceptions of what is meant by mathematics in preschools. Some educators

believe that teaching mathematics should not start until primary school (Doverborg & Pramling Samuelsson, 1999). Palmer (2010) found that most students of Early Childhood Teacher Education had a negative attitude towards mathematics and linked this dislike to counting, math books, Palmer investigated the student of Early Childhood Teacher Educations' subjectification in relation to mathematics in training. Palmer found that when the students participate in aesthetic, interdisciplinary learning practices, their understanding of mathematical subjectivity is essentially changed. In accordance with the results of the study, she believes that we should rethink didactics for students and young children.

An idea that seems to be prevalent among preschool teachers is that a pre-schooler learns by participating in everyday situations. Therefore, many educators believe that children are learning all the time and from everything (Björklund, 2007; Doverborg & Pramling Samuelsson, 1999). Some educators believe that children discover mathematics in a natural way when they play games, build with Lego or tidy up toys. However, the problem with these approaches is that it is usually the children who already have some knowledge and are interested who get something out of these activities (Ahlberg, 2000). Children learn independently to a certain extent, but they must be challenged to think one step further and see things from different perspectives. Children can discover mathematics when teachers create an educational environment, when they take a step back and when they let the children play. The foundations of mathematics can be laid through activities such as building with sand, playing with water and various containers, or doing puzzles. However, in order to be able to build on these foundations and to be able to understand mathematical concepts, children need a teacher.

Free play can provide a useful foundation for learning, but a foundation is only an opportunity for building a structure. Adult guidance is necessary to build a structure on the foundation of children's informal mathematics (Hildebrandt & Zan, 2002, p. 2).

In order to be able to follow the curriculum and communicate around some specific mathematical concepts, it helps if the teacher focuses on the content, otherwise the contents will drown into other contents (Thulin, 2011).

DATA PRODUCTION AND ANALYSIS METHOD

This article is based on the data collected between spring 2011 and autumn 2012. My research questions were:

- How talk some preschool teachers about the national curriculum objectives in mathematics with focus on content and form?
- How are the national objectives for mathematics transformed in some preschool teachers' planning and implementation of a mathematical situation?
- Which didactic contracts emerge from some preschool teachers in transforming the national objectives in mathematics?

I conducted interviews with four preschool teachers to investigate how they discuss and interpret the national curriculum objectives for mathematics and to examine how they transform their interpretations in to action. I video recorded the preschool teachers implementing a mathematical activity outdoors. The teachers work in two different preschools. They work actively with mathematics in a group consisting of both four-year-old and five-year-old children. The interviewees have been working as preschool teachers for 22, 9, 15 and 32 years, respectively. Two of them have attended mathematics courses at the university since their degree because mathematics was not a part of the programme at the time of their initial education. The two others have not attended any mathematics courses. To answer my research question, I interviewed the teachers individually. In order to be flexible, allow the follow-up of an idea and ask supplementary questions (Bryman, 2010), the interviews were semi-structured. Finally, I video recorded the group with a hand-held camera from a distance.

The preschools included in the study are located in two small communities of the same municipality. They show no major differences in staff composition, group size or children's socio-cultural and economic background.

To analyse and interpret my data, I have used a hermeneutic approach (Bryman, 2010). My understanding is based partly on my experience as a preschool teacher, partly on theoretical perspectives and partly on prior research that discusses the preschool teacher's approach to mathematics for younger children.

BROADER CURRICULUM CONCEPTS – CURRICULAR WORK AS DIDACTIC ACTIVITIES

Since the study focuses on preschool teachers' transformation of the mathematical national curriculum objectives with a focus on content, I placed my study in a curriculum didactic perspective (Gundem & Hopmann, 2002). The formally decided curriculum is interpreted at different levels and is therefore never the same for school politicians, administrators, teachers, parents and children. My study focuses on the perceived curriculum based on the preschool teachers' talk, description and transformation of the national mathematical objectives. There are many ways to discuss curriculum concepts and curricular work as didactic activities. The curriculum is transformed differently and what preschool teachers choose to focus on, will, to some extent, depend on different actors' expectations on each other and on the school's mission. Transformation is not an easy process and it is unique for each actor (Linde, 2006).

DIDACTIC PERSPECTIVE

Didactics focus on the content of education in general, while subject didactics focus on education in relation to specific subject content (Kroksmark, 1987). I use the Central and North European tradition of didactics, which highlights the theory and practice of teaching on the basis of what should be taught, how it should be taught and why it should be taught in a certain manner (Gundem & Hopmann,

2002). Traditionally, preschools in Sweden do not divide activities into subjects; instead, integrative didactics have been customary and preschool teachers work with themes and subject-integrated activities. According to the curriculum, care, education and learning should shape the activity (National Agency for education, 2010), but how this fits in with subject didactics is not self-evident. The use of the term "subject didactics" may affect preschool activities, but preschool needs a language that can make visible and problematize the new mission (Thulin, 2011). Thulin believes that the preschool teachers' perception of their mission is problematic in practice, because the focus is on care and education, while what should be learned remains unclear. Furthermore, she means that when care, education and learning form a whole, there is a good possibility for implementing a changed knowledge mission in preschools.

To make mathematics visible in preschools, I consider it important to be able to talk about didactics of mathematics. In Swedish preschools, when children help to set the table for a meal, for example, languages, play, mathematics, care and education are mixed together. Even in such contexts, the preschool teacher should be able to focus on mathematics in order to better assist children in understanding mathematical concepts. One might not learn languages in the same way as one learns mathematics. Didactic of mathematics can help us to understand in what circumstances a child may be driven to use a specific knowledge in order to solve a specific mathematical problem. Why does a child do this instead of this? Why is it that knowledge that dictates this behavior? Teachers often try to find activities to introduce a new mathematical knowledge to the children. When one asks himself why, one will see a situation, not as a simple reproduction of knowledge, but as an environment that give answers to the children. Which games will the children play to have this knowledge? How will the children play on to be able to discover or use the knowledge? What information do the children need from the environment to make their choices, and use this knowledge rather than that one? (Brousseau, 2000). However, in the case of younger children, subject didactics focuses more on meaning making and investigation than it focuses on children acquiring a given amount of knowledge (Lundgren, Säljö & Liberg, 2010).

In this article, I will focus on the didactic questions *what?* and *how?* in order to highlight the teachers' interpretation of the national objectives and the examples they give to illustrate their interpretation. By 'what' I mean the interpretation of what mathematics for young children is according to the teachers' interpretation of the Swedish curriculum for preschools. When the teachers talk about 'how' they interpret the mathematical objectives, they also give examples to illustrate how they transform these objectives into practice. The preschool teachers' interpretation and implementation may improve the expectations they have of the children and themselves. To highlight the expectations that preschool teachers have in relation to the interpretation of the curriculum, and the implementation of an activity, I will introduce the concept of didactic contract as a metaphor in my study (Brousseau, 1998; Wedege & Skott, 2006).

DIDACTIC CONTRACT AS METAPHOR

Guy Brousseau introduced the concept of didactic contract, which was originally used in theory of didactical situations. Brousseau has developed the theory of didactical situations in the 1980s, which is not strictly part of the Piagetian theory, but the characteristics of the objects are marked by this theory. The theory of didactical situations offers a modelling of knowledge, situations of teaching and the roles of the teachers and students in the classroom. Brousseau (1998) studied what happens between teacher, students and the learning object in a mathematical situation. He introduced the concept of didactic contract to illuminate a potential cause of students' failure in mathematics (students who have difficulties understanding mathematics or are completely indifferent to it but who succeed in other subjects). He defined the didactic contract as the teacher's behaviour expected by the student and the students' behaviour expected by the teacher and he studied how it would affect mathematical learning. The didactic contract comprises all the rules that determine, partly explicitly but mostly implicitly, what each partner in the educational relationship has to manage and what his or her responsibilities are to the other partners in the relationship (Brousseau, 1988). Brousseau's use of the didactic contract focused on mathematics in education. The definition of mathematics in Swedish preschools is not obvious (Doverborg & Pramling-Samuelsson, 1999), and the mathematical objectives in the Swedish curriculum are focused on the preschools and not on the children. How mathematics should be taught to children is even more vague. To negotiate a didactic contract with children, the preschool teacher needs to define what mathematics for young children is and how it can be communicated. Although the curriculum can be a starting point, the responsibility to interpret and transform the mathematical objectives lies with the preschool teachers. How they interpret the mathematical objectives is affected by a variety of factors, for example, personal experiences, knowledge and ambitions (Hopmann & Riquarts, 1993). The preschool teachers' interpretation of what mathematics for young children is and how it can be communicated to them affects the rules of a didactic contract and the expectations teachers have of the children. These expectations are transformed into didactic invitations to action, which immediately offer a didactic contract (Mercier, 1997). Teachers usually develop different practices to give children the exact assistance they need, while children try to meet the teachers' requirements by interpreting their signals. However, detailed instructions on how to solve mathematical problems should not be provided because it results in children not learning anything. The didactic contract does not stand still; it moves and changes over the time under the influence of the teacher's or children's behavior (Garcion Vautour, 2002). During the situation, the preschool teacher repeat, clarify or ask a question that allows the didactic contract to move in a direction that the teacher have in mind. Sometimes, it can be a child's discovery, reflection or understanding that allows the contract to move. The contract is not a distribution of data, which is determined once and for all and unilaterally by the teacher. The didactic relation is not controlled exclusively by teachers, children are also responsible. Children must accept to learn. The contract specifies the rules of the game, the game as it is expected to be

played when you come into the kind of interaction that governs the game (Chevallard, 1998). In preschool context the children are not aware of what is defined as mathematics and their expectations are not necessarily connected to the subject. My interpretation is that the preschoolers' expectations is connected to procedures around the situation. Not until the children have been in school for a few years, they can associate mathematics with the content and not the procedures surrounding the situation (Lerouxel, 1993). The preschoolers participate many times in specific situations and recognise what the teacher expect of them and what they can expect of the teacher. With expectations in connection with the didactic contract I mean a situated and performative definition, in other words, what may be interpreted as expectations in the talk and the implementation of mathematical situations in the empirical material.

The didactic contract is often not visible until one breaks it. A child can break the contract when it cannot fulfil the teacher's expectations; for example, the child is unable to count the children that sit in the morning meeting although the group has been doing this the whole semester. The teacher must then renegotiate the didactic contract by asking, for example, the help of the entire group to guide the child (Garcion Vautour, 2002). The contract can also be broken when the children already know what the teacher expects of them; for example, they can subtract the number of absent children from the number of children enrolled at the preschool to count how many are attending on a certain day. In this case, the teachers need to adapt their expectations. The negotiation of a didactic contract is not only a consequence of the teacher's instructions but also a condition for learning (ibid). Blomhøj (1995) believes that the development of a didactic contract must be understood as a consequence of a fundamental educational dilemma—a dilemma between the teachers' intention to follow the mathematical objectives stated in the curriculum and their idea of how mathematics should be communicated effectively. The ability to recognize this dilemma and its importance for the establishment of a didactic contract can become an important tool for educators in their teaching practice.

ANALYSIS OF THE DATA

I analyses my data in tree step. Every step is connected to a research question.

Step 1	Question 1	Interview 1	Transformation What How
Step 2	Question 2	Interview 2 Videotape	Transformation What How
Step 3	Question 3	Interview 1-2, Videotape	Didactic Contract

I did a reflexive interpretation of preschool teachers' stories. I used an abductive analytical method, which meant that I've alternated myself between data and theory analysis (Alvesson & Sköldbberg, 2010). In the preschool teachers talk and implementation of the situations I found differences that i categorised and sorted under different headings.

In Summary, national expectations expressed in the curriculum are transformed in a process, which emerges from the interview with the teachers. The process lead to mathematical situations (filmed material) which I analysed in terms of didactic contract alongside two transformed directions – an analysis of the didactical contract, woven in the transformation of the mathematical objectives and the planning of a situation.

TWO DIDACTIC CONTRACTS

In this article, I will concentrate on some of the mathematical concepts preschool teachers talk about and implement. In my analysis, I will discuss two didactic contracts that I will develop. In my data I find a tendency towards two different ways of communicating mathematics. One way is child-initiated and the other way is teacher-initiated. In the child-initiated contract (CI) mathematics is perceived by the body. In the teacher-initiated (TI) contract, mathematics is thought of as an easier form of primary school mathematics. The preschool teachers talk about the importance of starting with concrete material to help children to understand, but they seem to have different ideas of how to communicate mathematics as well as different expectations of the children.

THE CHILD-INITIATED CONTRACT (CI)

In the CI contract the preschool teacher believes that young children should perceive mathematics with their body. The children can get a conceptual perception when they walk a tightrope around a square sandpit, for instance, they will understand the surface of it.

Susan: When they are young, it is important, from the beginning, to get the feeling of mathematics. What you learn with the body stays in your head."

When the children are playing and the preschool teacher notices that they are counting something, she goes to find out about their thoughts and tells them how she thinks. However, she does not want to tell them how it should be.

Susan: I see something here: There are three. What do you see? It is not, "I have the correct answer". No, it is based on what they see.

The preschool teacher does not want the children to remember what the teacher says without understanding the mathematical concept; namely, she does not want to respond to the children's questions by merely giving them the correct answer. It is more important to look for an answer together with the children. The interest is in the process of finding an answer rather than to find a correct answer. To help children in the process, the preschool teacher will ask open questions:

Susan: I don't ask yes or no questions, and I do not want these answers from the children - this will not develop children or the activities we do. Instead, you can do research together with them and ask questions that challenge the children's thinking and encourage their willingness to learn.

The preschool teacher based her planning of a mathematic situation based on the children's interests. She listens and observes children to find out what they are interested of. If the preschool teacher suggests an activity, it is always based on what she believes belongs to the children's interest areas:

Susan: We can go on a number hunt. I may say, "five has disappeared! Where is five?" Five could be the number five, or it may be a symbol for five, for example, five cars, the number of the street, or something similar.

Susan also says that the children are very excited about treasure hunting. They will draw a treasure map, look for a treasure and communicate about positions and orientation:

A treasure map is enormous fun. ... Every child likes to look for treasures, and mathematics is very clear and visible to the children when looking for treasures.

EXPECTATIONS

The preschool teacher expects the children to control the situation by showing an interest in something. Thereafter, she helps them to go further by asking questions, in order to do the research together. The children should be active with their bodies when exploring their surroundings, and they have to learn at their own pace—playing is more important. Mathematics should be incorporated into a theme. The preschool teacher expects the children to show their interests and the teacher to be aware of these and follow them up in a theme in which mathematic content is included. Mathematics is used as a tool.

THE TEACHER-INITIATED CONTRACT (TI)

In the TI contract the preschool teacher believes that mathematics at preschool level is the same as mathematics at primary school level, just easier:

Åsa: When I was at primary school, we worked a lot with mathematics./.../It was for slightly older children, but I have had the great advantage of taking it down to the younger children's level here.

The preschool teacher will, for instance, work with fractions and patterns in order to help the children to be prepared for school mathematics. There is a belief that children will understand if they can follow the entire process concretely from the beginning to end. The preschool teacher can plan situation where the children are asking how to divide things, such as fruit or clay, so that every child in the group receives a piece:

Åsa: Everyone will get a bit and there were eight children. ... "How can everyone get a piece? Yes, we have to share! How shall I divide? Yes, in the middle. And then how do I divide? Yes, you have to divide one more time. ... It's four, then

it's four quarters." They were four years old, these children, and a little boy says, 'you have to divide each of these four quarters one more time because you will get eight pieces and then everyone will get one eighth.' Four years! But it's because it's so concrete.

The teacher planned many situations where the children were asked to work with mathematical concepts. Åsa gives this example for working with patterns:

They had to collect leaves and pinecones. Then, we lay one leaf, one pinecone, one leaf, one pinecone and so on; thereafter, we went ahead and lay three. We did patterns: "sticks, leaf, and pinecone! What will come next? Sticks, leaf, and pinecone!

Åsa explained how she introduces location to the children during the day:

We work a lot with location in different ways. We have tree stumps where we meet when we have our outdoors day. Sometimes when we are waiting, I ask 'Can you stand behind the stump? Can you stand to the right of the stump? Stand in front of? Stand on?

In the TI contract the preschool teacher will introduce situation where children can practice addition or subtraction. Åsa likes to introduce small competitions where she asks questions and the children try to answer:

Should we have a competition? And the prize is – everyone gets a prize – the prize is a sandwich if you respond correctly... Then I can be quite advanced: "What is nine plus two"... And you know someone understands it, 'Please, there will be a prize, please take a sandwich.'... And the youngest are asked what is $1 + 1$, and sometimes they need a little help: perhaps, $1 + 1$ (shows with fingers). A surprising number of children actually manage the abstract idea because we've previously worked with so many concrete ideas. They have internal images.

Åsa explains that children must have fun and that they know that they will get a sandwich anyway. She emphasises that they have done a lot of concrete activities before.

The teacher can introduce a situation to help children to perceive mathematics by Justifying their choice and following reasoning. The children have to know how to justify their answer in order to understand what mathematics is about. One preschool teacher describes situations in which the children have to pick up two things that they believe are related and justify their choice. She says that nothing is right or wrong but that children should justify their decisions:

Åsa: They may say, "I think these are related because they are yellow, and they are made of plastic". It is to describe - they learn to describe ... with words, shapes, sizes, colours and materials. They may feel like scissors and a fork work well together because they are both made of metal.

Malin explains that she has cards and a big picture with numbers on it. The children can pick a card and put it on one number of their choice:

If the card shows a picture of a cake and three candles, the children can choose what image they prefer, and they may put it wherever they like. Someone put it on the number one because it's one cake, and someone else put it on the number three because it's three candles. There is nothing that's right, nothing is wrong, and they decide, but they have to justify their choice.

EXPECTATIONS

In the TI contract the preschool teacher initiates many activities, and she expects the children to be interested in and pay attention to her instructions. She challenges the children with teacher-initiated mathematical situations but does not expect the children to show their interest in mathematics because they do not know yet what they are interested in when it comes to the subject. The teacher is expected to create an interest. The children will perceive mathematics by finding the correct answer. The preschool teacher seems to have high expectations of the children's possibility to understand abstract mathematics if the teachers give them the opportunities to do so. Mathematics is used as a goal comparing to the CI contract where mathematics is used as a tool.

BREAKING THE DIDACTIC CONTRACT IN THE CI CONTRACT

According to Brousseau (1998) and Blomhøj (1995), the didactic contract is not visible until some of the actors breaks it. This can be seen in one of the videotapes. In the following videotape the preschool teacher organises a play where children can select four objects that they have previously found in the school yard and discuss which one is not related to the others. The children have to explain which one they wish to remove and why they would like to do so. I classified this situation in the CI contract because the preschool teacher let the children make their own choices and try in their own way. She introduces the play and then takes a step behind. When Lotta works with mathematics and children, she wants them to discover many different ways to solve a problem. She expects them to find many different solutions but she does not explain to the children what she expects until one of them breaks the contract.

Olle: Yes, but what is this? You should take it off. They are not the same as those. They are the exact same letters, white with letters. Not white with letters. Error.

Lotta: It is very good, and you others have also thought about a solution. Very good, Well done, Olle, very good. What do you say? Let's gather around.

Olle: What did you think? You thought it was a little difficult? You thought it was easy, and it was not.

Clara: You can't know whether we think it is easy.

Lotta to Olle: (puts hand on Olle) - There are several different solutions; it was really good.

Olle: Did you guess right?

Lotta: There are many correct solutions. You had a very good explanation of how you thought, Olle, and, David, you too. You also thought very well. And Eric, you thought in the same way and Clara also. Very good.

Olle would not accept that there should be more proposals for objects that do not belong together. He thinks that the others would try to guess what he is thinking. He breaks the didactic contract; and when Lotta explains that there are many correct solutions, the contract becomes visible.

My interpretation is that the preschool teacher had expectations that the children would find many different solutions and understand that there are many solutions to the same problem. The children expected of the teacher to let them find their own way. They follow the rules of the game and they do not protest when somebody else comes with different solutions. But Olle does not accept the rules and Lotta has to explain. Her and Olle's expectations were both visible.

BREAKING THE DIDACTIC CONTRACT IN THE TI CONTRACT

In the TI contract the preschool teacher believes that if children can follow every step of a process, they will develop mental images and, consequently, be able to think abstractly. She wants to arouse an interest in mathematics among children. Below are some examples of situations in which the didactic contract is broken and becomes visible in the videotape. Åsa asks the children to find two sticks in the forest and compare them to decide which one is the largest. Then she gives the children different instructions to follow, to help them pay attention to mathematical concepts. She is just about to give a new instruction.

A child to Åsa: Miss, look! A bee in the stump.

Åsa: A bee! Now it will be harder.

All the children run back to the meeting circle and Åsa tells them what to do next.

Åsa gives the children instructions. When a child breaks the didactic contract by stopping at a tree stump and drawing attention to a bee, Åsa clearly shows what she expects the child to do. She repeats what the girl said and then continues to instruct the children on what to do.

The interpretation I make of this situation is that the preschool teacher's intention to focus on specific mathematical concept, leads to a didactic contract, where children are expected to follow the instructions. When they make their own associations, or they call attention to something else, the preschool teacher thinks they lose their focus on what should be taught and they break the contract. It can be compared to the CI contract where this kind of child initiative is encouraged by the preschool teacher.

In these two examples the implicit rules of the didactic contract turn explicit when a child does not follow or does not accept the rules. The didactic contract can move when children or the preschool teacher acts in a way that helps children to perceive some mathematical concept. These examples are developed in my theses (Delacour, 2013, forthcoming).

SUMMARY

Since the mathematical objectives in the Swedish curriculum have no method instructions, they open possibilities for several didactic contracts. In the analysis of the interviews and the videotapes, the preschool teacher's interpretations of the mathematical objectives differ, leading to two separate ways of transforming the objectives into practice. The preschool teachers have different expectations of the relationship between children, teachers and mathematics.

In the child-initiated contract, mathematics is about number concepts, shape, size, differences, but the preschool teachers do not expect the children to understand the concepts. The preschool teacher believes that children need to feel mathematics with their body by for instance walking a tightrope; feeling the distance; seeing the forms, the colours and the numbers. Understanding will come once they are mature enough. The didactic contract offered to the children is based on learning by doing. The preschool teacher communicates mathematics by offering opportunities to explore. All the activities have their starting point in the children's interests. The preschool teacher seems to have faith in the children's ability to seek knowledge and to learn from each other. That is, they expect the children to take an active part in the planning of the activity by showing and sharing their interests among themselves.

In the teachers initiated contract, mathematics for children is about learning to recognise and name shapes and about understanding fractions and patterns; consequently, children should pay attention to differences and justify their answers. The preschool teacher works with concrete material, but the mathematical concepts she uses are sometimes abstract. The didactic contract she offers is based on cognitive skills. She communicates mathematics by initiating situations in which the children can learn mathematical concepts by following the instructions and trying things practically. When children have been following every step of a process, they will obtain mental images and will thus be able to think abstractly according to the preschool teacher. The preschool teacher task is to evoke the children's interest in mathematics.

CONCLUSION

Preschool teachers have a very important role to play in communicate mathematical concepts with children. Prior research conveys a very pessimistic vision of preschool teachers' knowledge of mathematics for young children and argues that they are unsure about how to communicate mathematics (Perry, Dockett & Harley, 2007). Many preschool teachers believe that children learn constantly and from everything (Björklund, 2007). Children can discover mathematics when teachers have created an educational environment, taking a step backwards and letting them play. Free play can provide a useful foundation for learning; however, in order to build a structure on the foundation of their informal mathematics, children need a teacher's guidance (Hildebrandt & Zan, 2002).

The results of my interviews and videotapes show that these preschool teachers are very confident about what mathematics is and how it should be communicated, but their interpretations of the curriculum differ. Furthermore, their understandings of mathematics for children and how it should be communicated differ from one another and lead to different didactic contracts. The purpose of this article is not to find the best way to communicate mathematics to preschool children but rather to open a discussion about what happens when mathematics didactic is a part of the Swedish preschool discourse.

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EDUCATION BETWEEN FORMATION AND KNOWLEDGE – A DISCUSSION BASED ON RECENT ENGLISH AND NORDIC RESEARCH IN RELIGIOUS EDUCATION

Geir Skeie

SAMMENFATNING

Artikkelen tar utgangspunkt i spenningen mellom kunnskap (knowledge) og danning (formation) og utvikler dette som religionsdidaktisk problematikk ved hjelp av impulser fra engelsk religionsdidaktikk som tale rom å lære om og å lære av religion i skolen. Michael Grimmitt, Andrew Wright og Robert Jackson diskuteres i forhold til hverandre og det påpekes hvordan de alle fører den religionsdidaktiske diskusjon i nær kontakt med bredere tankestrømmer i pedagogisk og filosofisk tenkning. Denne diskusjon føres videre inn i nordisk religionsdidaktisk debatt via Bråtens komparative studie og ved hjelp av Berndt Gustavssons danningsteoretiske perspektiver. Her vektlegges samspillet mellom ulike dimensjoner i danningen og det demonstreres hvordan dette kan bidra til å fange inn nyere forskningsbidrag i religionsdidaktikken. Konklusjonen er at fagdidaktisk debatt og forskning tjener på å bli sett i lys av mer allmenpedagogiske perspektiver og at den kan bidra til utdyping av den allmenpedagogiske debatt om skolens innhold og mål.

Nøkkelord: religious education, religionsdidaktik, danning, kunnskap

INTRODUCTION

In public discourse about educational issues, people sometimes position themselves by referring to words like *formation* and *knowledge*. The first has both denotations and connotations towards *Bildung*, *bildning*, in English sometimes called 'general education', and refers to the broad aims of education, seeing this as a transformative process, contributing to a sense of citizenship, personal character and familiarity with the knowledge tradition of human societies. Those who instead prefer to position themselves by referring positively to 'knowledge' rather than 'formation' may see education as a somewhat more limited project where emphasis is the transmission of cognitive content and skills, making students acquainted with the accumulated stock of knowledge associated with the different scientific disciplines. With such constellations, the 'formation' and the 'knowledge' positions

GEIR SKEIE

Professor i ämnesdidaktik med inriktning religion
Centrum för de humanistiska ämnenas didaktik,
Stockholms universitet
106 91 Stockholm
E-post: geir.skeie@cehum.su.se

appear as complimentary; you may invoke the one in order to criticise the other, or you will be placed according to the rhetoric you employ. In a complimentary pair of binary oppositions, there is a tendency to use the extreme versions of the opposing positions as reference points for critique. So, formation-oriented, transformative education may be pictured as totalitarian, while a knowledge and transmission-oriented education can be seen as instrumental and essentialist.

Even if the knowledge-formation discourse in itself is almost a stereotype, it is detectable also in academic debate, and more particularly within religious education. Here, the 'formation' perspective accepts the possibility that religious education may influence students existentially, while the 'knowledge' perspective underlines the illegitimacy of such influence and reinforces the need for an objective and descriptive perspective on religious education^[1]. In this way stereotypes are strengthened and rather than showing the large field of partly overlapping positions, there is sometimes a lack of will to negotiate disagreements in a more nuanced way or to accept the possibility of such oppositions to be part of a dialectic that all education has to deal with or possibly transcend. In the spirit of transcending rather than rejecting the oppositions, this article discusses recent religious education research in the light of 'formation' versus 'knowledge', by using the two terms heuristically and by arguing that theories of general education and of religious education can fruitfully influence each other.

FORMATION AND KNOWLEDGE: LEARNING ABOUT AND LEARNING FROM RELIGION

Researchers from countries with 'confessional' and 'non-confessional' religious education largely constitute one research community and many of the research issues are similar, in particular the challenges and opportunities of diversity. The practice of teaching and learning about religion and world-views regularly raises discussions about the pedagogy of religious education (often termed 'didactics' in Nordic countries), and as part of this, concepts with a family resemblance with 'formation' and 'knowledge' are on the agenda. One example is a much used expression within religious education literature, namely Grimmitt's distinction between learning *about* and learning *from* religion (Grimmitt, 1987, 2000), which also has even entered into the national religious education curriculum.^[2]

Grimmitt's understanding of this was originally based in his ambition to develop a 'theory of religious education's contribution to human development' (Grimmitt, 1987, p. 13). In other words, his starting point is educational theory, not theology or religious studies, and the underpinning is partly philosophy of knowledge and partly a philosophically based anthropology. Grimmitt argues that religion has a distinct contribution to make in education, and that this 'educational use of religion' (Grimmitt, 1987, p. 46) shall contribute to humanisation, to the development of children and young people. Therefore, religious education should both help students to learn about and learn from religion:

When I speak of pupils learning about religion I am referring to what the pupils learn about the beliefs, teachings and practices of the great religious traditions of the world. (...) When I speak of pupils learning from religions I am referring to what pupils learn from their studies in religion about themselves – about discerning ultimate questions and 'signals of transcendence' in their own experience and considering how they might respond to them (Grimmitt, 1987, pp. 225-226).

In his later writings, Michael Grimmitt has used this differentiation to discuss pedagogical models (Grimmitt, 2000, p. 17f, 34f). He argues that a pedagogy of religious education aims at promoting a 'particular kind (or several kinds) of interaction between the pupils and the religious content which they are studying.' (p. 17). 'These interactions may be grouped into two broad categories: those which contribute to pupils *learning about religion* and those which contribute mainly to pupils *learning from religion*.' (pp. 17-18). The first category includes 'instructional, conceptual, empathetic interactions' and the second 'reflective, interpretive, critical and evaluative interactions'. According to Grimmitt, pedagogical models or approaches in the different subject areas of education employ pedagogical principles, procedures and strategies in order to articulate the relationship between students and content matter, and ideally this 'use' should be as conscious as possible. He presents and comments on eight different pedagogies of religious education and finds that all of them in one way or another address the issues of learning about and learning from religion.

The proponents of all eight approaches to religious, with the exception of Andrew Wright seem to address the double perspective positively, seeing it as a legitimate educational concern. Wright's background for being critical towards the 'learning from' perspective, is that he sees this as giving in to 'the mind-set of modern romanticism' with a strong emphasis on subjective experience, that the cultivation of spiritual experience 'fails to empower children to think critically about religion' and 'bypasses questions of ultimate truth' (Wright, 2004, pp. 186-190).

Wright wants religious education research and practice to reflect on its philosophical foundations in order to become 'literate' and he goes through theories of philosophy, theology and education in order to explain his 'critical religious education. In some of his writing one may get the impression that he is presenting learning about and learning from as a dichotomy, a question of choosing which side you are on (Filipsone, 2011). More recently Wright has made clear that he is now supporting a combination of the two, also in writing together with Elina Hella (later Elina Wright) (Wright, 2007, p. 259; Hella & Wright, 2009, p. 62).

Hella and Wright argue that the relationship between the two is in need of clarification that since it should not be based on the pursuit of tolerance, not on the development of spiritual experience and not on students' freedom to construct individual visions of reality. Instead the unity of learning about and learning from 'lies specifically in the *pursuit of truth and truthfulness*' (Hella & Wright, 2009, p. 58). Based in critical realism with the principles of ontological realism, epistemological relativism and judgemental rationality, they recommend phenomenography and Variation Theory of Learning as pedagogical strategies for a liberal and critical religious education that has this aim of truth and truthfulness (Wright & Wright, 2012). Even from their rather short presentation it seems that the use of these pedagogical theories points in the direction of a somewhat more complex and context sensitive representation of learning about and from religion than suggested in Wright's earlier writings.⁽³⁾

Also Robert Jackson suggests a critical approach to religion and education, even if does not support Wright's specific view of critical realism and also disagrees on other points (Jackson, 2008; Wright, 2008). While generally supporting Grimmitt's perspective on learning from and learning about (although seeing the two as very closely related hermeneutically), Jackson qualifies his own position by underlining that he has 'not been considering 'religion' as an abstraction nor 'religions' as straightforwardly definable belief systems' (Jackson, 1997, p. 132). He sees different religions and cultures in Britain as more internally diverse than Grimmitt and he places less emphasis on the ambition that all should reach 'the same 'educational' goal – that is, they should become fully autonomous individuals' (p. 132). Jackson also presents his approach as being less structured in terms of 'formulating the effects of 'learning from' the material studied', seeing this as more 'spontaneous' (p. 132). It is interesting that Grimmitt does not argue with Jackson on this point but rather emphasises the achievements of the interpretive approach in enriching the concept of 'learning about' through their encouragement to engage pupils in hermeneutical activity (Grimmitt, 2000, p. 39).

The core concepts of the interpretive approach can therefore be understood as conceptual alternatives to the learning about/learning from duality, or rather as a way of qualifying it. Jackson does not emphasise the pursuit of truth and on the truth claims of distinct traditions, but argues strongly for the *representation* of diversity by differentiating between levels of 'tradition', 'group' and 'individual' within religions. Further, the *interpretive* perspective involves, among other things helping to make the learners' presuppositions about the learning content visible, by comparing and contrasting these presuppositions with each other, with research based text-books, with the perspectives of insiders and outsiders, and with historically transmitted presuppositions (Jackson, 2004, pp. 88-94). By doing this, the interpretive approach includes a certain degree of personal involvement, often associated with 'learning from', in the representation of religion, which otherwise could be seen mainly as belonging to the 'learning about'. The third core concept, *reflexivity*, emphasises 'various aspects of the relationship between the experience of students and the experience of those whose way of life they are attempting to

interpret' (Jackson, 2007, p. 82). See also Robert Jackson (2011, p. 192). This includes critical engagement with the content including discussing questions of truth, tolerance, respect etc. (eg. Jackson 2009a), evaluating one's own worldview in light of the content studied (edification) and reviewing of the methods of study. By including edification in the wider category of 'reflexivity' the perspective of 'learning from religion' is integrated in a larger whole, and in a way borrows from what is often associated with 'learning about':

'Edification does not imply the *adoption* of the beliefs of followers of a religion being studied, but does recognise similarities and differences between all humans and of the relationship between the identity of each person and the manifestation of differences...' (Jackson, 2011, p. 193).

Jackson involves the learner as an actor in the process of 'learning about religion' by making the process a more self-reflexive and transformative, while he opens up the process of 'learning from religion' towards interaction and collective reflection without excluding the personal dimension. This is partly done by drawing on epistemological perspectives, partly by using research-based perspectives coming from ethnography, social sciences, educational theory and religious studies and partly by integrating this with a the reappraisal of religious education research the past and present.

Even if Grimmitt, Wright and Jackson present different ways of managing the perspectives of learning about and learning from religion, they all affirm a broad trend in English religious education, which is to see the relationship between 'learning about' and 'learning from' as part of the educational enterprise itself and not something particular to religious education. In this way religious education is liberated from a stereotyped opposition between descriptive and normative perspectives. By using the relationship between 'learning about' and 'learning from', all these three researchers contribute to a discussion about religious education 'for all'. They also seem to share the idea that both theology and religious studies have something to contribute in religious education research, in addition to other disciplines like philosophy and social sciences.⁽⁴⁾ There is not a general dismissal of theology for being too formation-oriented or of religious studies for being too knowledge-oriented even if the relationship can be full of tension (Cush, 1999, 2009)

In spite of the general agreement in English religious education research that 'formation' and 'knowledge' are not something you can choose between, the knowledge/formation distinction can be used to bring forth both similarities and differences between religious education research positions, in this case between Grimmitt, Wright and Jackson. One may sum up the positions by suggesting that they all see 'knowledge' as the content part of education and 'formation' as the functional part. As such they are both indispensable, but so is the tension between them. All three relate to a framework of general education theory. In dialogue with this, they develop their distinct pedagogies of religious education (or 'subject area didactics' / fagdidaktikk / religionsdidaktikk). Such distinct 'approaches' have been less pronounced in Nordic religious education research to which I now turn.

COMPARATIVE PERSPECTIVES

Oddrun M H Bråten has done a comparative study of religious education in England and Norway based on both empirical and literature/document data. She argues that while most researchers and teachers in England use a combination of 'learning about' and 'learning from', Norwegian religious education seems to have moved somewhat in the direction of France, where learning *from* religion according to Bråten is 'entirely absent' (Bråten, 2009, p. 168). She sees this development as a result of what she terms 'supranational forces' at work, like the European Human Rights Court in Strasbourg, but this is interacting with the 'national imaginary', which among other things includes 'plurality as a more integrated feature of the English national imaginary than the Norwegian' (Bråten, 2009, p. 171). She arrives at her results about England and Norway by using a sophisticated and fruitful analytical framework that takes into account several levels of comparison and draws on several theoretical sources (including Goodlad). She presents four interrelated levels of curriculum with data to support them:

A: the societal level (Data: Themes within academic debates in Norway and England)

B: the institutional level (Data: Recent legal and political developments in Norway and England)

C: the instructional level (Data: Case studies from Norway and England)

D: the experiential level (Data: Pupils perspectives in Norway and England)

In order to capture the comparative dimension, these four levels of curriculum investigated in the two countries are seen in the light of how nations respond to internationally shared challenges. These challenges are differentiated by pointing to three different levels;

1: Supranational (example: secularisation, pluralisation and globalisation)

2: National (example: responses to secularisation, pluralisation and globalisation)

3: Subnational (example: differences in how regional or local practices exist nationally)

This complex dynamic is beautifully illustrated in the following figure, which is employed in Bråten's analysis.

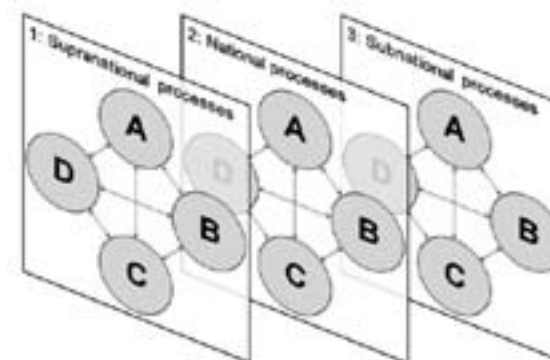


Figure 1: A model for comparative analysis of religious education (Bråten 2009:305)

Bråten's main findings in terms of explaining differences between England and Norway are that the scholarly traditions within religious education proved to be quite different and that the school systems were so different that this also contributed to significant differences in RE. In fact, with such different school systems, it is particularly interesting that both countries justify their multi-faith religious education in the same way; as a response to increasing plurality in society.

Applying the learning about and learning from religion at instructional and experiential levels, Bråten found in her case studies that this differentiation was more clearly understood and practised among the English teachers and students than seemed to be the situation in Norway. She also points towards interesting differences in the academic debates on religious education as part of the societal level of curriculum, and mainly refers this to certain national processes. In England religious studies as an academic discipline has developed in close relationship with religious education for several decades, while theology has been much more dominating in Norway (Bråten, 2009, pp. 114-115).

Bråten shows how complex this field is, and that pedagogical approaches and legal arrangements interact in different ways with local, national and international processes in addition to the different curricular levels and that only a careful unpacking of these relationships will give a sufficient understanding of the situation in a given country in order to argue normatively. Bråten gives an example of such reasoning in her comments on Wanda Alberts⁽⁵⁾ research, which recommends a 'study of religions approach' as the general pedagogy of religious education (Alberts, 2006, 2007):

The tradition for RE research in England can be described as an educational/pedagogical tradition where a range of distinct *pedagogies* are suggested, some of which are more theologically based while others are more clearly based in a religious studies or social science tradition (see chapter 3). This is why, in my view, making a very clear distinction between theological and study-of-religions approaches, as Alberts (2006, p. 360) suggests, would be a step back in the English context. In the German, and perhaps also Norwegian context, this might still be useful (Bråten, 2009, p. 323-324).

The mere distinction between a theological and a religious studies approach does not solve the challenges of religion in education. One important reason for this is that these are possible to identify as academic disciplines, but hardly as school based or school related practices. When the issue at stake is religion in education there needs to be a conversation between these subject area disciplines as well as with educational theory and practice. Even if Nordic countries are different in terms of legal framework of religious education, researchers in all of them could benefit from an open and unbiased discussion about how to address the internationally relevant questions in the field of religion and education that we are confronted with. Oddrun Bråten has given both insights in how to do it and challenges to be met by addressing comparative issues in religious education and by applying insights from general education related to the contextualisation of subject area pedagogies.

Inspired by this, I want to suggest the use of a well-known tension from the field of education, namely between content-oriented and child-oriented approaches in order to construct a map or typology of religious education pedagogies. This is relevant for the purpose of the present discussion since we can assume that content-oriented approaches are more knowledge-oriented in their aims ('learning about') and that child-centred approaches are more preoccupied with formation (learning from'). By using this mapping devise we may get the following picture.

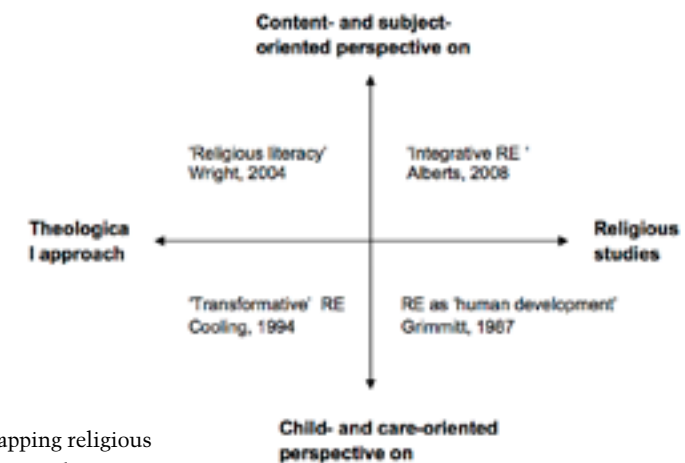


Figure 2: Mapping religious education approaches

It is not possible to discuss the details of this here, including the location of examples from religious education theory. They are placed in this system of coordinates in order to exemplify how such mapping can be done. By doing this the dialectic between formation and knowledge is expanded towards a richer and more complex picture. This is done by drawing on educational theory, but in conversation with the distinctive character of subject area didactics. A similar expansion can be done by looking more closely into the *Bildung* aspects of religious education.

BILDUNG AND RELIGIOUS EDUCATION

In his discussion of the meaning of general education (*Bildung*), Berndt Gustavsson presents this as a complex and dialectical unity of several elements (Gustavsson, 1996). Drawing on other scholars, he is working with a combination of three basic dimensions:

- classical education (tradition),
- citizenship education (society)
- personal development (identity/individual)

From Gustavsson's perspective these dimensions are intersected by certain questions about relational 'pairs':

- between the known and the unknown,
- between theory and practice
- between difference and integration.

In the following I will restrict myself to the three dimensions of education. I see Gustavsson's concept of 'classical education' as being parallel to what I have earlier referred to as 'knowledge' orientation and as 'learning about' in the field of religious education. In other words, Gustavsson includes the knowledge dimension in the 'Bildung', not seeing this as contrasting perspectives. This is in itself worth a discussion, but for my present purpose I will focus on the two other dimensions; citizenship education and personal development. These two can and should be seen as different aspects of 'formation' in a religious education context. Historically speaking, the 'formation' element in education can be seen as oscillating between an emphasis on a collective and an individual pole. In the case of social formation or citizenship education, political and societal aspects of Bildung are of course central, and educational aims drawing on this has become more and more relevant to religious education research in recent years, sometimes to the extent of dominating the other two dimensions of education (knowledge/tradition and individual development). Debate on religious education policies, practice and research today often focus on issues of multiculturalism, intercultural education and social cohesion, and this is also reflected in research (Jackson, 2009b Jackson, Miedema, Weisse & Willaime, 2007; Skeie, 2006, 2009; Ziebertz, 2003).

For religious education research it is important to draw this development into its own theoretical reflection process in dialogue with general education theory. In order to stimulate this, I will argue that both the social and the individual dimension of religious education can be formulated as dimensions of 'formation'. I continue to argue that 'formation' and 'knowledge' are interrelated in a way that 'formation' is not considered only as different from 'knowledge', but also as dependent on it. In order to visualise the above I have made the following illustration.



Figure 3: Dimensions of Bildung in religious education

How this interrelationship can and should be understood, is a longer debate, but I believe that religious education research has a role to play in this discussion. The reason for finding Gustavsson's contribution particularly relevant for religious education research is that it includes several dimensions in the concept of education, and keeps them in a relationship with each other. Also, by loosening up the dyad of 'knowledge' and 'formation', replacing this with a triad, opens possibilities for further reflection. In the following I will draw particularly on the social dimension in order to show that in discussing education for citizenship and social cohesion, the opposing categories 'formation' and 'knowledge' are insufficient. This resonates well with Gustavsson's inclusion of an ethical perspective in the educational thinking. Education should be seen as one of several efforts to make a good life accessible for all people in society. The fact that ideas about 'social formation' also may be exploited for oppressive purposes does not make citizenship and social cohesion obsolete, no more than the constant critique and revision of what 'scientific knowledge' is makes science or knowledge obsolete. Similarly, the questions of personal development and identity should not be stored away as a residual element of education or as a possible bi-product, but should be researched and discussed as vital part of the equation. In order to substantiate this I will discuss how some examples of Nordic religious education research have dealt with issues of social and personal formation.

KNOWLEDGE AND SOCIAL FORMATION

Mette Buchardt has done descriptive empirical investigation of multicultural classrooms and she explicitly refuses to present views on how teaching about religion should be (Buchardt, 2008). Her PhD thesis is categorised as 'sociology of education', but this can be challenged since it is placed within the academic framework of religious education research and draws on this for relevance. Buchardt argues that there is an increasing focus on pupils' identity and on multicultural issues in Danish educational policies, and she justifies her study by claiming that it looks into these issues at the level of classroom micro-politics. According to her, there is a mismatch between high political focus and interest in the religious education school subject on the one hand and the lack of research based interest in the actual teaching and learning going on in classrooms.

In her contribution to such research, Buchardt is aiming to describe how knowledge about religion and politics is 'coming to be' in the RE-classroom. The research material is recordings from the classroom interactions in religious education as well as documentation of how people in the classroom take turns in acting and speaking and how they are placed and move in the room. She also has conducted interviews with teachers and students. By using her analytical tools rooted in a theoretical framework particularly based on Michel Foucault and Basil Bernstein, and applying discourse analysis, Buchardt builds up a case for certain findings. She refers to identity as 'a spatial and differentiated production of subjects and subjectivities – as differentiated locations in the room. This production is to a large extent being done 'from below' intimately connected with bodies' (Buchardt,

2008, p. 348, *my translation*). This is what Buchardt calls the micro-politics of the classroom and here she finds 'religion' and 'culture' as elements of identity production. 'Religion' and 'culture' are not seen mainly as a given stock of educational knowledge, but a 'productive and potent part of social classification'. Therefore the category 'Muslim' as it appears in the classroom, is not only to be understood as related to social classification and redistribution of knowledge, but it is in itself part of a process of social classification and redistribution going on in the classroom (Buchardt, 2008, p. 349). In other words, the understanding of what it means to be a Muslim is at the same time school subject content ('knowledge') and also a way of shaping the understanding of Muslims present as well as those in the local context ('formation'). As part of this, there is even one 'legitimate' and another 'illegitimate' Muslimness being played out in the classroom. This is possible through the power that is built into communication and utterances, in particular through the powerful valuation done by the teacher. Classroom conversation should therefore not be seen as a 'free' conversation about e.g. Christianity and Islam, but analysed as a discourse where some utterances are legitimate and others not. Knowledge about religion is likened to power relations and ways of self-definition and these are not possible to decouple according to Buchardt.

On the one hand Buchardt's analysis is both convincing and impressive; but there is hardly any interpretation of motives, only a discussion of communicative practices with background information to support the analysis. This means that both teachers and students seem to be strongly determined by forces of power in the multicultural society. The lack of discussion about alternative teaching methods and about the interpretation of pupils' actions and utterances is a consequence of the theory and method used, and the results highlight power and social relations as the vital elements in the production of knowledge in the classroom. All the small things said and acted out in the classroom together form the subject area knowledge and contributes to the shaping of people's self-understanding. This may seem one-sided, but is particularly relevant in times when 'knowledge' in education sometimes seems to be pictured as a result from an international standardised test. This research shows how knowledge in religious education is also a result of micro-politics. We may link this up to the main theme by summarising; for Buchardt knowledge is built on micro-politics and formation is strongly power laden and because of this partly out of control of the classroom actors.

A political perspective is also prominent in another recent thesis by Lars Laird Iversen, drawing on empirical research in Norway⁽⁶⁾. Iversen is not from the outset a religious educator, like Mette Buchardt, but sees himself as a sociologist of religion, investigating Norwegian multicultural classrooms, and his main interest is the relationship between religion and national identity (Iversen, 2012). Also he discusses the production of knowledge in religious education, but combines the analysis of curricula with empirical classroom studies and focuses more on the social dimension of identity than on subject area knowledge. While Buchardt hardly discusses the literature on multicultural society or classrooms, Iversen relates his findings and analysis to the debate about multiculturalism in Western

Europe. As a result of this discussion, he comes up with the concept of 'viscosity'. The identity claims of groups in society are seen as being different in their degree of permanence, coherence and openness to change, they are fluid. Iversen argues that this is related to a similar variation on the level of social practices. Sometimes these practices tend to be stable and solid, at other times they are less so, and Iversen shows how this can be analysed fruitfully in order to understand better the actors and actions in the classroom. On the level of curriculum, Iversen's analysis shows that the focus on identity has changed. By studying changes in the meaning of 'values' in curriculum texts between 1974 and the present he shows that in the beginning the term 'values' was related more or less exclusively to ethics, while in the 1990s the term became much more connected to notions of identity. Along the same lines, also religion in the latter period is seen by the curriculum authors as a resource for both individuals and society at large, providing stability in terms of both individual identity and social cohesion. This result is achieved not by appealing to religion as a spiritual force in confessional terms, but more by using it as a cultural framework on a metaphorical level.

Iversen has combined curriculum analysis with empirical classroom research. Here his findings does not show that the same ambition to produce stable individual and social identities found in the curriculum. Even if religious identities are referred to and used in self-description or to characterise others, the same identities are also negotiated, challenged etcetera, what Iversen calls being 'worked on'. In this way identities appear to be fluid and open to change or objects of reinterpretation. Identity is something worked on through the opportunity school gives to engage with differences and diversity, rather than offering stability and a common framework of thought or 'sameness'. Sometimes this is facilitated by the actions of the teacher, usually by attempts to manage disagreement, not trying to create uniformity. In Iversen's terminology, the classrooms sometimes appeared to be 'communities of disagreement', sometimes 'communities of shared action', sometimes 'communities of shared decision making' and sometimes 'communities of shared knowledge' (Iversen, 2012). Iversen's research shows that social and individual (trans-) formation is taking place in the classroom, and that this is not possible to separate from the teaching and learning of subject knowledge even if it is often going on parallel to the formal teaching and learning. Individuals make use of the resources they find to be of interest, which points towards the individual dimension of formation.

KNOWLEDGE AND INDIVIDUAL FORMATION

In 2008, before the economic crisis hit Iceland, Gunnar Gunnarsson presented his research on the thoughts and ideas of young people in his country (Gunnarsson, 2008). In the light of this, it is striking how optimistic and secure the young people seemed to be at the time. Gunnarsson's research focuses on the motivations, thoughts and opinions of young people and through his analysis we come close to the individual. The insights most relevant to religious education are therefore

not related directly to the class-room situation, but more indirectly by presenting background knowledge about the learners.

While there are several examples of investigations into the life-interpretation of children and young people in other Nordic countries, both recently and from earlier years, one of the most prominent being Sven G Hartman, Gunnarsson breaks new ground by including Icelandic youth into this picture. He highlights the importance of contextual perspectives, and how Icelandic youth is also gradually becoming more influenced by socio-cultural plurality. Gunnarsson also discusses gender, a perspective which is generally lacking in Nordic religious education research. Perhaps better developed gender perspectives can add something significant to our insight into the social and individual dimensions of formation, and also to the construction of subject area knowledge in the classroom? The lack of gender perspectives is noticeable also outside Scandinavia (O'Dell, 2009, 2012)

Gunnarsson's empirical studies show that Icelandic youth are preoccupied with trust and security in their lives. These values are closely tied to their family life and the situation in the family as well as their relationship with peers. More in the periphery, social and cultural surroundings are also coming into the view. Summing up his findings, Gunnarsson sees one line – representing tension between plurality and homogeneity – being crossed with another line stretching from security to insecurity. Within this system of coordinates the young people he has studied can be seen as occupying different life-interpretation positions. Maybe Gunnarsson's map does not exist only in the thinking of the researcher, but also to some extent in the young people's minds, as a map of the terrain they are moving in. Sometimes they want security, and sometimes they risk insecurity in their movement between homogenous and more heterogeneous contexts. Gunnarsson argues convincingly that religious education needs to pay attention to the 'work' that young people are doing in order to interpret their lives while living them. If this is not done, knowledge about religion is not going to have much relevance to these young people, and then what values does it have?

In his PhD thesis Gunnarsson has covered much of the debate about life-questions, life-views, life-interpretation and life-philosophy, particularly in Sweden and Norway and discussed conceptualisation in relation to empirical investigation in the field. A considerable literature including conceptual debates and empirical studies related to concepts with 'life' in them has appeared since the late 1960s in the Nordic countries. Nevertheless, there is no agreement in terms of how this relates to the educational questions of knowledge and formation, and also what implications it has for pedagogy of religious education. In terms of terminology Gunnarsson prefers the concept of 'life-interpretation' and it would be interesting if his research opens the path for more international debate about what may be called a Nordic discourse (Heimbrock, 2004). Signhild Risenfors' dissertation certainly proves that this dis-course is alive and self-reflexive (Risenfors, 2012).

There are also researchers critically addressing issues of individual formation in Nordic religious education research. Bengt Ove Andreassen has analysed the textbooks used in teacher training of religious education in Norway (Andreassen, 2008). There are limitations to such a study, because it does not say anything about how these books are used, only about their content. However, the textbooks may be seen as reflections of research trends in the field. Andreassen is representing an emerging interest in religious education from young researchers from the discipline of religious studies/history of religions and he uses this perspective programmatically. By focusing on the textbooks for teacher training mainly towards primary and secondary teacher training Andreassen is looking for the construction of a teacher training school subject. In this way he hopes to get insight into 'what understanding of subject area knowledge that underpins the education of school teachers' (Andreassen, 2008, p. 25, my translation). In addition he focuses on what kinds of student-role and teacher-role seems to be implied in the books. His method is discourse analysis, drawing on Foucault's theories about knowledge and power, arguing that the texts he is investigating need to be interpreted and analysed as 'power texts' which define an area of knowledge. Based on his methodological approach constructs a map of key concepts used in the books and of the networks of meaning in which these concepts are inscribed. The reading of the textbooks is sensitive and critical with a hermeneutical interest in power and context.

The result of his analysis is that the existential dimension proves to be particularly strong in the most used textbooks in contrast to an approach with more emphasis on 'knowledge'. The dominant way religious education is pictured points in the direction of learning *from* religion. He sees this as being close to the perspectives often found in new religious movements where religion is seen as a resource for self-development. The way the books picture the role of the student parallels this by emphasising students as young persons who are developing 'themselves'. By using concepts like 'life-interpretation' the textbooks are focusing on this self-development and on how this can be brought in contact with a religious language. The role of the teacher is to facilitate and possibly guide the students in the development of a life-interpretation. In this way the teacher appears to be some kind of 'identity-expert' or facilitator, supporting the students in their search for a more mature self-understanding. The aim of this search is not a Christian identity, which was the case in religious education years ago. Instead all religions are seen as resources in the search for meaning and identity. Andreassen also finds books that point in other directions; one points towards a Christian-theological position, while another is more religious studies and knowledge oriented. But since these books are not the most used ones, Andreassen can argue that his main result covers the most powerful texts: There is a hegemonic discourse defining pedagogy of religious education in Norway and there are other marginal discourses pointing in other directions. He argues that the dominating discourse is a mainly theological one, but an important qualification is that it is not bound to one religion. The 'learning from' perspective is in itself theologically biased, according to Andreassen, since theology sees religion as something to 'learn from', while from a religious studies perspective the emphasis is on the 'learning about' approach. His analysis of the

dominant discourse in Norwegian religious education also uncovers a underlying discourse of 'goodness', where conflict, borderlines, differences and contradictions in the field of religion(s) are excluded from the picture.

Even if Andreassen's analysis may be challenged in various ways, this is a type of research relevant for the debate about 'learning about' and 'learning from' religion, irrespective of whether one accepts the way Andreassen pictures the relationship between academic disciplines. The question is rather how religious education pedagogy is going to deal with the challenges related to individual formation and the role of research in this.

INDIVIDUAL AND SOCIAL FORMATION

This discussion of the complexities of the formation/knowledge relationship supports the view that rather than being a dilemma to be sorted out or a choice between different paths, the dichotomy has proven to be a fruitful heuristic tool, and points in the direction of more dialectical relationship between the two. The English researchers presented all dealt with this as a dialectic of substance (knowledge) and function (formation) where both are inconceivable without the other. Also Nordic research on religious education and research in the field of subject area pedagogy (didactics) can benefit from more dialogue with general education and vice versa. The field of religion in education may seem to many as special, since it is not only connected with academic disciplines but also with contextualised beliefs of individuals and groups. I hope to have shown that the questions and answers presented in religious education research have something to offer in the discussion of what we want education to be across subjects, and I am particularly concerned with the humanities and social studies. Several of these subjects are marginalised by the present policy focus on skills in reading, writing, arithmetic and science, but life on the margins can also be a stimulus to renew the discourse of what these subjects deal with. By not getting involved in the debate about knowledge, but by expanding the discourse about knowledge and formation it is possible to raise a debate about the content and aims of individual and social formation in education. Here I believe recent and on-going research in religious education research has important contributions to make.

NOTES

(1) See the discussion of French and English religious education in (Meer, Pala, Modood & Simon, 2009).

(2) See National Curriculum website where the curriculum content as well as attainment targets are structured according to 'learning about' and 'learning from' as headlines: <http://webarchive.nationalarchives.gov.uk/20100823130703/http://curriculum.qcda.gov.uk/key-stages-1-and-2/subjects/religious-education/index.aspx> (accessed 2011/04/27)

(3) (Filipsone, 2011) does not refer to this article (Hella & Wright, 2009) but she upholds her critique in spite of (Wright, 2007). Another recent critique of Wright focuses on his emphasis on rational argumentation in the learning about religion and his knowledge- and truth- oriented understanding of 'religion' (Strhan, 2010). For a recent comment on the learning from/learning about perspective see (Wright & Wright, 2012) where this distinction is commented critically as in danger of 'assuming a basic dualism between the learner-learning-from and the object-learned-about, and invites the notion that certain skills must be cultivated if the division between the two is to be overcome'. Instead Wright and Wright here argue a 'virtue-centred education'.

(4) See reflections on theology (Grimmitt, 1987: pp. 170-173, 257-261; Wright, 2004, pp. 67-124), religious studies (Robert Jackson, 1990), and both (Cush, 1999; 2007; 2009)

(5) Wanda Alberts is working at the University of Bergen, Norway and has compared approaches of religious education in England and Sweden in her PhD thesis (Alberts, 2007).

(6) Lars Laird Iversen is identical with Lars Laird Eriksen, which is the name he had when he delivered his thesis at the University of Warwick 2010. It was later published (Iversen, 2012).

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SCIENTIFIC TRUSTWORTHINESS – THE CONSIDERATIONS AND PERCEPTIONS OF STUDENTS

Mats Lundström & Anders Jakobsson

SAMMANFATTNING

I den här artikeln beskrivs och diskuteras en empirisk studie där gymnasieelever diskuterar olika förklaringsmodeller kring ämnesområdet kropp och hälsa. Syftet har varit att utvärdera och analysera elevernas användning av begreppen tillförlitlighet och trovärdighet i förhållande till såväl vetenskapliga som icke-vetenskapliga förklaringsmodeller. Vi har analyserat elevernas användning av olika epistemologiska resurser i argumentativa situationer. Analysen ledde fram till att eleverna använde fyra olika typer av epistemologiska resurser; relativistiska, normativa, auktoritativa och vetenskapliga. Resultaten visar att samma elev kan använda olika epistemologiska resurser vid olika tillfällen. Vi anser att vårt teoretiska ramverk som utgår från epistemologiska resurser kan bidra till att förstå hur individer använder olika förklaringsmodeller i olika sammanhang.

Nyckelord: Epistemologiska resurser, pseudovetenskap, argumentation

INTRODUCTION

The concept of nature of science (NOS) has been in focus in a large number of research studies in recent decades and the significance of both students' and the broader public's understanding of this area has been highlighted by several scholars in the field. For example, Lederman (1992, 2007) asserts that students' perceptions of NOS, above all relate back to their understanding of the epistemology of science; science as a way of knowing, or the values and beliefs that are inherent to scientific knowledge and its development. According to him, the concept is also related to issues of ontology; i.e. how individuals understand which concepts and categories they need to use in order to give coherent and consistent descriptions or explanations of the world. Sadler, Chambers and Zeidler (2004) argue that students' understanding of the concept may become explicit when they are involved in discussions about issues related to scientific trustworthiness and reliability in

MATS LUNDSTRÖM

*fil. dr lektor i naturvetenskapernas didaktik,
Malmö högskola
Lärande och samhälle, 205 06 Malmö
E-post: mats.lundstrom@mah.se*

ANDERS JAKOBSSON

*Professor med inriktning mot de naturvetenskapliga
ämnenas didaktik, Malmö Högskola
Lärande och samhälle, 205 06 Malmö
E-post: anders.jakobsson@mah.se*

contemporary science. In their study, upper secondary students in the US were requested to evaluate the scientific trustworthiness of popular scientific articles. The study revealed that the students had a strong tendency to overestimate the trustworthiness of articles that supported their own original idea. Kolstø (2001) found that students in Norway expressed strong hesitation in evaluating what kind of sources to trust when they examined statements related to the risks of power transmission lines.

One way of understanding why issues related to NOS and scientific trustworthiness seems to cause such problems for students may be to use Cobern's (2000) framework. He asserts that an individual's different interpretation of the world and world view may be explained by the epistemological macrostructure, which constitutes the fundamental organisation of mind and influences how we view, act and argue in and about the world. However, Hammer and Elby (2003), and Hofer (2001, 2004a) take another philosophical perspective when arguing that an individual's understanding of scientific trustworthiness is related to their personal epistemology and to what kind of epistemological resources the individual is able to use. According to them, personal epistemology is dependent on what encounters and experiences the individual has had, and the kind of epistemological resources the person actually uses is strongly related to the specific context or situation. From this perspective the different epistemological resources used by an individual are not seen as stable, mental entities but rather different argumentative resources whose use is dependent on the situation or context. Thereby, this perspective differs from studies that connect epistemological beliefs with cognitive structures (i.e. Wu & Tsai, 2011).

In this study we intend to use framework of Hammer and Elby (2003), Hofer (2004a), Hofer and Pintrich (1997) in order to explore upper secondary students' considerations and perceptions of scientific trustworthiness through analysing what epistemological resources they use when discussing issues related to the human body and health. The student assignment is to evaluate the scientific trustworthiness in texts and articles that are related to scientific, as well as non-scientific explanations.

THE ABILITY OF STUDENTS TO EVALUATE SCIENTIFIC INFORMATION

Erduran, Simon and Osborne (2004) argue that one way to develop students' understanding of issues related to the nature of science is to focus on the students' use of arguments when they are involved in discussions about science. The authors suggest, for example, a focus on educational situations where students are requested to work with so-called socio-scientific issues. These tasks tend to be less well structured, more value-laden and open-ended than standard learning tasks that are framed within accepted disciplinary discourses. In these situations, learning science seems not only to be related to learning scientific concepts, problem solving skills and process learning, but also to students' appropriation of the practice of argumentation in scientific communities. Bricker and Bell (2008) also focus on science learning in situations where explanations and models of scientific phenomena are jointly constructed through social discourse in which the explanations and models are questioned, evaluated and revised. Several studies indicate that this way of organising science lessons creates opportunities of developing the students' understanding of scientific trustworthiness and reliability. For example, Ratcliffe and Grace (2003) show in a study that students improved their understanding of these issues and their reasoning skills related to NOS when working with socio-scientific issues, especially if the teacher facilitated the discussions with well-structured questions about the content. Other researchers (e.g. Erduran et al., 2004) assert that this way of organising science education develops the students' abilities when it comes to seeing and exploring new perspectives. In their study, the students increased their ability to use counter-argument and rebuttals to higher degree than other students.

However, a lot of other studies indicate that the development of students' understanding of issues related to scientific trustworthiness and reliability may be problematic. For example, in a study by Sadler et al. (2004), upper secondary students were requested to evaluate the scientific value of popular scientific articles. The results revealed that approximately 40 % of the students had a tendency to overestimate the scientific value of articles that supported their own original idea. Kolstø et al. (2006) investigated the ability of 89 science student teachers to assess the trustworthiness and reliability of different scientific claims in popular science articles during group work. The students' answers and statements were analysed and categorised from 13 different criteria, such as the students' abilities when it comes to evaluating the empirical and theoretical adequacy, the completeness of information and the social aspects in the articles. The result indicates that the students above all focused on the consistency or validity of the argumentation in the articles, and that they emphasised the importance that the conclusions in the articles did not go beyond the referred evidence. When it comes to the social aspects, the students questioned the possible influence of the underlying institutional interest and the competence of the authors or experts. According to the conclusion of the study, the quality of the students' critical examination clearly indicates that these issues need to be emphasised in science teacher education

in the future. Korpan, Bisanz, Bisanz and Henderson (1997) also point to the fact that science students in general usually request more information about how the empirical part of the research process is conducted when they assess the value of short news items with scientific content. Additionally, the students often ask for descriptions of how the researchers were able to draw conclusions from their research. Very few of the students raised questions about closely related research or if other research studies have come to the same conclusion.

In another study Kolstø (2001) found that 16-year-old students in Norway expressed hesitation when it came to evaluating what kind of information to trust and what sources to believe when they examined statements related to the risks of power transmission lines. In the study Kolstø used as a basis for interviews a news item about power transmission lines and their significance in relation to leukaemia. The analysis identified four different resolution strategies that were used to different extents by the students when they assessed the information in the article. The resolution strategies were *acceptance of knowledge claims*, *acceptance of authority*, *evaluation of statements* and *evaluation of authorities*. Most of the students only used one of the strategies but some of them could use more than one in order to come to a conclusion. However, according to the author, the students to some extent were able to draw conclusions regarding the trustworthiness of the knowledge claims, the reliability of the information and arguments used in the articles.

THE STUDENTS' WORLDVIEW AND PERSONAL SCIENTIFIC EPISTEMOLOGY OF STUDENTS

Coburn (2000) argues that the ability to understand issues about the nature of science and to assess and evaluate scientific trustworthiness and reliability in contemporary science is, above all, related to the individual's worldview. According to him, the individual's worldview is mainly established in early years and is difficult but not impossible to change during a person's life. Formal schooling may build up cognitive frameworks that can influence the world view and the epistemological macrostructure. Hofer and Pintrich (1997) and Hofer (2001; 2004a) take a different philosophical perspective when describing the individual's beliefs and knowledge about the world in terms of *personal epistemologies*. They argue that all individuals successively and constantly develop their personal epistemology during life and that this also constitutes how and in what ways individuals evaluate information and draw conclusions about phenomena in the world. Additionally, they refer to personal epistemology as the theories and thoughts about knowledge and knowing that the individual develops during encounters in the social and cultural world. This implies that individuals develop different *epistemological resources* (Hammer & Elby, 2003; Hofer, 2004a; Louca, Elby, Hammer & Kagey, 2004) due to what they encounter and experience, and that these resources may be utilised in different contexts or discourses. According to Hammer and Elby (2003) and Hofer (2004a) the idea the individual seems to use of different epistemological resources on different occasions may explain the phenomenon that people are able to express different world views or understandings, depending on what situations or contexts

they are involved in. From this perspective, the different epistemological resources used by an individual are not seen as stable, mental entities but rather as different argumentative resources whose use is dependent on the situation or context.

In relation to research on the world view of individuals, Hofer (2004a) argues that carefully conducted explorations of the personal epistemology, used in action may create a framework for describing and analysing an individual's personal theory of knowledge and a tool to analyse which authorities the students believe and why. Hofer (2001), and Rizk, Jaber, Halwany and Boujaoude (2012) describe various strands in personal epistemology such as knowledge construction, sources of knowledge, evaluation of knowledge and progression and development of knowledge. Additionally, Hammer and Elby (2003) and Hofer (2004a) refer to resources as context-dependent and situated, which imply different kinds of analyses than used in studies where knowledge is viewed as stable and constant in all contexts. However, Hofer (2004b) calls for more observational studies about individuals' personal epistemology in everyday and educational settings; studies that focus on the individuals' view of the nature of science and students understanding of issues related to reliability, trustworthiness and justification of knowing.

One study that partly explores these perspectives is Hansson's (2007) study about upper secondary students' understanding of the Big Bang theory. According to the author, the results indicate that the students' worldview makes it possible for them to present and understand scientific explanations without making them their own in other contexts. The students were able to describe thoroughly and use explanations about the theory during physics lessons despite the fact that their own ideas or beliefs actually were quite different. The study also reveals that most of the students were not familiar with some of the fundamental presuppositions or ideas that relate to a scientific worldview about the universe, despite the fact that they have chosen to study the natural science programme in upper secondary school. In this way, the study clearly indicates that the personal epistemology used by students is related to the situation in which individuals evaluate and assess new information and when they form their ideas about what can be counted as scientifically trustworthy. Sinatra, Southerland, McConaughy and Demastes (2003) also investigated students' understanding of the reliability and trustworthiness when related to issues of different scientific content. They found that students to a relatively high extent seem to accept the scientific explanation of human evolution but expressed hesitation or even scepticism in relation to evolution in other species.

In conclusion, the authors elaborate on possible explanations in a discussion about the relation between the students' ability to display scientific knowledge on the one hand and their willingness to accept the same knowledge as their own on the other. In another study, Lundström and Jakobsson (2009) found no obvious correlation between students' knowledge about the human body and health and their tendency to agree or disagree with non-scientific explanations and statements. The results indicate that the students' level of knowledge of and about the function of the human body did not automatically seem to be related to their dissociation

with non-scientific or even pseudo-scientific statements about the human body and health. Shermer (2003) comes to a similar conclusion and argues that our beliefs or ideas about the world are often not immediately related to empirical evidence and logical reasoning. Instead it seems that social and cultural influences such as family and peer pressure, experiences and life impressions have a strong impact when we make choices of what we believe in.

All these studies clearly demonstrate the complexity of the relationship between the individuals' displayed knowledge and their acceptance of that knowledge as a part of their own world view. However, we argue that the difficulties of interpreting and fully understanding these issues should not prevent the research community from taking further steps in order to increase its understanding of them. A number of scholars, such as Sadler et al. (2004) and Hofer (2004a), suggest advancing research on this matter by studying students' understanding of the nature of science; to focus on their understanding of reliability and trustworthiness and to interpret their use of epistemological resources in different contexts and in argumentative situations.

PURPOSE AND RESEARCH QUESTIONS

As mentioned, several research studies in recent decades have explored the understanding of the nature of science in students, as well as other individuals: scientific trustworthiness and issues related to the personal epistemology of individuals. Hofer (2004a, 2004b), and Hammer and Elby (2003) refer to personal epistemology as different epistemological resources that individuals are able to use, dependent on what encounters they have previously experienced and that these resources can be utilised in different contexts or discourses.

In this study, we use this framework in order to explore what kind of epistemological resources upper secondary students actually use when they discuss issues related to the human body and health. The student assignment is to assess and evaluate the scientific trustworthiness in texts and articles that are related to scientific, as well as non-scientific explanations. The research question in this study is:

In what ways may students' considerations and perceptions of scientific trustworthiness be expressed through their use of different epistemological resources?

METHODOLOGICAL CONSIDERATIONS AND ANALYSIS

This study is a part of a larger research project where the understanding of upper secondary students' ideas about the nature of science and the relationship between scientific and non-scientific explanations are investigated. Our earlier study (Lundström & Jakobsson, 2009) explored nearly 300 students' ideas of issues related to the human body and health and the relationship between the students' knowledge and their perceptions of scientific trustworthiness. The design of this study made it possible to describe what kind of statements the students believed were scientific trustworthy or not. However, it did not actually succeed in explaining

the students' underlying argumentation or their use of different epistemological resources. In order to capture students' reasoning and their use of epistemological resources requires carefully conducted observations during active, argumentative problem-solving situations in an everyday classroom discourse (e.g. Jakobsson, Mäkitalo & Säljö, 2009). This implies that the focus in this study have to be on the students' use of epistemological resources in action, when they make sense of school assignments and on their perceptions of trustworthiness in relation to these assignments.

In order to study these issues two different assignments (see appendix 1) were intentionally constructed by the researchers. The first assignment (Case A) consists of a person's description of her allergy. She wants to know what causes her problem and two alternative explanation models are presented. The first is a text that relates allergic reactions to the immune system and anti-histamines, and a description of the medicine was given to the students. The second alternative uses a non-scientific explanation which assumes that her allergy is the result of unresolved conflicts and a suggestion that a 'cure pendulum' may ease the symptom. (Some people and pseudoscientific organisations claim that the pendulum responds to 'electromagnetic energy that radiates from everything on Earth' and that it can cure illnesses.) A pendulum and a description of how to use it were enclosed with this assignment. In the second assignment (Case B), the students were requested to discuss different factors that may have an impact on an individual's state of health. The first explanation model consisted of a medical text that suggests that human health may be understood from of a combination of the individual's lifestyle, environment and genes. The second explanation uses a non-scientific model including astrology and a predestined view of human health. The aim of constructing these two assignments was to explore what kind of epistemological resources the students use when they are involved in discussions about trustworthiness related to different explanation models. The two cases were not traditional socio-scientific issues in which an important question for the society was investigated from scientific perspective. However, the two cases included different perspective on science and were less well structured, more value-laden and open-ended than standard-learning tasks that are framed within accepted disciplinary discourses, as proposed by Erduran et al. (2004).

31 students (aged 16-17) in their first year of the science programme in upper secondary school in Sweden were chosen to participate in the study. The selection of science students can be regarded as typical *case sampling* (Patton, 2002) because all of the students, to some extent, belong to a similar culture in that they are enrolled in the science programme. The science teacher in the participating class had answered a call for voluntary science programme classes. All students, except four, agreed to be involved in the study. The research project followed the law on ethical considerations applying research that involves humans and met the demands with respect to information, consent, confidentiality and use in the research process (CODEX, 2010). The students themselves chose their pseudonyms used in the excerpts. The students worked with the assignments (Case A and B) in mixed and

single gender groups, with 3-5 students in each group in an ordinary school setting. Each group was videotaped during all of their discussions and excerpts of these discussions constitute the total empirical material in the study. The regular classroom teacher moved between the groups and made comments or asked questions in order to facilitate the discussions, which aimed to create an authentic everyday classroom situation (see Goldman-Segall, 1998). This setting was supposed to facilitate the students' use of scientific argumentation.

However, according to Mork (2005), the main focus of research on argumentation on controversial issues in science education has usually been the process of argumentation rather than the factual content of the arguments used in the discussion. The dominating analytic tool used has been Toulmin's (2003) argument pattern (TAP). This model assumes an analysis of the different types of utterances, such as the declarations or the rebuttals people use in argumentation in order to underpin their statements. Several researchers like Erduran, Simon, and Osborne (2004) and Mork (2005) argue that the problem of using the TAP-model is that the model does not include an analysis of the content of the argument. Additionally, Driver, Newton and Osborne (2000) argue that the semantic and situational contexts are important when analysing arguments and that Toulmin's TAP does not take this into account. We have considered these arguments and the criticism carefully, especially as the focus of our research concerns, above all, the content of the students' argumentation. From this starting point, the analysis of the students' arguments and use of epistemological resources followed a two-phase model.

In the first phase, the thematic patterns (Lemke, 1990) of the discussions were identified. Lemke describes thematic patterns as a pattern of connections between the meanings of words. In this way the pattern may be 'semantic relationship that describes the thematic content, the science content, of a particular area' (Lemke 1990, p.12). He argues that there is always more than one thematic pattern woven into discussion, where sometimes alternative patterns may be those of common sense or everyday language. The purpose with this phase has been to find the general themes or patterns that most of the students frequently expressed. When different arguments were analysed, utterances and statements related to judgements of the scientific trustworthiness in the explanation model became particular thematic patterns to focus on in this first phase.

The next phase of the analysis has been to identify, transcribe and categorise what kind of epistemological resources the students actually used during the discussions about trustworthiness. This phase of the analysis focused on in what ways individuals evaluated and concluded on the available information. In other words, the students' use of different argumentative resources guided the analysis (Hammer & Elby, 2003; Hofer & Pintrich, 1997; Hofer, 2004a). In this phase the transcripts were read several times, looking for the typical or the unique, and for similarities and differences. The categories are in this way constructed from the material and not predefined. After this first categorisation, the authors tested the validity by rearranging the different statements in new groups in order to find new categories until the stage where the two interpreters reached consensus. Additionally, we

neither claim that the described categories constitute the only ones possible, but acknowledge that continuing studies probably will complement the image further.

RESULTS

As mentioned, the main task in this study has been to explore in what ways students' considerations and perceptions of scientific trustworthiness may be understood through the analysis of their use of different epistemological resources when discussing trustworthiness in relation to scientific as well as non-scientific explanation models. In the first example from the empirical material (Excerpt 1), four students, two girls (Gucci and Sonja) and two boys (Grebe and Gaban) are involved in a discussion about what kind of factors that may affect human health in general. The assignment (Case B) the students are engaged in is formulated as a dilemma where two different explanation models about what may influence health are presented. The students are requested to discuss and consider the scientific trustworthiness of the two explanation models and come to a joint decision. In the introductory part of the dialogue, Sonja expresses the idea that it is actually not possible to be sure if the movements of the planets may affect humans in some way or not. This statement seems to stimulate the discussion and to explicate what kind of epistemological resources the students use in this specific situation. The first excerpt constitutes an example of this discussion.

Excerpt 1

- 1 *Gucci*: What do you think?
2 *Sonja*: I think that the movements of the planets affect us, ... yes.
3 *Grebe*: In what way?
4 *Sonja*: I don't know, but everything affects us in some way...and the earth rotates
5 [Pause 2.0]
6 *Sonja*: ...you don't really know if it is true. Nobody knows. But it sounds a little... [shakes her hands] it sounds like a movie, that the stars...
7 *Gaban*: I've never heard of it.
8 *Sonja*: That the stars and...
9 *Gucci*: But if you read your... when you read in the newspaper...
10 *Sonja*: ...horoscope.
11 *Gucci*: Sometimes they're right.
12 *Sonja*: Yes, that thing ... boys are from Venus and girls from Mars, or whatever it was.
(inaudible small talk)
13 *Grebe*: Yes, that thing with the horoscope, I think it's true.
14 *Gucci*: Yes, sometimes it's right.

Sonja's first statement (turn 2) that the movements of the planets may have an effect on humans leads to a demand for clarification from Grebe by asking *In what way?* (turn 3). The question seems to cause some uncertainty and Sonja avoids

answering by saying *I don't know, but everything affects us in some way* (turn 4). However, Sonja does not clearly explain her view of how humans and planets could be interrelated. Her statement might also constitute an example of a situation, in which she uses an epistemological resource that assumes that it is not possible to be absolutely confident about the trustworthiness of any statement related to these issues, and the idea that everything is possible. This interpretation is reinforced when Sonja in the next utterance (turn 6) expresses...*you don't really know if it is true. Nobody knows*. On the other hand, she simultaneously expresses hesitation about her own statement by shaking her hand and saying *But it sounds a little ...* (turn 6). The discussion goes on when Gucci adds a statement about horoscopes and claims that *sometimes they're right* (turn 11). In doing so, she seems to support Sonja's reasoning that the planets and the stars may influence or have an impact on humans in some way. Grebe also expresses some confidence in horoscopes (turn 13) and Gucci ends the discussion, confirming Grebe's statement, by saying *Yes, sometimes it's right* (turn 14).

The first excerpt constitutes an example of a situation where some of the students and Sonja in particular uses a category of epistemological resources where it is not possible to make any confident or reliable statements about the scientific trustworthiness of the explanation models at all. This may also include situations where the students use epistemological resources, which express a view that everything seems to be possible and that it is impossible to be absolutely sure of anything related to these kinds of issues. The use of this epistemological resource occurs on several occasions (in one third of the groups) in the total data material and has therefore been categorised as a situation where students use *relativistic epistemological resources*. This does not imply that the students who use these resources in this specific situation will necessarily use similar resources in other situations.

In the next two examples (excerpts 2-3) the students in different groups discuss the causes of allergies and different explanation models related to allergy (Case A). The discussion in excerpt 2 is to some extent initiated by the teacher, when she is trying to encourage the students to compare the different explanation alternatives related to the case. The dialogue starts when Aslan takes the pendulum in his hand and says:

Excerpt 2

- 15 *Aslan*: This? [holds the pendulum]
16 *Teacher*: Hmm!
17 *Aslan*: It is ridiculous. It only glows!
18 *Mossa*: That method is ridiculous.
19 *Nob*: All you get is a tired arm [laughs]

In excerpt 2, Aslan (turn 17) and Mossa (turn 18) express the view that the *pendulum* and *the method* [are] *ridiculous*. Even if the group is requested to give explicit arguments or a justification for their statements, no one in the group takes the

discussion further on. A possible interpretation of the lack of discussion may be that the students are agreed on the negative value of the pendulum, which seems to result in a situation where further discussion seems unnecessary. However, it is also possible to interpret the situation as though the students are actually displaying a lack of ability to express why they not consider the pendulum a serious alternative. The next excerpt (3) constitutes one of the examples where one of the students tries to take the discussion a step further by asking the others in what ways the pendulum possibly may have an impact on the human body.

Excerpt 3

- 20 Per: This pendulum doesn't work. Do you think it works?
21 Elle: Why?
22 Per: How can it affect your body..?
23 Per: ...there's nothing in the pendulum that goes inside and kills the bacteria. How can it [the pendulum] kill them?

The discussion begins in a similar way as the discussion in excerpt 2, but Per tries to find a possible solution to the assignment by asking the others *How can it [the pendulum] affect your body?* (turn 22). No one in the group reacts to his invitation so he finally chooses to answer the question himself by seeking a logical connection between the pendulum and the body. But no one in the group takes the opportunity to discuss the issue further. Per's reasoning about allergies and bacteria is of course not scientifically correct (turn 23) but the statement clearly indicates a cause-effect view which may be seen as a kind of logical reasoning, despite the erroneous conclusion.

Thus, excerpts 2-3 may constitute some examples of an approach that several of the students display when it comes to relating their explanations to arguments about scientific trustworthiness. This lack of scientific reasoning is common in the total empirical material (occurs in nearly all groups), and the students often express what they believe in through the use of everyday language or with the help of normative statements without any clearly expressed justification. In this way, this kind of reasoning has been categorised as the use of *normative epistemological resources*. In this category, the similarities between the utterances are the use of resources above all seems to be related to traditions, preconceived opinions or general normative reasoning and rarely consists of references to scientific knowledge or trustworthiness at all.

However, some of the students use epistemological resources as they relate arguments to some kind of justification. In excerpt 4, the students discuss the scientific explanation model that was given in the case about allergies (Case A). The students are requested to read the text used to explain the scientific view of the disease and the possible cure. The excerpt (4) starts when Mossa expresses a general statement of what he thinks of the scientific explanation model, without any further justification.

Excerpt 4

- 24 Mossa: I think it's right.
25 Jenny: It's good
26 Bast: It looks right to me.
27 Aslan: Justify your answers!
28 Mossa: It seems reasonable.
29 Jenny: Because it's scientists that have put it forward. We're studying the science programme in order to know things like that.
30 Aslan: But is it only researchers that can be right... and not other people?
31 Jenny: Yes.
32 Aslan: How is that?
33 Jenny: What do you mean by...?
34 Aslan: But answer the question.
35 Jenny: Can you cure allergy with that thing that hangs... [Refers to the pendulum]
36 Aslan: No, it's quite ridiculous.

The first statements in this example actually only display some general statements of what the students think of the scientific explanation. The discussion gathers some speed when Aslan asks the group to *justify* their answers (turn 27). The call for justification seems to produce the use of other kinds of epistemological resources and Jenny clearly articulates her view, *because it's scientists that have put it forward* (turn 29). Additionally, she asserts their own responsibility to *know things like that as students at the science programme* (turn 29). She uses this kind of resource on several occasions throughout the discussions and by that asserts the idea that the students have to be sceptical about non-scientific explanations. Jenny seems to use the argument that *scientists put it forward* as a strong motive to trust one of the proposed answers in the case. This is an obvious reference to an authority, which seems to be relatively common in the discussions throughout the data material. Other examples of the use of these references to authorities are found in excerpts 5 and 6. In these excerpts the reliability of the prescribed medicine, mentioned in case A, is in focus.

Excerpt 5

- 37 Elle: They work [the tablets] because they sell them at the pharmacy.
38 Teacher: How do you know they work?
39 Per: Because people buy them. If they didn't work, people wouldn't buy them.
40 Teacher: But how do you know that they work?
41 Per: Because people buy them and get well.

Excerpt 6

- 42 Rocky: If this [the pendulum] had worked they would have sold them in all the pharmacies. Have you ever seen this in a pharmacy?
- 43 Annelie: No
- 44 Per: Good argument, Rocky!

In the excerpts it is obvious that the argument – if a medicine is sold at the pharmacy or not – seems to be important for the judgement of the level of trustworthiness, as Elle (excerpt 5, turn 37) and Rocky express (excerpt 6, turn 42). However, it seems to be possible to use this argument in different ways. In excerpt 5, Elle argues that *they [the tablets] work because they sell them at the pharmacy* (turn 37) and in excerpt 6 Rocky uses the same argument in a discussion about the pendulum by saying *If this had worked they would have sold them in all the pharmacies* (turn 42). In this way they seem to express the view that when a prescribed medicine is allowed to be sold at the pharmacy, it automatically implies that the medicine is trustworthy. The students do not exactly describe what this means or what testing procedures the medicine has to go through before becoming licensed to be sold at the pharmacy, despite the fact that the teacher asking for more information. In this way it is possible to assert that the students' use of the argument – if the medicine is sold or not at the pharmacy – as an authoritative argument without describing the scientific process behind the development of the medicine. The term 'authoritative arguments' may be understood here in the students' references to different actors engaged in scientific procedures, traditions or cultures, without giving any further explanations of the trustworthiness. This may also include the reference to people's own market evaluation and behaviour as Per argues in excerpt 5 (turn 39 and 41) that *people buy it* and *If they didn't work, people wouldn't buy them*. By this statement he seems to point out that people buying them is a sufficient argument for evaluating the trustworthiness of the medicine and its effect.

The way the students use epistemological resources in these excerpt differs from earlier categories and is therefore labelled as the students' use of *authoritative epistemological resources*. This category constitutes the use of epistemological resources that refers to scientific authorities or cultures without discussing what the actual scientific trustworthiness may comprise of. In this way, it is the individual that states who the authority is.

On some occasions, the discussions of trustworthiness seem to evolve further and relate to different scientific activities, such as research, or the specific scientific content. In these situations, the students seem to use their epistemological resources in another way than in earlier examples. Excerpt 7 is the continuing discussion from excerpt 2. The teacher initiates the discussion about the explanation models in case A.

Excerpt 7

- 45 Teacher: What is the difference between these two? Which of them would you recommend and why?
- 46 Aslan: Answer two, because that is something professionals work with [referring to the scientific explanation model].
- 47 Jenny: Exactly!
- 48 Mossa: They have to know something, before they take out something. They can't just... if they don't know something, they have to do research.
- 49 Jenny: They know how the substances - the ingredients - react with the cells and so on.

In excerpt 7 where the students discuss the assignment on allergies (Case A), Aslan refers to *professionals* (turn 46) when he is requested to argue for which of the models he could recommend. Additionally, Mossa and Jenny use references that relate to the *research process* and to the scientific *content* (turn 48 and 49). This implies that Mossa argues that before professionals can make any statements about a substance *they have to do research* (turn 48). Jenny supports Mossa's utterance by saying; *they know how the substances - the ingredients - react with the cells and so on* (turn 49). In this situation, she uses scientific terms or concepts such as *substances* and *cells* and doing so shows that she is able to use them in a relevant way. This type of argumentation, which explicitly refers to scientific processes or content, is relatively sparsely represented in the students' discussions throughout the data material. One obvious explanation of this phenomenon may be that the teacher is present and her question to the students has an impact on the discussion.

In the next excerpt (excerpt 8) the discussion about the medicine and the pharmacy goes further in that some of the students refer to the scientific processes behind a new medicine. Excerpt 8 is the continuing discussion from excerpt 5 and the teacher is present.

Excerpt 8

- 50 Per: Because people buy it and get well.
- 51 Teacher: But how did they know... before it was sold at the pharmacy?
- 52 Per: It was approved.
- 53 Annelie: Guinea pigs!
- 54 Per: It has to be approved before it can be sold, doesn't it?
- 55 Teacher: But what do you do when you approve it then?
- 56 Elle: Guinea pigs!

When the teacher asks for a clarification or an explanation of the commoditisation process for medicine, Per and Annelie refer to the fact that the medicine is tested before it is *approved* (turn 52 and 54). By doing this, Per seems to use other resources compared to the arguments he used in excerpt 5 (turn 39 and 41). Annelie (turn 53) and Elle's (turn 56) statements also indicate that they are familiar with a sci-

entific process by referring to the use of *guinea pigs* in the research process of the approval of medicines. This situation, compared to the situation in excerpt 5 may constitute an example where the same students may use different argumentative or epistemological resources on different occasions. We will return to this discussion later on. In this specific case, it seems that the teacher's demand for further clarification has an impact on the students' use of new resources.

As mentioned, the use of a developed scientific language and explicit scientific explanations are relatively rare in the discussions between the students. The fact that they sometimes use scientifically accepted terms or words do not necessary implies that they were able to use them as arguments in the discussion. However, the examples in excerpts 7 and 8 may constitute situations where the students actually are able to use some scientific references, such as the approval of medicines, the scientific content, research methods and the use of laboratory animals. However, this does not imply that the students were able use all of these references in a scientific, relevant way, but rather that they are able to use some of them as an argumentative resource in this specific situation. When students use their epistemological resources in this way we have labelled them as they use *scientific epistemological resources*. Unfortunately, there are relatively few statements in the empirical material that can be placed in this category.

In all, four categories of the different use of resources were identified in the data material; *relativistic, normative, authoritative* and *scientific epistemological resources*. As mentioned, it is possible to conclude that the students may use different epistemological resources on different occasions or situations. For example, when the same students (in excerpt 5) at first used authoritative epistemological resources when discussing the case about allergy and later on, challenged by the teacher, changed direction in order to use scientific epistemological resources. These changes commonly occur in the total data material and most of the students use several of the described categories in different situations. Consequently, the use of different epistemological resources should not be understood to imply that the use of one of them automatically excludes the use of the others. Additionally, they may not be understood as individual or mental entities but rather as the *repertoire* of the epistemological resources students are able to use in specific situations. Further, the described categories should not be understood to be the only ones possible. They instead constitute the epistemological resources the students used in this study, and we can assume that more of them probably exist.

DISCUSSION AND IMPLICATIONS

We have in this study used the framework of Hammer and Elby (2003), Hofer (2004a), Hofer and Pintrich (1997) in order to explore what kind of epistemological resources upper secondary students use when discussing different explanation models about phenomena related to the human body and health. The aim has, above all, been to analyse and assess the students' use of the concept of trustworthiness and reliability in relation to scientific as well as non-scientific explanations.

To some extent, this framework may be described as divergent from the commonly used frameworks in the science education research community. Cobern (2000), for example, argues that the individual's worldview is mainly established in early years and constitutes the fundamental organisation of the mind influencing how we view, act and argue in and about the world. From this perspective, students' ideas and their understanding of issues about scientific trustworthiness are viewed as a kind of individual property, which constitute a rather stable, mental entity.

In contrast to this view, Hammer and Elby's (2003), Hofer's (2004a), Hofer and Pintrich's (1997) framework describes the students' world view and their personal epistemology being situated and embedded in the specific situation the students encounter, and that they may use different resources dependent on this specific situation. From this perspective the epistemological resources the students are able to use may rather be understood as the repertoire of the resources students is capable of using specific situations or when working with specific issues. We argue that these ideas may, to some extent, be used in order to understand the phenomenon that students use different explanation models in, for example, school contexts and in everyday contexts, as several studies indicate (e.g. Hansson, 2007; Lundström & Jakobsson, 2009; Shermer, 2003). It is possible to discover a similar pattern in this study. Most of the students use different kinds of epistemological resources on different occasions and in relation to different issues when discussing the trustworthiness of the explanatory models. The used epistemological resources were mainly connected to sources of knowledge and justification of knowledge (Hofer, 2001; Rizk et al., 2012). However, it seems to be necessary to carry out additional studies in order to address these issues further.

Nevertheless, the framework of Hammer and Elby (2003), Hofer (2004a), Hofer and Pintrich (1997) has offered an opportunity to analyse what kind of epistemological resources the students actually use when they are involved in discussions related to scientific trustworthiness. In this way, the different resources have been categorised as relativistic, normative, authoritative and scientific epistemological resources. We argue, the categories should not be understood as the only ones possible. Rather, they constitute a starting point in order to develop an analytic tool that may contribute in deepening our understanding of how individuals perceive issues related to the nature of science and scientific trustworthiness. Such a tool may also help clarify issues related to the phenomenon that individuals are to be able to use scientific knowledge in a school context without making them their own, or as a part of their worldview, as Hansson (2007) reveals in her study.

The dominating category utilised by the students in this study has been the use of normative and authoritative epistemological resources. The students often express what they believe through the use of an everyday language, referring to traditions, preconceived opinions or general normative reasoning without any clearly expressed justification or references to scientific knowledge or trustworthiness at all. In addition, when they did not utilise normative resources they instead demonstrated a tendency to use authoritative resources. They refer to scientific authorities, cultures or other sources without discussing wherein the actual trustworthi-

ness consists. The results may be seen as surprising, especially as the students in this study participate in the science programme in upper secondary school. Several other current studies show a similar picture. For example, in Kolstø's (2001) study it was, above all, normative or authoritative statements that were utilised as sources of trustworthiness and these references were seldom challenged or criticised in the discussions. In addition, Sadler et al's (2004) study shows that nearly half of the students have the tendency to overestimate the scientific value of articles that supported their own original idea. Very few of the students in these studies raised questions about closely related research or if other research studies have come to the same conclusion.

The implications of this study could therefore be related to two different, but interrelated conclusions. Firstly, our study and several others, once again highlight the necessity to focus on issues about the nature of science and trustworthiness in science curricula and in science education at different levels. It is obvious that the students in our study express a lack of experience working with these kinds of assignments and that they need support and tutorials about how to evaluate the scientific trustworthiness of different explanation models. On some occasions, the teacher explicitly facilitated and deepened the discussion by raising open-ended questions and by pointing to the differences in the explanatory models, which probably had a positive impact on the discussion in these groups. This highlights the question of how to introduce and organise the instruction on these matters in science education. One possibility is to discuss pseudo-scientific issues in relation to science. If pseudo-scientific explanation models will be examined instead of ignored in science classrooms this could provide possibilities to enhance critical thinking and create opportunities to explore and develop an understanding of the nature of science. We think this way of working with cases and group discussions are opportunities to discuss and investigate the epistemology of science; science as a way of knowing, which is an important part of NOS.

Secondly, the study asserts the suggestion from Hammer and Elby (2003), Hofer (2004a), Hofer and Pintrich (1997) of considering student interpretations of scientific trustworthiness in their use of epistemological resources. We argue that this framework may contribute to further increase the understanding of how students experience issues related to the nature of science and scientific trustworthiness in the future.

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LÖSNUMMER, ORGANISATIONER OCH INSTITUTIONER:
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UTBILDNING-OCH-LARANDE@HIS.SE



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