

MULTIVOCAL DIDACTIC MODELLING: COLLABORATIVE RESEARCH REGARDING TEACHING AND CO-ASSESSMENT IN SWEDISH PRESCHOOLS

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Abstract

In Swedish preschools teachers seem to struggle with the concept of “teaching” in their day-to-day practices. A three-year collaborative research project involving preschool teachers, managers and researchers therefore aimed to describe and further develop knowledge about what could characterize teaching and co-assessment based on scientific grounds and proven experience. The research was carried out in between 93 and 137 preschools/or preschool departments in ten municipalities in Sweden between 2016 and 2017. The method was based on a praxiographic approach where preschool teachers tested four different theory-informed teaching arrangements. The material consisted of about 895 co-plans, 740 co-evaluations and 110 hours of video. Analysis was based on a didactic premise and can be methodologically described in terms of abductive analysis. The analysis was merged and tested in a communicable entity through the “multivocal didactic modelling” concept. The results indicated that teaching is modelled through co-assessment. Multivocal traces related to didactic questions and didactic levels emerge from theory-informed teaching arrangements. The research stands to make a highly significant contribution to knowledge development concerning teaching and co-assessment in preschool. Theory-informed teaching arrangements, with integrated didactic models, have been tried and shown to support teachers in conducting teaching that is based on scientific grounds and proven experience. The concept “multivocal didactic modelling” paves the way for alternative (meta)theoretical trajectories for critical reflection and for more cohesive and finely tuned teaching. In conclusion, the contribution to the development of knowledge can be described in terms of theory-informed practical development and practically grounded conceptual development.

Keywords: co-assessment, didactic models, multivocal didactic modelling, preschool education, Swedish preschools, teaching arrangements.

Introduction

This three-year experimental collaborative research project aims to address the challenges, opportunities and circumstances faced by today’s preschool in relation to the higher ambitions of the preschool mission (see for example, OECD, The Organization for Economic Cooperation and Development, 2017; Skolinspektionen [Swedish School Inspectorate], 2018). The research stems from the questions raised by participants concerning teaching, as related to co-assessment in the preschool (Vallberg Roth, 2016). Co-assessment includes at least two individuals/agents (see section “Co-assessment”). The co-assessment may include co-planning of teaching arrangements, co-action and feedback in teaching, as well as co-evaluation of teaching arrangements (cf. Allal, 2013; Thornberg & Jönsson, 2015).

There is an urgent need to clarify what could characterize preschool teaching in Sweden (Skolinspektionen, 2018). Preschool is a firmly established practice in Sweden that serves 85 per cent of all children aged 1–5 and 95 per cent of 4- and 5-year-olds (Skolverket [Swedish National Agency for Education], 2019). Swedish preschool has been a separate school form since 2011, is included in the educational system, and conforms to the Education Act. In the latest revision of the curriculum (SKOLFS, Statutes of the Swedish National Agency for Education, 2018:50, Curriculum for preschool, revised 2018), the mission of teaching is enhanced. The preschool curriculum is characterized by set objectives, which means that the objectives have a predetermined trajectory, but no specified endpoints or knowledge requirements at the individual level. According to the Education Act, teaching in preschool is defined as goal-directed actions led by preschool teachers that direct children’s attention to stimulating “development and learning through the acquisition and progression of knowledge and values” (SFS 2010:800, Chapter 1, Section 3). Teaching is included in education, which “should always be founded on a scientific basis and proven experience in terms of both content and work methods” (SKOLFS 2018:50, Curriculum for preschool, revised 2018, p. 11).

Swedish preschool is aligned with a Nordic tradition based on welfare-state ambitions that are highly ranked in international comparisons (OECD, 2017). Nordic preschools have similar systems of management by objectives, so it is more relevant to refer to, translate, and employ results from Nordic than non-Nordic research when examining Swedish preschools. However, research into teaching in preschool contexts in other countries adds important perspectives.

Background and Identified Research Problem

“Didactics” can be understood as the overall knowledge base for teaching and learning (see section “Didactics as the underlying premise of the research”). However, prior didactic preschool research in Sweden and the Nordic countries has focused more on learning than teaching (Vallberg Roth, 2018), although some studies have focused on teaching (see for example Björklund, Magnusson, & Palmér, 2018; Doverborg, Pramling, & Pramling Samuelsson, 2013; Hammer, 2012; Pramling & Wallerstedt, 2019; Rosenqvist, 2000; Sæbbe & Pramling Samuelsson, 2017; Sheridan & Williams, 2018). The content of teaching and learning in preschool varies depending on the underlying theoretical perspective and gateways used (Vallberg Roth, 2018). For example, some sociocultural perspectives focus on “situated learning”. Variation theory in “Learning studies” focuses on intentional learning. Other examples include pragmatic perspectives focusing on “reflective learning”. There are also post-constructionist and post-humanist gateways that focus on “rhizomatic learning”. In this way, a form of “learnification of didactics” (Vallberg Roth, 2018) emerges. The learnification of didactics can be linked to Biesta’s (2017) concept of “learnification,” which pertains to the changing use of language towards “learning” and “learners” instead of teaching.

Critical didactics (see section “Teaching-oriented and Critical-reflective Didactics”) and didactic levels (Kansanen, 1993) are not prominent in Nordic and non-Nordic preschool studies (Vallberg Roth, 2018). Moreover, there is a lack of long-term comprehensive studies focused on teaching at the Swedish preschool level conducted in collaboration with preschool teachers, managers and researchers. This three-year collaborative research project aims, therefore, to address the challenges, opportunities, and circumstances faced by today’s preschool in relation to the higher ambitions of the preschool mission (see for example, OECD, 2017; Skolinspektionen, 2018).

According to an analysis of studies concerning assessment and documentation within the preschool, with a focus on Swedish and Nordic research (Vallberg Roth, 2017), assessment research is still a relatively young and as yet undeveloped field. The field of documentation and especially research on pedagogical documentation holds a significantly stronger position

(cf. e.g., Alasuutari, Markström, & Vallberg Roth, 2014; Elfström Pettersson, 2017; Johansson, 2016; Lenz Taguchi, 2012; Lindgren, 2016). Assessment forms are characterized as focusing more on activity level in Nordic studies (cf. Bennett, 2010; OECD, 2013). In non-Nordic research, assessment methods may focus more on learning outcomes at the individual level and on standardized and graded assessment methods (e.g., Bennett, 2010; Ishimine & Tayler, 2014; OECD, 2013). Research on co-assessment in schools (Allal, 2013; Thornberg & Jönsson, 2015) showed that co-assessment can serve as a tool for collaborative learning, but its potential depends on several inter-related factors, such as how often it is carried out and from what point of departure (see section “Co-assessment”).

In the collaborative research at hand, different (meta)theoretical gateways were integrated when participants tested various theory-informed teaching arrangements (see section “Theory-informed Teaching Arrangement”). Opportunities to shift the focus from learning to teaching were created by introducing didactics (didactic questions) and co-assessment (assessment theory) into all teaching arrangements.

Research Focus: Aim and Research Questions

The aim of this collaborative research project involving preschool teachers, managers and researchers was to describe and further develop knowledge about what could characterize teaching and co-assessment based on scientific grounds and proven experience. This was carried out in between 93 and 137 preschools/or preschool departments located in ten municipalities in Sweden. The following research questions framed the overarching direction of the research:

1) What could characterize teaching and co-assessment in theory-informed teaching arrangements as expressed in texts and documented co-actions by participants?

2) What traces of didactic questions and didactic levels can be inferred from texts and documented co-actions by participants?

In addition, the research specifically aimed to test the “multivocal didactic modelling” concept (see section “Multivocal Didactic Modelling: Concept-testing Focus”).

Research Methodology

General Background

The method was based on a qualitative design of collaborative research. The research was

large-scale (see Table 1) in the sense that it was run for three years and included in between 93 and 137 preschools/or preschool departments in ten Swedish municipalities. The method design was based on a praxiographic approach where preschool teachers tested four different theory-informed teaching arrangements, between 2016 and 2017. The approach also considered triangulation, abductive analysis and research ethics.

The material collected comprises about 895 co-plans, 740 co-evaluations and 110 hours of video. The analysis was based on a didactic premise and can be methodologically described in terms of abductive analysis. The data is presented in a material overview (Table 1).

Research Design

In terms of methodology, the research design was influenced by praxiography (Bueger, 2011, 2014; Mol, 2002). In collaboration research, praxiography refers to the analysis of registered practice. The praxiographic research process can be described as a process “in

turning implicit knowledge into explicit. This implies a high degree of interpretation” (Bueger, 2011, p. 6). “The overall orientation of praxiography is to reconstruct meaning” (Bueger, 2011, p. 4). One way for praxiographers to turn implicit knowledge into explicit is to try, by using observations, speech and documents, to identify “moments in which participants themselves tend to articulate implicit meaning” (Bueger, 2011, p. 6). In general, the collaboration research at hand has made multivocal didactic modelling *explicit*. Altogether the chosen methodological approach can be described in terms of a “praxiographic collaborative method” that involves the abductive analysis of parallel and investigative series of theoretically informed teaching methods based on a didactic approach.

Theoretical Approach: Didactics as the Underlying Premise of the Research

This research was based on an underlying premise of didactics. The “didaktik” premise derived from the continental and Northern European didaktik tradition (cf. Gundem & Hopmann, 1998; Hopmann, 2007). Didactics focuses on the teacher–child–content relation – in other words, a theory of teaching (e.g., Bengtsson, 1997; Brante, 2016; Comenius 1657/1989; Uljens, 1997). ‘The word “didactics” may be explained as “the art of pointing out something to someone” (Doverborg, Pramling, & Pramling Samuelsson, 2013, p. 7).

Teaching-oriented and Critical-reflective Didactics

This research described teaching-oriented didactics, which may be viewed as an alternative to “learnified” didactics (Vallberg Roth, 2018). A focus on learning is not solely problematic; on the contrary, learning-oriented studies can contribute valuable knowledge about learning among children in various situations and relationships both inside and outside educational institutions. Studies on learning do not need to focus on the relationship between someone who teaches something to someone else, but may instead concentrate on learning and those who learn through environments and relationships (cf. Biesta, 2017). Without belittling the values of such studies, it is important to emphasize the need for alternatives to learning-focused research and learnified didactics. Alternatives may entail studies taking a perspective from more teaching-oriented didactics.

There are many different approaches in the didactic landscape (Kroksmark, 2007). The collaborative research is guided by critical-reflective didactics (cf. Biesta, 2011; Broström, 2012; Klafki, 1997; Uljens, 1997). Didactics shares a link with education as “a process in which the child is ‘shaped’ through education for the encounter with an unknown future” (Brante, 2016, p. 57). Critical-reflective didactics can be based on reflection regarding alternatives to what is taken for granted in relation to an uncertain future. In concrete terms, this means that in the research question we have replaced “should” with “could”. In didactic questions, “should” pertains more to traditional normative didactics (Uljens, 1997), whereas “could” is associated with critical didactics. “Could” ensures that there might be alternatives to the choices made, without claiming to have definitively established “what should be taught” or “what characterizes teaching”, but that we instead emphasize ‘what could characterize’. So, in this collaborative research, teaching-oriented didactics is guided by critical-reflective didactics.

Didactic Levels: Theoretical and Practical Aspects of Didactics

Brante (2016) addressed the theoretical and practical aspects of didactics. Didactics is a field of science, multidisciplinary in nature, that relates to multiple scientific foundations. The practical side of didactics relates to proven experience. The didactics in the collaborative research was characterized by multivocality regarding both scientific grounds and proven

experience. The concept concerns multivocality on didactic levels (Vallberg Roth, 2018), at the action, theoretical and metatheoretical levels (Kansanen, 1993). In the collaborative research the action level related to traces in co-planning, teaching and co-evaluation, all linked to policy documents. The theoretical level referred to traces in which participants based their teaching practices on scientific grounds and related them to theoretical gateways and concepts. This occurred when testing teaching arrangements that were didactically, variation-theory, post-structurally and pragmatically informed. The metatheoretical level pertained to traces in which participants immersed and positioned themselves in the theoretical gateways on a metatheoretical level that concerns ontology and epistemology. Depending on the premise and gateway, the implications for the meaning of teaching and assessment may vary. The metatheoretical level may shift between social-constructionist foundations with associated phenomenological and phenomenographic approaches, post-constructionism and realism (Vallberg Roth, 2017, 2018). The research at hand focuses on the action level and the theoretical level.

Key Concepts

Teaching and co-assessment rest on scientific grounds and proven experience. Proven experience can be

something more than experience even if it is long. It has been tested. This requires that it be documented or communicated in some way so that it can be shared with others. It must also be peer-reviewed based on criteria that are relevant from the standpoint of experience and the contents of the activity. It should also be tested according to ethical principles: all experience is not benign and thereby worthy of emulation. (RFR, 2012/2013: 19–20)

In the co-assessment process, experiences were shared, communicated, documented, and subjected to critical reflection during the three-year research (see Vallberg Roth, Holmberg, Löf, Palla, & Stensson, 2019). In the following, the key concepts “theory-informed teaching arrangement”, “co-assessment” and “multivocal didactic modelling” are described (see also Figure 1).

Theory-informed teaching arrangement. This refers to the testing by participants in the collaborative research of various educational arrangements that are linked to different theories. In this research, the theory-informed arrangements related to theories that participants addressed in descriptions of what might characterize teaching at research start in January 2016 (Vallberg Roth, 2018). Theories that participants explicitly addressed were didactics, variation theory, post-constructionism and pragmatic perspective. The research involved testing theory-informed teaching arrangements that consistently combined didactics and assessment theory with learning-oriented theories, such as variation theory (intentional learning), with reference to Marton (2015) and Ljung-Djärf and Holmqvist Olander (2013). In addition, didactics and assessment theory are linked to post-structural gateways (rhizomatic learning), with reference to Palmer (2010), as well as to pragmatic perspectives (reflective learning), with reference to Dewey (1916/1966) and Hedefalk (2014).

Co-assessment. In summary, co-assessment may include intertwined interpretational approaches such as co-interpretation of objectives, co-planning of teaching arrangements, co-action and feedback (cf. Hattie & Timperley, 2007) in the implementation of teaching, as well as co-evaluation and follow-up of teaching arrangements (cf. Allal, 2013; Thornberg & Jönsson, 2015). Co-assessment includes at least two actors, such as teacher–child, or child–teacher–material, or teacher–manager–document. Actors refer to people, artefacts, and matter of various types in action. Action refers to something that is being carried out – being active. The term “co-action” as it pertains to teaching (cf. Gjems, 2011; Lenz Taguchi, 2012; Uljens, 1997) entails an action between at least two actors. The concept of co-action may include both

interactions between humans, and intra-actions between the human and the non-human material (cf. Lenz Taguchi, 2012). Co-actions were registered in video documentation. In this research “co” especially included those participating teachers/educators and children who had given their consent to the research (see section “Research Ethics Guidelines”). Co-assessment provided support to allow practice during the three-year research period to lead to proven experience, with an aspiration towards reasonable equivalence and scientifically based approaches in the pedagogical processes of preschools.

Co-assessment may be defined according to the explanation by Osberg and Biesta (2010):

Moreover, engagement in such judgements should not be seen as something that is done from the ‘outside’ – teachers judging students; parents judging children – but should rather be seen as a collaborative process, as something that all who are engaged in the activity should take part in and should do so continuously. It is this continual engagement in judgement (not the arrival at an end point) that makes the educational process educational. (p. 604)

Didactic modelling. This involves working systemically with didactic models in teaching practices (Ingerman & Wickman, 2015). Didactic models are a central part of didactics and refer to theoretical tools that teachers can use in their teaching. Didactic models can be used both as tools for teaching and as analytical instruments for research purposes (e.g., Uljens, 1997). Didactic modelling may entail the development of didactic knowledge by teachers in collaboration with researchers (Ingerman & Wickman, 2015). Examples of fundamental didactic models are didactic questions and what is known as the didactic triangle, which encompasses teacher, child and content in different combinations (see e.g., Rosenqvist, 2000; Uljens, 1997). Another example of a didactic model is, as previously mentioned, the didactic levels (Kansanen, 1993). In the preschool, formulating and testing didactic models for the care, development, and learning relationship in a broad teaching context may also be involved (Vallberg Roth & Holmberg, 2019). Ingerman and Wickman (2015) referred to the interplay between theory and practice as “didactic modelling.” This research explores and makes explicit the processes involved in didactic modelling.

In the collaborative research didactic modelling specifically refers to how teachers, based on theory-informed arrangements or models for teaching, develop connections between co-planning, teaching and co-evaluation (cf. Ingerman & Wickman, 2015). For the purposes of this research, teaching was modelled through co-assessment, which in part is rooted in science and in part leads to proven experience.

Multivocal Didactic Modelling: Concept-testing Focus

Collective analysis in relation to the overarching questions produces a result that can be communicated as a whole through the concept “multivocal didactic modelling”. The concept can capture, consolidate and provide alternative tools for critical reflection in teaching and co-assessment in relation to the development and learning of each child.

Researchers hold that “no theory can actually encompass the teaching situation as a whole” (Arfwedson, 1998, p. 131). This constitutes a basic assumption in the research at hand, and for this reason, several theories are included. The term “multivocal” refers to multiple voices in many parts, which can be translated into multiple perspectives and a variety of approaches. The Norwegian linguist Dysthe (1993) launched “the multivocal classroom” concept, largely inspired by the work of Russian philosopher and literary theorist Bakhtin and his colleagues (e.g. Bakhtin & Medvedev, 1978). Sociolinguistic and sociocultural premises are prominent in the multivocal classroom. Multivocal teaching and co-assessment was inspired by Dysthe, even as a more expansive approach intended to encompass several scientific grounds was tested (see

section “Triangulation” and Vallberg Roth, 2018). Multivocality and variation in the theory-informed alternatives for teaching and learning can also be interpreted as being more beneficial for democracy and sustainability than exclusively unilateral choices (cf. e.g., Gerholm et al., 2018).

In summary, multivocal didactic modelling can be tested as a tool for critical reflection, which may include the perspectives (versions) of various actors, diverse scientific grounds and proven experience. Everyone involved in the collaborative research may, given their diverse backgrounds and experiences, be viewed as knowledge carriers, knowledge users and potential knowledge developers. Moreover, the multivocal didactic modelling concept can be tested in its encounter with individual children and groups of children in co-action to uncover knowledge and values in spontaneous and planned teaching sessions with various contents where teaching, learning and care are intertwined in various ways – not assuming that “one size fits all” (Vallberg Roth, 2018). The key concepts are illustrated in relation to the aim and research questions in Figure 1.

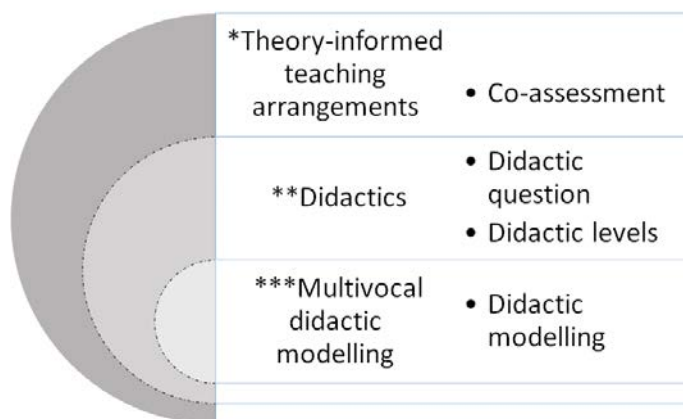


Figure 1. Key concepts in relation to the aim and research questions.

*The concept “Theory-informed teaching arrangements”, including “co-assessment”, is related to the aim and primarily research question 1.

** The concept “Didactics”, including “didactic questions” and “didactic levels”, is related to the aim and primarily research question 2.

***The term “Multivocal didactic modelling” is related to the aim and research questions 1 and 2.

Broken lines in the figure indicate permeability and overlapping relationships between aim, questions and concepts (see section “Research Focus: Aim and Research Questions”).

Triangulation

A basic assumption in the collaborative research was that “no theory can actually encompass the teaching situation as a whole” (Arfwedson, 1998, p. 131). For this reason, the research was based on several theoretical perspectives. Triangulation can serve as support to strengthen variation since the same phenomenon can be investigated using various types of data, theoretical perspectives and researchers/actors in the research process (cf. Larsson, 2009). The goal is not to provide “a more valid singular truth, but to open up a more complex, in-depth, but still thoroughly partial, understanding of the issue” (Tracy, 2010, p. 844).

In this collaborative research, triangulation was accomplished mainly through data (“word data” and “audio-visual data” were generated), theoretical gateways (didactics, variation theory, post-structural gateways and pragmatic perspective) and the use of a qualitative approach by the researchers/participants in the collaborative research. Depending on level of credibility, “Multivocal research includes multiple and varied voices in the qualitative report and analysis” (Tracy, 2010, p. 844).

The theoretical perspectives were in part selected, as previously mentioned, because traces of them could be found in the results from the questionnaire that participants answered at research start in 2016 (Vallberg Roth, 2018). In part, they were selected because they were positioned relatively far from each other regarding focus and direction: from didactics (knowledge base for teaching, including assessment) across variation theory (intentional learning, perceptions), and post-structural arrangements (rhizomatic learning, transdisciplinary constructions), to pragmatics (focused on values, actions and reflective learning¹). Aided by proper selection from the various theoretical perspectives, theoretical triangulation could be achieved. This approach clears the path for variation and multivocality at the action level as well as the (meta)theoretical level (Kansanen, 1993).

Didactics and various areas of content in teaching were also varied, with examples from the cultural arena, including music and language, as well as from mathematics and science (including social and environmental sustainability).

Sample Selection

The participants learned about each theory-informed arrangement at specific input occasions. The number of participants at the occasions were 240, including 175 preschool teachers, 55 preschool managers and 10 administrative directors. The municipalities/responsible school authorities appointed the participants at the specific input occasions. In all, 5,236 individuals consented to participate in the research, including 4,365 guardians/children, 806 preschool teachers/educators and 65 managers (see section “Research Ethics Considerations”).

Procedures: Knowledge in Collaboration

During the research, knowledge was developed through collaboration among participants (cf. Enthoven & de Bruijn, 2010). Each participating municipality/responsible school authority participated through one or more development teams that included preschool managers and preschool teachers. They ran and tested teaching arrangements within the preschool. In addition, the responsible school authority appointed one or more local process managers to support the participants. Their primary task was to lead and run the developmental processes locally within the municipality/responsible authority. The process managers were either preschool teachers or managers.

Input to the theory-informed teaching arrangements occurred once each term when the arrangements were introduced. The participants learned about each theory-informed arrangement on specific input occasions, namely lectures by researchers associated with each theory-informed teaching arrangement, as well as to workshops with theory-informed discussions. Workshops were also held, during which participating preschool teachers and managers generated inter-municipal co-plans that were followed up through inter-municipal co-evaluations after the arrangements had been carried out (see Table 1). All participants also had access to reference material describing the theory-informed arrangements with links to relevant

¹ See Burman (2014), who points to “learning by reflective experience”, where the word *experience* can express that this involves experiencing a situation and not just carrying out an action, which the word *doing* in “learning by doing” could suggest.

references (Vallberg Roth, 2016). Based on input, the participants then tested the theory-informed teaching arrangements in the municipalities without the presence of the researchers in the preschools.

Didactically informed teaching arrangements were introduced in the spring term of 2016 and the variation-theory-informed teaching arrangement was introduced in the autumn term of 2016. The post-structurally informed teaching arrangement was introduced in the spring term of 2017 and the pragmatically informed teaching arrangement was introduced in the autumn term of 2017.

For the purposes of the research, collaboration means in part that participants initiated questions about teaching and co-assessment, and in part that they generated material. Furthermore, collaboration also entailed analysis in which the teaching arrangements and material were repeatedly discussed with the process leaders (three times each term), as well as communicated with other participants during national seminars once each term.

The Researcher's Role: Collaboration in the Research Group

The research group, consisting of four researchers, met continuously (approximately once every fourteen days) to work on the analysis and the theory-informed arrangements. Regarding the material from the theory-informed arrangements, one or two researchers had responsibility for the analysis of each arrangement. Regarding trustworthiness and for more nuanced analyses (cf. Tracy, 2010) meetings were arranged where a researcher other than those who performed the analysis read the presented interpretation (see Table 2) and commented on the written analysis. The analysis was also discussed more thoroughly during specific research and writing weeks. In the research group, the scientific leader had the ultimate responsibility for the analysis.

Material Overview

An overview is presented in Table 1. The total document frequencies include co-plans, pre/post-assessments (in variation theory arrangements), video photo/documentation and co-evaluations (2,259 documents and 478,685 words).

Table 1. Material overview for collaborative research 2016–2018.

Arrangement	Co-planning	Video/doc. Implementation	Co-evaluation	Total
1 Didactically informed arrangement				
Spring term 2016 Cycle 1 Cycle 2 122 depts/ preschools***	C1* 104 docs. C2** 73 docs.	C1 104 video/docs. C2 89 video/docs. About 63 video hours	C1 91 docs. C2 81 docs.	542 docs. About 63 hrs. About 80,000 words
2 Variation-theory-informed arrangement	C1 120 docs. C2 101 docs.	C1 127 video/docs. C2 96 video/docs. About 34 video hours	C1 84 docs. C2 82 docs. Post-assessment at individual level: C1 69 docs. C2 72 docs.	939 docs. About 34 hrs. About 214,000 words
Autumn term 2016 Cycle 1 Cycle 2 137 depts/ preschools	Pre-assessment at individual level: C1 96 docs. C2 92 docs.	68 video/docs. about 10 video hours		
3 Post-structurally informed arrangement				
Spring term 2017 93 depts/ preschools	93 docs.	42 photos/docs:	74 docs.	277 docs. About 10 hrs. About 74,000 words
4 Pragmatically informed arrangement				
Autumn term 2017 120 depts/ preschools	117 docs.	Video: 64 about 5 video hours Photos/ documentation: 34	87 docs.	302 docs. About 5 hrs. About 75,000 words
5 Municipalities' selected arrangements	Municipality/ preschool co-planning 27	Presentations by municipality	Municipality/ preschool co- evaluations 18	45 docs. About 16,685 words
2018				
Intra-municipality level – **** 2016–2018	Arrangement 1. 20 Arrangement 2. 18 Arrangement 3. 14 Arrangement 4. 21	- - - -	Arrangement 1. 22 Arrangement 2. 21 Arrangement 3. 17 Arrangement 4. 21	42 docs. 39 docs. 31 docs. 42 docs. About 19,000 words
Total	896 docs.	548 video/docs. About 110 video hours 76 photos/docs.	739 docs.	2,259 docs. About 110 hrs. About 478,685 words

*C1 refers to Cycle 1. A “cycle” includes co-planning of teaching, implementation of teaching (e.g., video) and co-evaluation of teaching.

**C2 refers to Cycle 2

*** dept/preschool refers to material generated at department level/preschool level

**** The intermunicipal level refers to co-planning and co-evaluation generated once each term in intermunicipal groups consisting of preschool teachers, preschool managers/acting preschool managers and process managers, as well as a steering group with representatives from the administrative level.¹

Data Analysis

Analysis of the material can be methodologically described in terms of abductive analysis (Peirce, 1903/1990; Tavory & Timmermans, 2014), alternating between theory-loaded empiricism and empirically loaded theory, “where both are gradually reinterpreted in light of each other” (Alvesson & Sköldberg, 2008, p. 57). The purpose of the analysis was to identify traces and patterns in “word data” and “audio-visual data” (cf. Silverman, 2011) relating to the aim of and questions posed by the research. Didactic questions serve as both practical tools and as a basis for analytical questions. In the context of this research, such questions focus on what (content), how (teaching actions), who/whom (actor/actors), where (space/place), when (time) and why (goal and motivation).

For the empirically based analysis a thorough examination of the material was conducted: the material was read, listened to and viewed several times and some of the audio-visual data was transcribed (cf. Duranti, 1997), while also highlighting prominent words in relation to didactic questions (Vallberg Roth et al., 2019). In a theory-based analytical path empirical traces were related to prior research and concepts associated with the theory-informed arrangements and Kansanen’s (1993) didactic levels (see Table 2 and “Research Results”). The theory-based analysis culminated in a concept-testing focus (see “Discussion”) in which the results were consolidated into a communicable whole where the research questions were tested and answered through the concept of “multivocal didactic modelling” (Vallberg Roth, 2018).

In the analysis the term “trace” has been used instead of, for example, “category”. Trace is a term that from an analytical standpoint may be consistent with various scientific grounds and perspectives that shift between qualitative and post-qualitative approaches (Vallberg Roth, 2018). The term “category” may misdirect thoughts to something more rigid with sharply defined limits (cf. Palmer, 2010). Traces can be associated with both fixed and temporary determinations and constructions that can be related to various scientific grounds and can be capable of capturing the variation in the material. Traces may represent themes or patterns in the data but may also be “units at a lower abstraction level” in the analysis, such as words in sentences and numbers related to the didactic questions in the material (see Table 2 and Table 3). Abductive moments in the analysis can involve suddenly seeing an alternative, discovering a previously undiscovered possibility: “Reality is not simply ‘what is here-and-now’/.../but also includes what potentially can be achieved – and which in the moment merely reflects a vague possibility” (Peirce, 1903/1990, p. 31). In this research, concepts were tested in relation to traces in the material that were revealed as possibilities by the analysis (see “Research Results” and Table 3). The analytical process is further described in Table 2.

Table 2. Analytical process.

Analytical path 1 – close processing of the material in Table 1	
1) A thorough analysis of the word-data and audio-visual data was conducted: The material was read, listened to and viewed several times and some of the audio-visual data was transcribed (cf. Duranti, 1997).	1) See Table 1 and transcribed examples in the result section marked "Excerpt from video transcript, 2016, 2017".
Analytical path 2 – didactic questions in focus – see Table 2	
2a) Traces were interpreted in "word data" and "audio-visual data" in relation to didactic questions. Action level (Kansanen, 1993) is in the foreground and related to co-planning, teaching and co-evaluation. 2b) Traces at an action level were related to concepts at a theoretical level associated with the theory-informed arrangements.	2a-b) See Table 2 and the result section. Results are based on the didactic questions regarding action level and theoretical level.
Analytical path 3 – didactic models in focus – see discussion and conclusion	
3) Cohesive analysis was performed in light of didactic models, including didactic questions and Kansanen's (1993) didactic levels, resulting in a conceptualising focus.	3) See the sections "Discussion" and "Conclusion" related to the didactic models. The concept "Multivocal didactic modelling" was analyzed and discussed in relation to didactic questions and didactic levels.

Research Ethics Considerations

The research complies with the research ethics guidelines of the Swedish Research Council (2017). This means that all participants were informed and asked for their consent according to the information requirement. All participation was completely voluntary and could have been discontinued at any time without any explanation, in accordance with the consent requirement.

The research was conducted using recorded activities such as notes, video and audio recordings. Professionals who worked in the preschools conducted and recorded the activities. Recorded data were treated confidentially and stored on a platform that was accessible to the researchers. One participant per preschool/department was appointed to enter the material on the platform. The appointed participants only had access to the material that they personally entered.

With respect to the use requirement, the generated data were only used for research purposes and reported by researchers in such a way that individuals could not be identified by third parties. All data production was encoded based on a system using a code key that was locked in the department archives for storage, in accordance with the confidentiality requirement. All consent forms were also stored in a locked filing cabinet. Young children participated in the research and consent from their guardians was required. The researchers had special responsibility to ensure the privacy of the children. Ethics questions were subject to continual discussion during the research.

Research Results

Didactically Informed Arrangements

Didactic what-question: The didactically informed teaching arrangements focused on the subject of music. For the purposes of the "what" question, music emerged as science in

concepts like “crescendo” and “accelerando”, as arts in “sensory experiences of listening and feeling music”, and as crafts in for example “playing instruments” (from co-planning, 2016). Various dimensions of music, such as acoustic, emotional, existential, bodily/kinaesthetic and structural, were also revealed. In particular, the structural dimension emerged and more specifically, dynamics and tempo: “What (content) Dynamic (loud and soft)” and “Endeavour to: Develop the children’s ability to distinguish between different tempos by giving them three changes of tempo” (from co-planning, 2016).

Didactic how-question: A trace of the “how” question could be seen in the three forms of activities – “song”, “movement” and “instrumental performance” (from co-planning, 2016). Moreover, teaching was preferentially carried out as teacher-led co-action: “We are the ones who have decided the pace of the activity/.../. The teacher has led, and the children have followed” (from co-assessment, 2016).

Feedback was either group-oriented or individual-oriented but was preferably group-oriented. An example of group-oriented feedback is: “Now we have clapped at just the right tempo” (excerpt from video transcript, 2016). Feedback is a tool that can be used to direct and maintain attention in teaching as a goal-oriented process. In research, various forms of feedback are described in terms of “feed up”, “feed back” and “feed forward”. There are traces in the material that derive from these forms of feedback. An example of feed up may be: “Today we will learn a new word – dynamics” (excerpt from video transcript, 2016). Feedback can be exemplified by “Just look how clever you’ve been! We have played the drum and listened to loud and soft and remembered that this is called dynamics when we change it this way” (excerpt from video transcript, 2016). Feedback can also be communicated through body language; examples include thumbs up, nodding and applauding. Feed forward can be exemplified by a preschool teacher who uses exaggerated slow movements to inspire, demonstrate and challenge children to clap: “Do you have long arms? Then stretch your arms out and we will clap” (excerpt from video transcript, 2016). The material also contained examples of children as sources of feedback. One example is when children played their instruments and one child conducted, while the other children showed their appreciation by spontaneously clapping their hands.

In addition, the assessment-theory-based concept “feedback” was tested in combination with traces of “rap”, which led to feedback as represented by “feed – rap”, or “rap feedback”. One example relates to the chosen content dimension “tempo”: “Today I am going to teach you about something called ‘tempo’. Different tempos when we sing”. In the example, the preschool teacher “rapped” her feedback and her reply in time to the clapping of the children: “Okay... one more time...the crow likes to clap at just the right tempo” (excerpt from video transcript, 2016).

Didactic who/whom-, where- and when-questions: For the “who/whom” question, four to eight children and one preschool teacher were usually included in the teaching, although as many as nine preschool teachers/educators and 30 children could be involved. Regarding the “where” question, teaching was usually conducted indoors with participants sitting on the floor in a circle. However, teaching sessions were also undertaken while moving between rooms and this too could characterize teaching outdoors. With regard to the “when” question, teaching and video time varied from 1 to 30 minutes, but teaching sessions were typically 6 to 15 minutes long. Teaching was primarily conducted in the morning.

Didactic why-question: Reference was usually made to the interests, creativity and learning of the child. Usually an objective was formulated that pertained to the Swedish curriculum area “2.2 Development and learning” (from co-planning, 2016). The result of the didactic questions in the didactically informed teaching method is summarised in Table 3.

Variation-theory-informed Arrangement

Didactic what-question: Concerning the “what” question, the focus was predominantly on mathematics and language, as well as some elements of science in the variation-theory-informed teaching arrangement. Arithmetic and geometry were at the forefront (from co-planning, 2016). One example of arithmetic was: “I have observed the children’s interest in counting and how they are familiar with the first numbers” (co-planning, 2016). In the following geometry was focused: “Place squares in contrast to circles. Place squares in contrast to rectangles” (from co-planning, 2016). From the standpoint of variation theory, learning is viewed as the ability to distinguish between various aspects of a learning object. A “learning object” refers to the defined content and knowledge that the learner can develop, and the idea is to distinguish more and more aspects of a phenomenon. Variation is a necessary condition in order for the learner to perceive a true aspect of the learning object. The preschool teachers used different models to vary the content, such as “contrast” (e.g., “the colour blue in contrast with the colour red”, excerpt from video transcript, 2016), “generalization” (e.g., positional words “in front of” and “behind” in various contexts, excerpt from video transcript, 2016), and “fusion”. Fusion means that several aspects vary simultaneously, such as “circles in different colours, sizes and materials” (excerpt from video transcript, 2016).

Didactic how-question: In terms of the “how” question, teaching was conducted predominantly as teacher-led co-action, but also alternated between teacher-led and child-led co-action in which the teacher led first and later switched roles, allowing the children to lead, ask questions and provide feedback to the teacher’s answers. In the teacher-led co-action the teacher pointed to the shapes on the table and said: “Rectangle, circle and square; now I am going to blindfold you and then place a shape in front of you on the table and you will then describe what shape you are holding. Is that OK?” The children nodded their heads and the teaching continued. After a while the children suggested that the teacher and children should switch roles. Then the preschool teacher was blindfolded, and the children selected a block for the teacher to feel. One child asked: “How many sides?” The preschool teacher felt, counted and said: “four”. Another child asked: “Are they the same or different?” The teacher answered: “OK, I am going to feel it like this, I believe there are two short and two long sides.” The child asked more about the sides: “So are they the same or different?” The teacher answered: “Different.” The child provided feedback: “Right!” (excerpt from video transcript, 2016). In this example the children also played the role of providing feedback.

Feedback was either group-oriented or individual-oriented, but through pre- and post-assessment it was predominantly individual-oriented. In the assessment, critical aspects were identified, as in this example: “The children appear to have problems explaining how to distinguish between the square and the rectangle /.../. Critical aspect: Mix up the concept corner/sides/edges” (from co-evaluations, 2016).

Moreover, the variation-theory-based concept “critical aspect” was tested in combination with the assessment-theory-based concept “feedback”. This combination led to feedback focused on critical aspects, which can be formulated in terms of “feed – critical aspects”. One example of feedback regarding critical aspects can be seen in the learning object “letters-numbers.” Children and teachers co-acted with a piece of material consisting of letters and numbers and the children sorted the symbols into different piles. For example, upper-case letter E ended up in the pile of numbers. The teaching was then directed towards feedback concerning the critical aspect that became apparent in the teaching situation – the similarity between symbols such as the number 3 and the capital letter E. Different interpretations of the number 3, as the letter E and a symbol that may resemble an ear, became apparent in the child’s reply:

a child points at the letter E and says: “That’s a three”. The teacher responds: “Is that a 3?”, whereupon the child says: “It looks like a three, it really does” and the teacher provides feedback confirmation: “Well, it does look like a three, it really does.” The child turns to the numbers and looks for and finds a three and says: “Now it almost looks like an ear.” The teacher places the number three and the letter E side by side and says: “You said that this one looks like a three and that one too” and the teacher points to a card with the number three and a card with the letter E. The child responds by taking the two cards with the three and the E and says: “Both are threes. The teacher turns to the child and provides challenging feedback: “What letter is at the beginning of your name?” The child replies: “E”. The teacher continues: “What does an E look like?” and the child responds by leaning forward and pointing to the letter E. The teacher: “If you write your name then you use...” and the child fills in: “Letters”. The teacher responds with a challenge by pointing to the letter E and asking: “So is this the number 3 or the letter E?” (Excerpt from video transcript, 2016.)

Another trace that can be found in the “how” question is the use of a “guessing element”, which can be interpreted as a didactic component that can be viewed as a playful way to be “on the path” towards a goal to be strived for. In one example, a preschool teacher observed the children’s creation of meaning concerning size and weight and challenged the children by asking them to line up six globe-shaped objects of different sizes, arranging them from heaviest to lightest. The preschool teacher asked: “Which one do you think is the lightest and which one do you think is the heaviest?” The children responded with lively discussion during which they tested the objects by holding them and guessing their weight and placing them in line. In other words, the dimension of play can be inferred when the children use their imaginations and conduct a thinking experiment, or a thinking game, in which they guess the weight of the object. Guessing can also be viewed as an everyday equivalent to more scientifically formulating hypotheses that can later be tested. The teacher provided feedback, wrote down the order that the children and the teacher arrived at by guessing, and then asked: “Should we try to find out whether this is correct now?”

Didactic who/whom, where- and when-questions: The “who/whom” question principally concerned three children and preschool teachers/educators in the teaching situations. Teaching in relation to the “where” question was mainly conducted indoors, while varying formations of the group around tables or on the floor. However, there are also examples of outdoor teaching and of teaching that transitions from outdoor to indoor spaces. Concerning the “when” question, teaching and video time both varied, but in general were somewhat shorter than in the first arrangement – 3–7 minutes is typical. Overall, video time varied between 27 seconds and 36 minutes and was carried out both before and after lunch.

Didactic why-question: Concerning the “why” question, 1–2 objectives were formulated that were linked to the interests of the children and in which the focus was on intentional learning and “changed know-how.” The objectives were preferentially set with reference to the Swedish preschool curriculum area “2.2 Development and learning” (from co-planning/preparation, 2017). The result of the didactic questions in the teaching method informed by variation theory is summarised in Table 3.

Post-structurally Informed Arrangements

Didactic what-question: In the post-structurally informed arrangement the “what” question predominantly focused on transdisciplinary content, with elements of mathematics-music-images-language-movement-nature-technology/ICT and values. Specific examples of transdisciplinary content are: “Ladybug music”, “Songmatics”, “Music-dance-mathematics,” “Butterfly project,” “Math-music,” “Robot-music,” “Tango-image”, “Receipt-music” and “Jungle sea”. A prominent example would be “Rhythmatics” (from co-planning and co-

assessments, 2017). An example in which the concept “transdisciplinary” was mentioned is: “We created ‘Song mathematics’. It feels natural to work with transdisciplinary learning” (from co-evaluation, 2017). The material in the collaborative research describes the post-structurally informed arrangement using terms such as “here and now”, “no right or wrong” (from co-evaluations, 2017). One example in terms of “Songmatics” is presented here:

Co-planning/preparation together with the children: The song ‘an egg, a rooster and a hen’ with lots of text, many pictures and a fast tempo is greatly appreciated by the children /.../ When the preschool teacher presented all of the pictures with numbers on the back, the children’s attention was focused on the numbers; there were so many pictures in this song (18). We put them in the order that the text showed, which clarified the structure of the song in words and sentences. This resulted in many lines. We discovered that one picture was missing, there was an empty space where the picture of ‘pop’ was to be, for which reason the numbers (count) were also missing. (From co-planning/preparation, 2017.)

Co-evaluation/reflection together with the children: In conversation with the children the preschool teacher illustrated the link between different types of content and described their discoveries in words. “You are making comparisons, you are discovering similarities and differences, you are seeing relationships. This is mathematics! You have also organized the pictures based on numbers; this is also mathematics. We have read and built sentences; this is language. We have sung at different tempos; this is music, etc. (From co-evaluation/post-work, 2017.)

Didactic how-question: In the “how” question, a project-oriented working method emerged with a variety of co-actions, though child-guided co-actions were more frequent than in previous arrangements. This can be expressed as: “We teachers have been able to monitor the interests of the children and the children have guided us teachers to their interests and approaches” and “We have quite simply observed the flow of ideas in the children at the best point in time and seen the results of how a project evolves when educators do not lead” (from co-assessments, 2017).

The previous arrangements focused on teaching about content *in* the world. In the post-structurally informed arrangement, this changes so that traces of teaching *with* the world also emerge. Within this context, characteristic traces for the structure were captured in the evolved concepts “co-led action” and “feed with”, which emphasize that feedback and response also occur from the material aspects of the ongoing events of the teaching. In co-led action, the actors may appear as alternating between main actors and co-actors, who can co-lead the action by triggering conversation, questions and responses. One example is co-led actions involving children, magazines and teachers, in which photos in the magazines triggered conversations about cookies and tractors (excerpt from video transcript, 2017). The material things as active could be expressed as: “One cornerstone in post-constructionist theory is that things are viewed as active in and of themselves” (from co-planning, 2017).

Moreover, teaching occurred through “feed with” in actions involving children, teachers and tablets. One example of “feed with” took place between a tablet showing hits and responses following the teacher’s search. A child leant over the tablet, which had then become the main actor, and asked what the tablet said, at the same time that the teacher slid a finger over the tablet and read aloud: “The Ghostbuster Machine” (excerpt from video transcript, 2017). So, in addition to “feed up”, “feed back” and “feed forward,” the material also provided examples of the concept of “feed with” as a potential actor, providing feedback and guiding the directions of events.

Didactic who/whom-, where- and when-questions: The “who/whom” question principally concerned three children, but the spread varied between one and nine children, and in one case as many as 70 children were mentioned. Usually one or two “educators” were present, but as many as four could be involved. Moreover, materials were considered to be co-actors. The

documentation and interpretation portrayed the children as being more involved. One example of this is: “Throughout the process we have involved the children in the documentation, and they have participated in choosing what images are to be visibly documented” (from co-evaluation/post-work, 2017). Regarding the “where” question, teaching was carried out “anywhere”, both indoors and outdoors, and “at any time”, both morning and afternoon. Concerning the “when” question, teaching and video time varied between 22 seconds and 35 minutes, with 3–7 and 7–9 minutes being quite typical. The total number of video events, put together from any given project, was usually just over one hour (68 minutes).

Didactic why-question: Concerning the “why” question, several objectives were formulated that were linked to the interests-events of the children, with an emphasis on non-linear learning and knowledge creation: “We think and practise continually in the rhizomatic approach and try to see various curriculum objectives that are intertwined” (from co-evaluation, 2017). The objectives were preferentially set with reference to the Swedish preschool curriculum area “2.2 Development and learning”, “2.1 Norms and values” and “2.3 Influence of the child”, as well as to the section on the environment in the curriculum (from co-planning/preparation, 2017). There are also interpretations of the objectives that make reference to “how the curriculum objectives are integrated with each other” (from co-planning/preparation, 2017). In this approach, a goal-relational interpretation becomes apparent, which entails a non-linear interpretation of objectives that falls within the framework of the linear, predetermined direction of objectives. Objectives can be shaped through interaction during teaching, which can be expressed as “the objectives being developed during the teaching work and not right at the start” (from co-evaluation/post-work, 2017). Evidence of objectives being changed after the fact are clear in the following example: “For a teacher, being able to change one’s objectives after the fact and to have partial goals” (from co-planning/preparation, 2017). Another example of non-linear interpretation of objectives that falls within the framework of the linear, predetermined direction of objectives, is the following:

In preschool, this view implies that the goal is not for staff to decide in advance exactly what knowledge is to be gained from the children’s exploration. Granted, of course, there are always overall goals to strive towards in any teaching activity. All pedagogical activities have goals and in pedagogical work with the children it is important to define a direction. This will take different forms depending on the particular children and adults participating, how the pedagogical environment is arranged and how the relational interactions develop. (From co-planning/preparation, 2017)

The result of the didactic questions in the post structurally informed teaching approach is summarised in Table 3.

Pragmatically Informed Arrangement

Didactic what-question: The “what” question focused on values, especially on democracy and influence in the pragmatically informed arrangement. It is more strongly oriented towards social sustainability than towards the environment or financial sustainability (from co-planning and co-evaluations, 2017). Nevertheless, a multivocality emerged in which social versus financial and/or environmental aspects interacted, as exemplified in the context of “Food Waste”: “Our cook has pointed out that food waste at lunch has increased, especially on those days when ‘popular’ food is served/.../. The children do not appear to see any relationship between how much food they want to take at the buffet and how much food they want to eat” (from co-planning, 2017). The chosen content focused on “the correlation between food that is taken, food that is eaten and food that is left” (from co-planning, 2017). Additional traces of multivocality emerged through interactions involving various actors, such as teachers and

children, parents and chefs, as well as resulting from integrative knowledge content moving within and between various value levels, such as societal, private and/or existential.

Didactic how-question: In the “how” question, teacher-led co-action emerged. Furthermore, normative and pluralistic teaching principles were cited more frequently than those that were fact-based. In fact-based teaching, teachers teach relevant facts; for example, teaching about “the organs of the human body” (excerpt from video transcript, 2017). Under normative teaching principles, the concern of teachers is to teach correct behaviour, such as how to treat one another, “not hurt anyone”, and “to listen to” and “respect one another” (excerpt from video transcript, 2017). Under pluralistic teaching principles, the teacher arranges teaching situations in which the children can reflect on various ways to think and act. One example is teaching about “the proper place for toys”, where the children may voice their opinions and listen to the opinions of their peers and then participate in a democratic decision on what to do (excerpt from video transcript, 2017).

Feedback in this arrangement was oriented towards both the group and the individual, as in this example:

The video begins with pictures of food. Next comes a sequence with videotaped photos of the plates of five children with food before and after they finished eating. By the photo of one child a caption says: “... I left food!” Then we are channelled into the teaching moment during lunch when the teacher asks a question to focus the children’s attention on the relationship between how much food the children take and how much they eat. The preschool teacher says: “Listen, children, do you know what I wonder?” The children answer: “No.” The preschool teacher says: “How do we know how much food to take?” One child says: “You have to ask your tummy.” The conversation continues. (Excerpt from video transcript, 2017.)

In another video sequence the children and preschool teacher are sitting in a ring on a mattress in a gathering room. They discuss the photos that the children took of their plates when they took food and when they finished eating. Different ways of thinking and acting are discussed, partly taking too much food or taking just enough food, partly leaving food on the plate or finishing eating the food. It turns out that it is difficult to know what is just enough and one child says that she needs to think about this more at home. The child says: “I’m going to think about this at home.” The preschool teacher says: “If you are going to think about this at home, maybe you can tell me if you come up with something smart.” (Excerpt from video transcript, 2017.)

The current research combines pragmatic perspectives with didactics and assessment theory. This combination leads to the alternative concept of “feed transaction”, which refers to feedback for change that is expressed as action resulting from the critical ability to act. One example would be children who at first become sad and cry when other children say that they created something ugly. And after teaching, with a focus on questions such as: “Who decides what is pretty and what is ugly?” and “Does everyone like the same things?”, signs of transaction were discerned. One child approached a boat that another child was creating from cardboard and said, “That’s really ugly” and laughed. The child building the boat then looked at the child who was laughing and said: “Yeah, we don’t think the same thing” (excerpt from video transcript, 2017). From the concept of “feed transaction”, alternative components also emerged as “multimodal feedback” through narrative, questioning and visualizing indicators. Multimodal feedback can be viewed as emerging in relation to the toddlers in the following statement: “The children are one year old, so when I talk about discussion I’m not referring to verbal communication, but rather to gestures, facial expressions, sounds and occasional words from the children that the teacher attempts to interpret and put into words” (from co-evaluation, 2017). Through multivocal co-action, teachers seemed to make the contents living, understandable, visible and conversational.

Didactic who/whom-, where- and when-questions: There are many examples of “value didacticized” teaching in which the values on which the group of children focused were linked to the “who/whom”, “where” and “when” questions. “The children are involved in problem-solving in which we decide on common rules and options” (from co-evaluation, 2017). With the “who question” it can be a matter of “who rules” and alternative rules based on questions in the teaching, such as: Who may or may not participate in the game? Who is the focus of the activity and who decides? We can also discern traces in the material of a value-didacticised “where question”, that can involve “where rules” and alternatives to the rules discussed in the children group - in other words, “site rules” for where things should or may be and places and where activities should or may occur can be focused on in the teaching. Moreover, there are also traces of a didacticised “when question” in the teaching of “time rules”, and alternatives to the rules are then discussed in the teaching group, which might involve a focus on speaking time, favourite bike-riding time and tablet time, for example. It is also important to note here that unique children need different amounts of time, as is made clear by the following statement: “The children have different ways of learning and need different amounts of time” (from co-evaluation, 2017).

Didactic why-question: The objectives were preferentially set with reference to the Swedish preschool curriculum areas “2.2 Development and learning”, “2.1 Norms and values” and “2.3 Influence of the child” (from co-planning/preparation, 2017). The teaching arrangement was based on identifying “gaps”, defined as problematic situations, such as “food waste”, “what is pretty and what is ugly” and “who may participate in the play”. The “why” question alternated between explicit value gaps and fact-oriented gaps. In the following the gap about “food waste” turned out in a new gap when the child said that the food was gone and not left on the plate when the child “scraped it down into the bucket”:

Three of five children had eaten all their food; two had left food on the plate. The children said: “Yes, I remember now when I thought about it a little.” – “I thought a little, it was just enough.” – “I thought when I stood there with the plates.” – “First I took that much. Then I left a little ... THEN... GONE... Because I scraped it into the bucket.” – “I took too many carrots.” – “I took just enough, because I only took this much, and my tummy wanted this much.” – “No, you left some on the plate,” said one friend. – “Yes, but then I scraped it down into the bucket, and then it was gone!” (New GAP!;-). (From co-evaluation, 2017.)

Table 3 summarizes the different theory-informed arrangements described above. Characteristic traces are used as examples and the traces shown in bold print are the most striking.

Table 3. Examples of traces from theory-informed teaching arrangements 2016–2017.

Arrangement	What	How	Who/whom*	Where	When	Why
1 Didactically informed arrangement Spring term 2016	Music as science, art, crafts	Teacher-led co-action	Teacher (1–9 primarily 1)	Primarily indoors	Primarily a.m. 1–30 min.	**Lpfö Objective 2.2 1 within-musical objectives
	Dimensions of music	Feedback-group-individual “Feed – rap”	Children (2–30, primarily 4–8)	Often in circle on floor	Primarily 6–15 min.	Children's interests Creativity-learning
2 Variation-theory-informed arrangement Autumn term 2016	Learning object Focus on math & language – elements of nature	Teacher-led – and child-led co-action Guessing is “being on the way”	Teachers (1–4, primarily 2) Children (1–9, primarily 3)	Indoors-also outdoors At table – on floor	a.m.–p.m. 27 sec.–36 min. Primarily 3–7 min.	**Lpfö Objective 2.2 1–2 objectives Children's interests Intentional learning –changed know-how
	Content as contrast generalization & fusion	Feedback-group-individual “Feed –critical aspects”	Children (1–9 & up to 70, primarily 3) “Educator” (1–4, primarily 1–2), several co-actors	Indoors-outdoors “anywhere”	a.m.–p.m. “at any time” 22 sec.–35 min– 68 min. Primarily 1–3 & 7–9 min.	Children's interests-events Non-linear learning know/create Several integrated objectives **Lpfö, 2.2, environment, 2.1 & 2.3
3 Post-structurally informed arrangement Spring term 2017	Trans disciplinary content with elements of: mathematics-music-image-language-movement-nature-technology/ICT values	Child-guided co-action and “co-led action” Project-oriented Feedback group-individual-material “Feed with”	Children (1–56, primarily 2–5) Teachers – (primarily 1–2 –sometimes “all”) Several co-actors “Who/whom rules”	Transitions Indoors-outdoors Everyday situations “Place rules”	Before, during and after lunch 36 sec.–31 min. Primarily 1–5 min. “Time rules”	**Lpfö Objectives 2.1., 2.2 & 2.3 1–10 objectives Reflective learning Value-oriented & fact-oriented gaps
4 Pragmatically informed arrangement Autumn term 2017	Focus on values Democracy Social, environmental & financial sustainability	Teacher-led co-action Fact-based, normative & pluralistic Feedback – group-individual: “Feed – transaction”	Children (1–56, primarily 2–5) Teachers – (primarily 1–2 –sometimes “all”) Several co-actors “Who/whom rules”	Transitions Indoors-outdoors Everyday situations “Place rules”	Before, during and after lunch 36 sec.–31 min. Primarily 1–5 min. “Time rules”	**Lpfö Objectives 2.1., 2.2 & 2.3 1–10 objectives Reflective learning Value-oriented & fact-oriented gaps

* Number in parentheses

**Lpfö refers to Curriculum for the Preschool, SKOLFS 1998:16

Discussion

The discussion addresses multivocality (cf. Dysthe, 1993) in teaching arrangements in connection to the research questions about what could characterize teaching and co-assessment in preschool, with a focus on didactic questions and didactic levels. Didactic modelling refers to how teachers, based on theory-informed arrangements or models for teaching, develop connections between co-planning, teaching and co-evaluation (cf. Ingerman, & Wickman, 2015). For the purposes of this research, *teaching was modelled through co-assessment*.

The two didactic models – didactic questions (e.g., Uljens, 1997) and didactic levels (Kansanen, 1993) – emerge in covariation in the summary discussion below, which sums up the major findings from the didactic questions in the four theory-informed teaching arrangements (see Table 3) in relation to the concept of multivocal didactic modelling (for more information see Vallberg Roth et al., 2019). In previous research, the concept of multivocality has not been systematically linked to didactic questions and didactic levels. The combination of the concepts of “multivocality” and “didactic modelling” constitutes the main research contribution of this article.

Didactic “What” Question: Multivocal Modelling of Content

Collectively, the “what” question contains both knowledge and values. The areas of content concerned a multivocal approach including music, language, mathematics, nature, technology/ICT, images, movement and values. Overall, the contents were organized in different ways depending on which theory-informed arrangement was tested. A multivocal organization was thereby created from content, or in other words, a multivocal modelling emerged in response to the “what” question. In the didactically informed teaching arrangement, “content-related dimensions” (structural dimensions in music such as dynamics, tempo, etc., see Holmberg, 2014; Holmberg, & Vallberg Roth, 2018) and “content-related aspects” (science, arts and crafts) emerged (cf. Nielsen, 2006). In the variation theory arrangement, content of limited and intended “learning objects” (e.g., letters-numbers, patterns, size and weight) was organized and such content may be modelled as contrast, generalization and fusion in teaching (cf. Marton, 2015). The contents of the post-structurally informed arrangement may be modelled into “transdisciplinary intertwining” projects/themes, e.g., “Math-music” and “Songmatics” (cf. Palmer, 2010). Values, such as democracy, influence, and sustainability, emerged as focused content in the pragmatically informed teaching arrangement (cf. Hedefalk, 2014). Even if values were woven into all arrangements, values such as “integrative knowledge content” (cf. Löf, 2014, 2018) in social versus environmental and financial aspects (for example, in the content “Food Waste”) were modelled at the forefront in the pragmatically informed arrangement. The traces of the organized content in each theory-informed arrangement are similar to earlier research (cf. Hedefalk, 2014; Marton, 2015; Nielsen, 2006; Palmer, 2010). The current research adds the combination and the multivocal modelling in relation to the content (Vallberg Roth et al., 2019).

Didactic “How” Question: Multivocal Modelling of Teaching Actions

The “how” question focused on teaching actions that may vary between the theory-informed arrangements, so a multivocal modelling of teaching actions emerged. Child-guided co-actions have greater influence in the post-structurally informed arrangement, whereas teacher-led co-actions are more prominent in didactic, variation theory and pragmatically informed arrangements. Specific traces of co-action such as “teacher and child-led co-action” emerged

in variation theory arrangements. In addition, “co-led action”, involving children, teachers and the material as actors, could be discerned in post-structurally informed arrangements. Teacher-led co-actions according to pluralistic and normative principles, and to some extent fact-based principles, were apparent in the pragmatically informed arrangement.

Multivocal modelling of feedback also emerged in the theory-informed arrangements. Teachers, children and the material appeared as actors that could provide feedback. In the didactic “how” question, feedback was both group-oriented and individual-oriented in all arrangements, but it was, for example, more group-oriented in the didactically informed arrangement and more individually oriented in the variation-theory-informed arrangement. Traces of “feed up”, “feed back” and “feed forward” (cf. Hattie, & Timperley, 2007) emerged. Traces of other types of feedback may also be seen as examples of the proven experience. “Rap” feedback in terms of “feed – rap” was emphasized in the didactically informed arrangement, while feedback on critical aspects, or “feed – critical aspects”, was emphasized in the variation-theory-informed arrangement. In the post-structurally informed arrangement, feedback involving groups, individuals and material became evident in terms of “feed with”. Moreover, in the pragmatically informed arrangement, traces also emerged of what may be designated as “feed transaction” – feedback on change that is evident in action, in the form of critical ability to act. The research at hand adds the combination and the multivocal modelling of teaching actions (Vallberg Roth et al., 2019).

Didactic Who/whom Question: Multivocal Modelling in Relation to Actors

The “who/whom” question encompassed a total of 1–70 children and 1–9 preschool teachers/educators. Both preschool teachers and educators were included, usually one or two of them in each arrangement. Teaching groups of 3–5 children recurred in all arrangements. Larger groups of children were more common in the didactically informed arrangement and smaller groups of children were more common in the variation-theory-informed arrangement. From a wider perspective, examples of various teaching constellations were found in all arrangements, including one child, children in pairs, large and small teaching groups. Occasionally all children in the preschool were mentioned, i.e., 70 children in the post-structurally informed arrangement. This arrangement also placed greater emphasis on participation by children in all work and documentation. Other actors were also sometimes included, such as guardians and student teachers. The greatest number of actors were mentioned in the pragmatically informed arrangement, including cook, interpreter, puppet and stomach. For example, one teacher asked: “How do we know how much food to take?” “You have to ask your tummy,” replied one child. Then, in contrast to previous arrangements, we also detected traces of the “value didacticized” “who” question addressed in the group of children. It may concern “who rules” and options based on questions in the teaching such as: “Who may participate in the play?” The current research adds the multivocal modelling in relation to actors in the teaching arrangements (Vallberg Roth et al., 2019).

Didactic “Where” Question: Multivocal Modelling in Relation to Space and Locations

In the “where” question, teaching occurred either indoors or outdoors. However, in general indoor teaching was more common than outdoor teaching in all arrangements, though with some variation; the post-structurally informed arrangement also stated that teaching could be carried out “anywhere”. The pragmatically informed arrangement emphasized spontaneous teaching in everyday situations, during transitions and in interspaces. Here traces of a value didacticized “where” question that may pertain to “where rules” and alternatives were also

found in the group of children. In other words, the focus of teaching may include “place rules” for where things should or may be placed and where activities should or may occur. The research at hand adds the multivocal modelling in relation to space and locations in the teaching arrangements (Vallberg Roth et al., 2019).

Didactic “When” Question: Multivocal Modelling in Relation to Time

Concerning the “when” question, preschool teaching was conducted for about 20+ seconds to 36 minutes in the second arrangement and up to 68 minutes as spliced teaching events in the third arrangement. Taking all arrangements into account, the most frequently occurring videotaped teaching time ranged between 3 and 7 minutes. The first arrangement was more frequently associated with longer video time and included the most extensive material, with a total of 63 video hours. Moreover, the fourth arrangement also contained traces of the didacticized “when” question in teaching, including “time rules” and options that focused on speaking time, favourite cycle time and educational tablet time. The material also showed that individual children needed different amounts of time: “The children have different ways of learning, take different amounts of time.” The current research adds the multivocal modelling in relation to time in the teaching arrangements (Vallberg Roth et al., 2019).

Multivocal Modelling in Relation to the Didactic “Why” Question

The “why” question was generally linked to curriculum objectives in all arrangements. In the first two arrangements, 1–2 objectives stood out, while the third and fourth arrangements had multiple objectives, with examples of up to as many as ten. Different goal areas were involved, and the first two arrangements primarily referred to “2.2 Development and learning” in the curriculum (SKOLFS 1998:16, pp. 9-10). The fourth arrangement emphasized areas concerning norms, values and influence (sections 2.1. and 2.3 in the curriculum). The third arrangement focused on several goal areas such as development and learning, and norms and values, as well as on formulations about the environment.

In the didactically informed arrangement, the “why” question was also linked to the interests and creativity of the children. Intentional learning and changed know-how figured prominently in the variation-theory-informed arrangement. The interests of the children and events combined with non-linear learning and knowledge formation were emphasized in the post-structurally informed arrangement. In the pragmatically informed arrangement, the “why” question was linked to reflective learning regarding both value-oriented and fact-oriented gaps. The current research adds the multivocal modelling in relation to the didactic why-question in the teaching arrangements (Vallberg Roth et al., 2019).

Methodological and Analytical Reflection

For the theory-informed teaching arrangements the participants in the collaborative research chose what material should be included on the intended platform. Consequently, there may have been a positive bias in the sense that participants only chose to include those co-plans, videos and co-evaluations that they wished to share. In this sense, there may have been teaching material to which the researchers had no access and that may have deviated from the analysed material. Based on the aim and research questions, it should be emphasized in this context that the results only present a picture of what “could” characterize teaching in the preschool. The outcome is related to participation and circumstances that emerged in the research and development programme.

Trustworthiness and Situated Generalization

In summary, the degree of trustworthiness and generalizability can be interpreted as high based on the triangulation and that the collaborative research was carried out in ten municipalities, including 5,236 consenting participants. Regarding generalization, an argument can be made for the logic of *situated generalization*, according to which the results provide alternative perspectives and concepts rather than a single truth (Larsson, 2009). In this approach the reader interprets the extent to which the results can provide guidance in similar cases, situations and contexts outside the study. The generalization is situated in the sense that it cannot be predicted and instead occurs through recognition – that is, when the reader recognizes identified teaching and co-assessing traces described in the paper and uses the results and concepts as tools in practice (cf. Larsson, 2009).

Conclusions and Implications

The aim has been achieved and the research questions answered in full through the concept of “multivocal didactic modelling”. Modelling refers to how preschool teachers, based on theory-informed arrangements (i.e., models for teaching) develop connections between co-planning, teaching and co-evaluation. Teaching is modelled through co-assessment. Multivocal traces related to didactic questions and didactic levels emerge from the theory-informed teaching arrangements.

The research stands to make a highly significant contribution to knowledge development concerning teaching and co-assessment in Swedish preschools. Theory-informed teaching arrangements, with integrated didactic models, have been tried and shown to give teachers support in conducting teaching that is based on scientific grounds and proven experience. The concept “multivocal didactic modelling” can pave the way for several alternative (meta) theoretical trajectories for critical reflection and for more cohesive and finely tuned teaching. The contribution to the development of knowledge can be described in terms of theory-informed practical development and practically grounded conceptual development. The concept of “multivocal didactic modelling” needs to be further tested and studied.

Knowledge Contribution and Implications

Theory-informed teaching arrangements have been tried and shown to be feasible and useful. This has opened the door to varied didactic modelling in relation to different fields of knowledge and values. For example, when preschool teachers prioritize values and sustainability, they *can* choose to test a pragmatically informed teaching arrangement. When preschool teachers choose to work with limited and intended learning objects, for the purpose of focusing attention on established knowledge and monitoring the change in knowledge of each child, they *can* try a variation-theory-informed arrangement. Furthermore, when preschool teachers work with creativity and non-linear learning, and transdisciplinary content with integrated goal areas, a post-structurally informed teaching arrangement *can* be put to the test. Didactic questions and co-assessment *can* be tried in all teaching arrangements as a tool to increase the potential for equivalence and to make the opportunities in life available to all children. The knowledge contribution may advantageously be used in early childhood teacher education.

As a professional, it is desirable to make teaching choices and assessments based on a variety of theories in order to capture experience and knowledge in their various complex forms. A basic assumption in the collaborative research was that no theory could actually encompass the teaching situation as a whole. Remaining open to trying more than just *one* theoretical approach reduces the risk of being swayed into single-track and one-sided tendencies.

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Endnotes

1 *Limitations on material:* For reasons related to limited space, this article only presents results from material generated pertaining to the four theory-informed teaching arrangements at preschools/departments between 2016 and 2017. The article does not include inter-municipal co-plans and co-evaluations, or material from the municipalities' own selected theory-informed teaching arrangements from 2018.

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