EDUCARE 2022: 2

doi: 10.24834/educare.2022.5.7

Post-structurally and didaktically informed teaching arrangements in preschool exemplified by "rhythmatechs" as multivocal teaching

Holmberg, Ylva
https://orcid.org/0000-0002-4606-5112
Ylva.holmberg@mau.se

Vallberg Roth, Ann-Christine
https://orcid.org/0000-0002-4521-1528
Ann-Christine.Vallberg-Roth@mau.se

The article is based on a sub study in an R&D programme in which participants try out a didaktically and post-structurally informed teaching arrangement. The article is guided by the question *What can characterise the "what", "how", and "why" questions of teaching from the standpoint of a post-structurally and didaktically informed teaching arrangement in the preschool?* The substudy is based on material consisting of 251 documents, including co-plans, videos (5.5 hours) and photo documentation, as well as co-assessment. A didaktical oriented abductive analysis was carried out. The results pave the way for the content combination offered by the concept *rhythmatechs* (rhythmics-mathematics-technology) as a multivocal alternative to more subject-focused teaching. Within the framework of project- and theme-oriented working methods, the content appears on the one hand to be both transdisciplinary and interdisciplinary, and on the other hand, to represent specific content areas, such as science, mathematics, and music. We tried out a didaktik model that combines the didaktik triangle with didaktik questions "what", "how" and "why" with the didaktik triangle. The model stands in relation to results that focus on inter- and/or transdisciplinary content, in project- and theme-oriented approaches, and selection of content as goals and/or means.

Keywords: Didaktik model, mathematics, music, preschool teaching, technology.

1. Introduction

Preschool education was introduced in Sweden in 2010/2011 (SFS 2010:800). In 2019, 85 per cent of all children aged 1–5 years in Sweden attended preschool (Skolverket [Swedish National Agency for Education], 2020). The Ordinance (SKOLFS 2018:50) on the curriculum for preschool reinforced the mission of teaching. Namely, preschool teachers are to lead goal-oriented actions and processes by directing children's attention and they are responsible for planning and implementing teaching based on the curriculum and from the knowledge and experiences previously acquired by the children. They are also to include spontaneously occurring activities and interests as well as daily activities and procedures in the teaching process (SKOLFS, 2018:50). At the same time, there is a knowledge gap regarding how teaching is planned, carried out and evaluated at preschools, indicating a need to clarify how to conduct teaching (Skolinspektionen [Swedish School Inspectorate], 2018).

Previous research on preschools in the Nordics has focused more on learning than on teaching (Vallberg Roth, 2020). This has changed in recent years, for example through themed publications on teaching in preschools (Eidevald & Engdahl, 2018) and on play-responsive teaching (Pramling & Wallerstedt, 2019). There is a lack of long-term, comprehensive studies conducted in collaboration with preschool teachers, administrators, and researchers. This article is based on a sub study within a three-year experimental research and development programme to address the challenges, opportunities and circumstances faced by today's preschools in relation to the higher ambitions of the preschool mission.[i] The research portion of the programme, which we refer to as "collaborative research", stems from the questions raised by participants concerning preschool education (see note 1).

This article aims to contribute knowledge about what can characterise the content of a post-structurally and didaktik[1] informed teaching arrangement in Swedish preschools. The study presented in this article is guided by the following research question:

[1] We use the German word didaktik (with the k letter), which is common in continental Europe and the Nordic countries, and not the Anglo-Saxon word didactics.

What can characterise the "what", "how", and "why" questions of teaching from the standpoint of a post-structurally and didaktik informed teaching arrangement in preschool?

2. Previous research

Based on the purpose and research question, previous research on trans- and interdisciplinary content as well as project- and theme-oriented content in preschools may be relevant. Among other things, transdisciplinary content in teaching involves weaving various disciplines together and creating alternative content foci, "moving between, across, through and beyond established scientific disciplines" (Palmer, 2011, p. 47). For one search (July 2020) via Eric Ebesco, we used the search words *transdisciplinary education* or *teaching* and *preschool* or *childhood education*. In 1999, Benjamin wrote about how in the future, learning would revolve around problems rather than fragmented subject areas. The future curriculum must be transdisciplinary, and Benjamin supported his writing with Small (1981), who wanted a thematic approach that integrated multiple disciplines and various levels of complexity. Souto-Manning et al. (2019) conducted a transdisciplinary meta-analysis of pre-schoolers' learning and development and van Vreden's study (2018) used the transdisciplinary approach when music-inspired free play was conducted with a transdisciplinary approach to foster exploration.

The number of hits increased when we replaced the search word *transdisciplinary* with *interdisciplinary*, making the new search combination interdisciplinary *education* or *teaching* and *preschool* or *childhood education*. One study (Frankenberg et al., 2019) involved an interdisciplinary research team and the resulting challenges. Several studies connected to an interdisciplinary approach revolve around which subjects were encountered, some of which (An et al., 2014; An et al., 2016; An & Tillman, 2015; Harris, 2007; Holmes & Hallam, 2017; Yoho, 2011) aimed to use music as a means of learning in mathematics. The present study focuses on the teaching by preschool teachers (rather than on children's learning) and on what characterises the relationship between several subjects and content areas, which shift between being goals and means.

Miller and Lindt (2018) discussed how using movement in teaching language and mathematics can lead to greater interest, engagement, and learning. Palmer (2010) challenged the discourse on

mathematics, which is taken for granted, and allowed five children, age six, to create breakdancing choreography using mathematical concepts.

Because the concept of *thematic work* is traditionally used in a preschool context, it was also used as search term. Björklund and Ahlskog-Björkman (2017) studied how preschool teachers integrate the teaching of mathematics and art. The results show different approaches to pedagogical goals, which produce different views on learning mathematics. In another study by Björklund and Ahlskog-Björkman (2018), six preschool teachers presented how they write and implement pedagogical goals in a thematically oriented and play-based preschool context. The results show that the goals are interwoven and shift between activity, work, and transdisciplinary goals.

Zimmerman Nilsson and Holmberg (2017) demonstrated a need for post-humanist research focused on preschools and music-based activities. Post-humanism can be interpreted as a radicalisation of post-structuralism and the present article focuses on a theory-informed teaching arrangement based on a combined didaktik and post-structural gateway. A post-structural gateway opens up alternatives to seeing children, teachers and music as actors. For example, Holmberg (2014) pointed out how the social and material aspects of music, such as the power of music (and its potential as an actor), can impact musical moments by "captivating" the children and shaping the moment. Music is not itself attributed with intentionality, but music speaks to us, influences, and changes us, which can broaden the didaktik "who" question to include not only children and teachers, but also, for example, music and instruments as actors in the "who/what" question.

Instead of focusing on preschool students (like much previous research), the present article focuses on the teaching by preschool teachers (not on students), using didaktik as the primary resource, but combined with a post-structural gateway. Planning, teaching, and evaluating teaching in preschools are focused on what can characterises a post-structurally and didaktically informed teaching arrangement.

3. Theoretical resources

This article uses didaktik and post-structural references in relation to the study's purpose and research question. The focus of this study is shifted from learning to teaching (Vallberg Roth, 2020) with the help of the didaktik questions (cf. Comenius 1657/1989; Uljens, 1997). Accordingly, preschool teachers planned, conducted, and evaluated their teaching with pre-schoolers. Based on Jank and Meyer's (1997) reasoning, didaktik has two sides: it is partly described as "the teaching reality as it *is*," and as a "suggestion as to what better education *should* be" (p. 47). Phrasing with words such as "should" and "shall" contains built-in, traditional normative didaktik. Instead, this article takes interest in alternative didaktik, namely critical didaktik (cf. Biesta, 2011; Broström, 2012). This concept concerns a didaktik focus that emphasises reflection on educational processes that involve preparing individuals for an open and unforeseen future. In this context, for example the modal verb "can" is used instead of "shall", which may create space for alternative didaktik reasoning (Vallberg Roth, 2020). In didaktik questions, "shall" is linked more to traditional normative didaktik, whereas "can" is linked to critical didaktik. "Can" opens the possibility of alternatives to the choices that are made, and we do not purport to establish once and for all "what must be taught" or "what characterises…" the content; rather, we focus on "what *can* characterise teaching content". Critical didaktik endeavours to provide support for critical reflection through alternative tools – that is, the point is to create space for an alternative. This article creates space for *rhythmatechs* as an alternative content combination for teaching, where content comprises interwoven music–mathematics–technology.

Broström (2012) raised the need for "critical preschool pedagogy and didaktik" in which he combines education-oriented critical-constructive didaktik (Klafki, 1995) with post-modern ideals. A post-modernist gateway allows the anthropocentric perspective, with the human at the centre, to be challenged. In conjunction with musical moments in preschool, Holmberg's (2014) study shows, for example, how music can "have inherent power (music says something to us but is interpreted individually) to captivate the children and shape the events of the musical moment" (p. 182).

Didaktik emphasises a triangular relation between content, child, and teacher. Meanwhile, post-structural theory highlights the relation between the social and materiality. In the discussed study,

we tried to combine these approaches in a didaktik triangle (see Figure 5) that focuses on didaktik questions and the material in connection to the content, the teacher, and the child. The study enabled us to highlight discourses of power relations between, for example science, mathematics, and music. Contents may appear as having different values, which produces a status hierarchy, in which different content areas appear to have different values. This approach also enables trans- and interdisciplinary bridge-building in co-action (see Figure 5).

In the combination of didaktik and post-structural theory, the material in the environment can also be touched upon as a co-actor in didaktik relationships. For instance, based on a post-structural theory, Nilsson et al. (2018) state that it is "a flexible and dynamic knowledge creation that arises in the meeting between different materials, words, texts and people in learning processes" (p. 112). In relation to didaktik, it then becomes possible to focus on the material from the three corners of the triangle – with the human material and the content material, such as instruments (see Figure 5). The meeting between didaktik and post-structural theory enables an intertwined concept and model development. It is in the combination of didaktik and post-structural input that a practical theoretical potential resides.

3.1 Main concepts

Teaching in a *non-linear* direction ("non-predetermined processes", Holmberg, 2014, p. 69) allows multiple disciplines to merge and perhaps also to be interwoven with a transdisciplinary approach. Non-linear teaching does not automatically have a clear beginning in terms of content, with predetermined objectives; rather, objectives can be chiselled out throughout the process, working together with the children. From the start, the objectives are open to unanticipated events that contain relationships between the social and the material in the environment, such as instruments and bodies that can influence creations, as well as children's questions and interests. Music, mathematics, and technology can be included as scientific disciplines whose logic can be interwoven into one broad content area, such as rhythmatechs. This involves "not only working together but daring and getting to borrow tools from one another and working *within* one another's

fields/discourses" (Palmer, 2011, p. 47). Instead of working first with the content of one subject and then with the other, "both practices are done simultaneously" (Palmer, 2011, p. 48).

The relationship of the subjects to one another can also be expressed with terms such as *goals* and *means* (Lindström & Hägglund, 2004; Österlind, 2018). "Content as goal" means that content is in the foreground and refers to intra-content goals. For example, the choice of content is related to intra-musical goals, such as tempo, dynamics, rythm and so on. "Content as means" means that content is used as a tool to support knowledge in other subject areas. Other researchers use the term *immersion* when content is at the foreground and *decoration* when content only serves as a decorative element (Österlind, 2018).

The concepts *theme* and *project* are also relevant theoretical resources. Doverborg at al. (2020) described a theme as "an additional meaningful context comprising diverse content" (p. 12). Further, they described it as "an overarching narrative, a fabric that weaves together individual threads and a meaningful context" (p. 13). Regarding themes in relation to projects, they wrote:

> Whether there is a difference between a theme and a project is a common question. From what we can see, these terms have different origins – theme has been included in preschools from the beginning and project was adopted by Reggio Emilia. (p. 8)

Regarding the project form, Theorell (2010) states that it involves a "project-oriented approach, i.e., creating development together with the children throughout the course of the project. In the meeting between the children, educators and the project, something new arises, something that is not predetermined" (p. 222). Swedish dictionaries define project as a "plan, outline; (larger) work that will lead to a set goal" (Bonniers svenska ordbok, 2002, p. 453). In this we perceive a shift from a predetermined to a non-predetermined direction. For instance, Elfström (2013) stated that "With the Italian word *progettazione,* they want to broaden and resist the mindset of a fixed curriculum and established programme, as has served as the frame of reference in their Italian context" (pp. 103–104).

Literature on both themes and projects includes a relationship to children's interests, documentation, and curricula. Doverborg et al. (2020) asserted, "Possible themes are those that engage and interest children, but that can also be related to the curriculum" (p. 118). One section in the text on themes has the heading "Documentation as a condition for development" (p. 119). Support material from the Swedish National Agency for Education (2012) states that "Projects are a frequently used work form with pedagogical documentation"; further projects "are based on an exploratory approach" (p.17). Children have the opportunity to investigate and create relationships with a wide variety of materials and other children in network-like, rhizomatic projects" (p. 35). Teaching in a non-linear direction, like a rhizome (Deleuze & Guatarri, 1987) can be described as thoughts arising in tangled connections (Palmer, 2011). From this perspective, teaching can be described as travelling this way and that down unpredictable, non-linear paths rather than as progressively moving in predetermined, linear directions (Swedish National Agency for Education, 2012). Within the framework of goals for which to aim, non-linear and goal-relational teaching may lack a predetermined focus; it has several gateways that may occasionally be linked together (cf. Lind, 2010).

Project and theme-focused working methods "are well suited to the intention of the curriculum for preschools to offer children a safe, challenging environment that inspires play and activity, and that inspires the children to explore the world around them" (Swedish National Agency for Education, 2012, p. 35). Palmer (2011) formulated this as "exploratory projects" (p. 72) and Åberg and Lenz Taguchi (2018) addressed it as "project work methods with small children" (p. 156). Further, some outlooks have emerged that view themes and projects as two different phenomena: "We view the concept of a theme as something without end, a common thread that can be broken down into smaller projects. A project is limited in scope and has an end" (Björkman, 2006). According to Doverborg at al. (2020), "theme" usually refers to "longer, connected subject areas, but a theme can also be very short and temporary" (p. 118).

In the "Pedagogical Programme for the Preschool", the National Board of Health and Welfare, (Socialstyrelsen, 1987) organised content into "nature, culture and society" (p. 26) and theme-based practices were described on three pages.

> Theme-based practices as a pedagogical method involve focusing for a longer period of time on a particular question or a specific and delineated area… A theme-based practice shall be based on the interests and prior knowledge of the group of children, as well as on the content of the pedagogical programme… Theme-based practices have no subject limitations. (pp. 43–44)

The first curriculum in 1998, which was the first binding regulation, included the phrase "theme-oriented working methods" in one sentence: "Theme-oriented working methods allow for diverse and cohesive learning among children" (Skolverket, 2016, p. 10).

In this article, we use the combined term *project- and theme-oriented working methods*. By this, we refer to working methods in which the content weaves together threads based on the children's interests, and questions, and in relation to the curriculum objectives and the preschool teachers' didaktik choices. Further, the interwoven content of project- and theme-oriented working methods may result in both inter- and transdisciplinary foci.

4. Research methodology

To accomplish the purpose and answer the research question, we conducted collaborative research that is methodologically influenced by praxiography (Bueger, 2011, 2014). Praxiography refers to studies and analyses of recorded practices (Vallberg Roth, Holmberg, Löf & Stensson, 2019). The praxiographic research process can be described as a process of "turning implicit knowledge into explicit", which "implies a high degree of interpretation" (Bueger, 2011, p. 6). Moreover, "The overall orientation of praxiography is to reconstruct meaning" (p. 4). One way for praxiographers to turn implicit knowledge into explicit knowledge is to use observations, speech, and actions to attempt to identify "moments in which participants themselves tend to articulate implicit meaning" (p. 6). In this article, traces of implicit meaning can be broadly interpreted, captured, and reconstructed using the concept of "rhythmatechs". We make didaktik processes explicit with examples of teaching that include the content combination of music–mathematics–technology in preschools. The exploration is based on recorded practices that comprise co-plans, videos, and co-

evaluations of teaching in preschools. In other words, word data and audio-visual data are our starting point (Vallberg Roth, et al., 2019, 2021).

4.1 Research design

The design of the collaborative research was based on the processing of qualitative data and comprised the testing of teaching by preschool teachers in approximately 44 preschools/departments in eight municipalities in Sweden. The collaborative research design involved participants testing "theory-informed teaching arrangements", which refer to participants trying different teaching arrangements that are informed by theory. These arrangements included so-called co-assessment (Vallberg Roth, 2017). The co-assessment involved at least two actors, such as teacher–educator or child–teacher–material. Further, it consisted of co-interpretation of objectives, co-planning of teaching, conducted teaching, and co-evaluation (cf. Allal, 2013; Thornberg & Jönsson, 2015; Vallberg Roth, 2020).

This article focuses on a post-structurally and didaktically informed teaching arrangement. Therefore, the point of departure for studying the arrangement includes the co-plans generated by the participants, their teaching that may be documented on video or in other ways (e.g., photos or column documentation); and the co-evaluations of the participants (Vallberg Roth, et al., 2019, 2021).

In this study, knowledge is developed through collaboration among participants such as principals and preschool teachers. These individuals ran and tried out teaching arrangements in the operation. The collaboration in the study meant that participants initiated questions about teaching, and generated material. Furthermore, it entailed regularly discussing the arrangements and analyses of the material, as well as communicating with participants.

Input to the theory-informed teaching arrangements occurred once each term when the structures were introduced. The number of participants at that time was about 300, (220 preschool teachers and about 80 principals and assistant principals). The municipalities/responsible school authorities appointed the participants. Input in this study's context refers to lectures by researchers associated

with each theory-informed teaching arrangement, and to seminars with theory-informed discussions. Further, all participants also had access to reference material describing the theory-informed arrangements with links to relevant references (Vallberg Roth, 2018). Based on the input, the participants then tried out the theory-informed teaching arrangements in the municipalities without the presence of researchers in the preschools.

At the research project's *national seminar*, an example was presented of teaching sessions with a transdisciplinary gateway, in which subjects such as music, movement, mathematics and technology were interwoven. The seminar introduced concepts such as the didaktik relationship, rhizome, pedagogical documentation, goals that remain open to the unforeseen, and transdisciplinary content. The example demonstrated an exploratory and experimental approach with a focus on creating, in which new and unforeseen content combinations emerged in terms of rhythmatechs.

4.2 Data generation and materials

Since this article aims to contribute knowledge about what characterises the content of a post-structurally and didaktically informed teaching arrangement, the principal for sample and selection is material from preschool teachers who used a post-structural and didaktik gateway to co-plan, conduct, and evaluate their teaching in the spring term of 2017. The material consists of around 170 written documents and 5.5 hours of video. In terms of content, the project has elements of interwoven subjects (e.g.,language, science, technology, dance and images). Since music is the subject that is least often mentioned as a goal and most often mentioned as a means, music – as a goal and/or means, combined with movement, mathematics, technology, and science – became fundamental when selecting samples of teaching arrangements. A comprehensive quantity of data was generated by the participants without the presence of researchers in the preschools. Participants uploaded the data to the platform Box.

4.3 Abductive analysis

Analysis of the material can be methodologically described as abductive analysis (cf. 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 is to identify traces and patterns in "word

data" and "audio-visual data" in relation to the aim of and questions posed by the article (cf. Alvesson & Sköldberg 2008; Silverman, 2011). Didaktik questions serve both as practical tools and as a basis for the analytical process. The didaktik "what" question is at the forefront of this article, with connections to the "how" and "why" questions.

We carried out a close reading of the material for the *empirically based analysis*. We read, listened to and viewed all the material several times and partially transcribed some of the material (cf. Duranti, 1997). We also highlighted prominent words in relation to didaktik questions (see sections 5.2–5.3 and Figures 1–3). Using a *theory-based analytical path* we related distinctive empirical traces to prior research and concepts associated with the theory-informed structures (see section 5.4). We carried out an analysis in which empirical and scientific texts were related to each other such as the content of *project- and theme-oriented* working methods, content as *goal and/or means*, and *transdisciplinary* and *interdisciplinary* content. The theory-based analysis culminated in a focus on concepts and model testing (see Figure 5). Finally, there was a summarising, theory-based discussion. In practice, the analysis was more intertwined than the preceding account would indicate. Our goal was not to provide a valid, singular truth but to open the way to more complex and deeper understanding of what may characterise teaching with a focus on post-structurally and didaktically informed teaching arrangements in preschool (cf. Tracy, 2010).

4.4 Research ethics guidelines

The research of the programme was reviewed and approved by the Regional Ethical Review Committee in Lund (10 January 2018). The collaborative research complies with the research ethics guidelines of the Swedish Research Council (2017) and the ethical principles for research in the humanities and social sciences. According to the *information requirement*, all participants are to be informed and asked for their consent; furthermore, all participation is voluntary and may be discontinued at any time without any explanation, in accordance with the *consent requirement*. Therefore, all participants in the programme were informed and given the opportunity to provide their consent.

The study was conducted using recorded activities such as audio recordings, notes and video. Professionals who worked in the preschool conducted and recorded the activities. The recorded data was treated confidentially and is stored on a platform that is accessible to the researchers in the project. One participant per preschool/department was appointed to enter the material on the platform. The appointed participants only have access to the material that they personally enter. The platform is called Box and complies with the legal and security requirements placed on a Swedish government agency. This means that Box can be used for all personal data except those that are covered by confidentiality (e.g., patient data, political views, ethnicity, religious beliefs, and sexual orientation). Despite this, we have been extra careful, requiring professionals to post written documents only where the names of people and preschools/departments are deidentified. In this respect, communication has been conducted with the data protection representative (*dataskyddsombud*) at Malmö University. The Swedish University Computer Network (SUNET) has signed an agreement with Box, and Malmö University has an agreement with SUNET for the use of the Box service; this agreement reflects SUNET's agreement with Box. All traffic to and from the service is encrypted, and the files are stored encrypted at the provider. With respect to the *use requirement,* the generated data is only used for research purposes and has been reported by researchers in such a way that individuals cannot be identified by outsiders. The empirical data cannot be used by other researchers in other research projects.

All data production was encoded based on a system that we determined using a code key that is locked in the department archives for storage, in accordance with the *confidentiality requirement*. All consent forms have also been stored in the archives. Since pre-schoolers participated in the study, and consent from their guardians was required. Ethical questions are subject to continual discussion in the collaborative project. A total of 10 404 individuals consented to participate in the research portion of the programme: 8219 guardians/children and 2185 preschool teachers/ educators/principals and managers.

5. Results

The presentation of the results follows the sub study's research question. First, we describe how the content is organised, its primary features, and its division into project- and theme-oriented content and working methods. Then, we describe the content areas mentioned in the written

material, as well as whether they are included as goals or means. Next, we focus on whether the content appears to be relatively interwoven and transdisciplinary, or relatively divided and interdisciplinary. We follow the interpretation with the abductive analysis, beginning with quantitative elements and characteristic, empirically based traces, and then transition to the theory-based analysis. The quantitative processing of teaching content is presented in Figures 1–3. It can be seen as a quantitative element of the qualitative processing of data. It is not a quantitative and statistical analysis that claims that each and every piece of content in the material has been quantified and statistically processed. Rather, the point of the quantitative element is to stabilise the analysis of such extensive material and hopefully reduce error sources and over-interpretation – such as confirmation bias (selectively noting data that confirms preconceived opinions) and ascribing outsize significance to a detail in the material. Distinctive traces have emerged from the content frequency analysis (see Figures 1–3). The analysis builds further on both high-frequency and low-frequency traces in the second interpretive path. Method triangulation, where the same empirical material is analysed based mainly on qualitative elements but also on quantitative elements, may contribute to showing the complexity of teaching in reality. The analysis aims to open the way to more complex and deeper understanding of what may characterise the "what", "how", and "why" questions of teaching from the standpoint of a post-structurally and didaktically informed teaching arrangement in the preschool. The presentation will culminate in an overarching discussion with a focus on concepts and model testing in relation to previous research.

5.1 Content of project- and theme-oriented working methods – the "what" and "how" questions

The content emerges in project- and theme-oriented form, which may connect the didaktik "what" question with the "how" question. Below are several examples:

> Transdisciplinary work in themes and projects facilitates the inclusion of the entire curriculum in a natural, meaningful way. (Co-evaluations, teacher)

> We constantly work with small projects that capture the children's interest. (Co-evaluations, teacher)

> Transdisciplinary learning: Where the surroundings and multiple subjects are woven together and lead to learning among the children, for example movement and mathematics.
> Learning occurs not in a straight line but a crooked one. (Working thematically) (Co-evaluations, teacher)

> Teaching based on the post-structural gateway has become an ongoing project with the children, which has made it possible for us to set aside a lot of time for this endeavour. (Co-evaluations, teacher)

In the examples from the co-evaluations above, the projects and themes are related to transdisciplinary content, the children's interests, and the curriculum, as well as to time.

5.2 Content areas – the "what" question

When the analysis explores the content-related "what" question, it focuses on whether the material mentions different content. The content is divided relatively evenly between the different content areas (see Figure 1). Content focusing on nature–science and images–form–drama–creativity is slightly more comprehensive. Content focusing on society–local environment (e.g., home construction and public functions) is smallest in scope. The content is attributed to the following valuesin the preschool surriculum: "2.1 Norms and values" and "2.3 Children's participation and influence" (SKOLFS 2018:50).

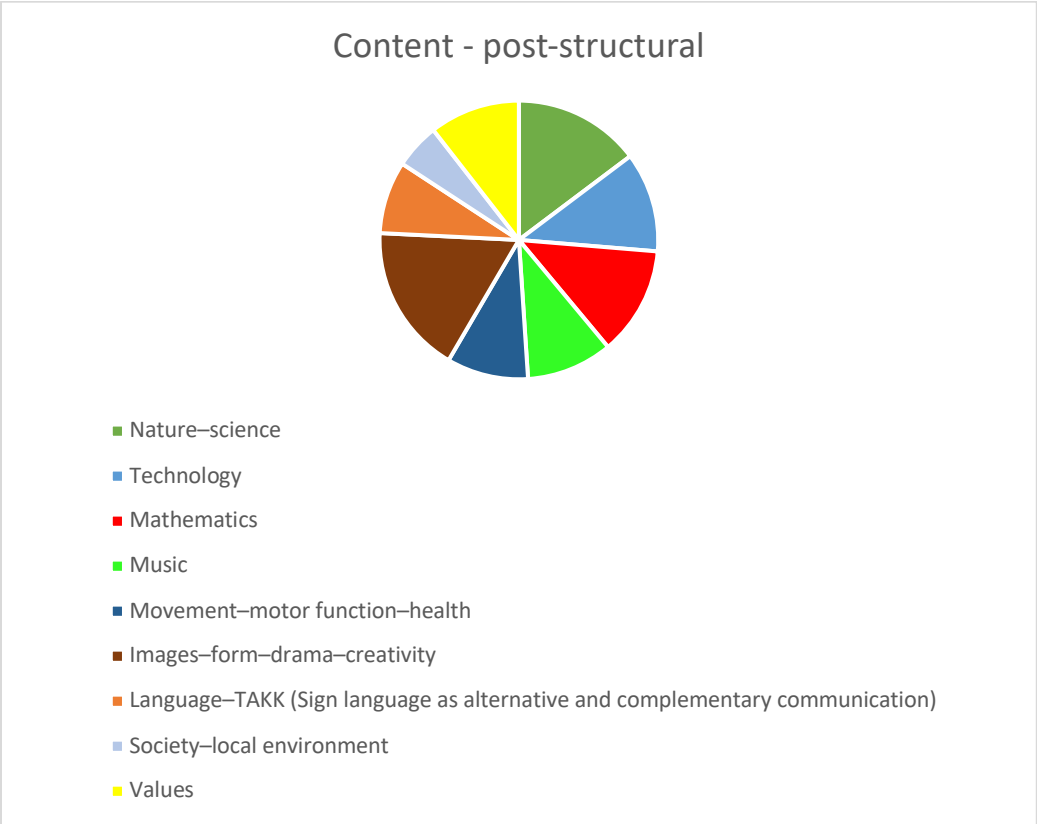

Figure 1. Allocation of content based on different areas.

5.3 Content as goal and/or means – the "what" and "why" questions

When the analysis focuses on content in relation to the didaktik "why" question and on content as goal and/or means, the allocation is not as evenly distributed. "Content as goal" means that content is in the foreground and refers to intra-content goals, such as intra-musical goals. "Content as means" means that content is used as a tool to support knowledge in other subject areas. The results indicate that nature-related content becomes more of a goal in the foreground and culture-related content becomes more of a means. Society and values may appear as both goals and means (see Figure 2); therefore, they are not further included. The results here are interesting, especially given that the example that was introduced at the beginning of the arrangement was not focused on nature-related content.

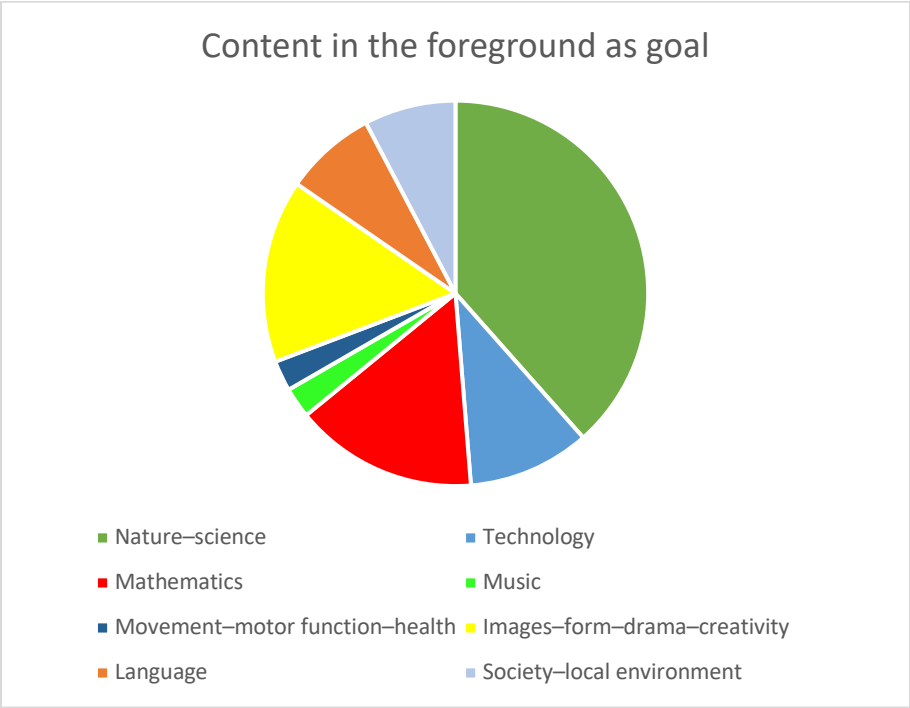

Figure 2. Content in the foreground and as goal.

When we analyse and track which content areas end up more in the background as means in the teaching arrangement, the picture is reversed. The culture-related content area, with music in the lead, ends up being significantly more comprehensive than nature–mathematics–technology area (see Figure 3). The following statement points out how music ends up in the background.

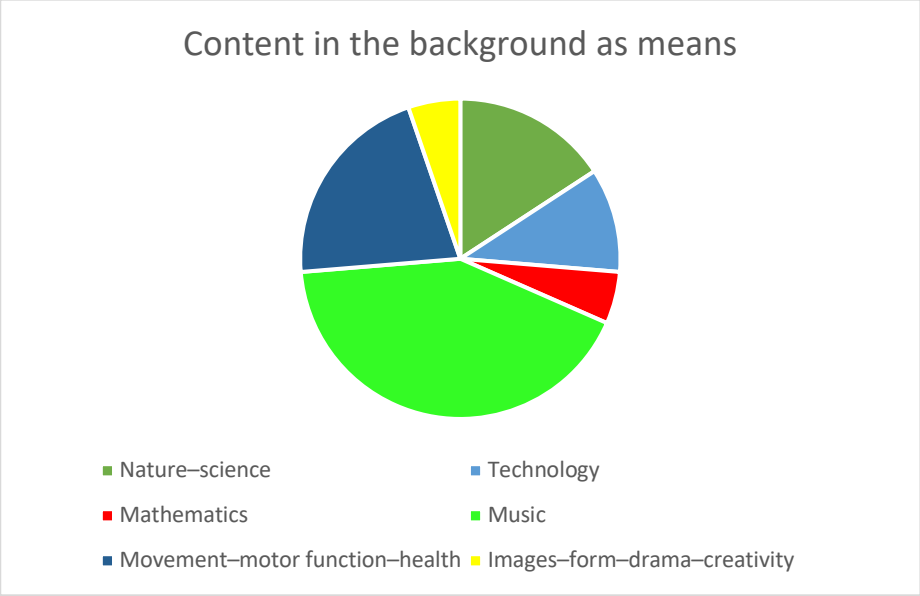

Figure 3. Content in the background and as means

Together, *characteristic and empirically based traces* can be interpreted as follows:

- Content of project- and theme-oriented working methods
- Content areas
    - Content as goal in the foreground
    - Content as means in the background

The content is modelled in project and theme form. The content areas can emerge in different combinations in the post-structurally and didaktically informed teaching arrangement. Different content may emerge as goals in the foreground and as means in the background. We now move to the theoretically based analysis concerning the "what" and "why" questions.

5.4 Goal and/or means in projects and teaching – the "what" and "why" questions

The result can be analysed in terms of some subjects serving as "decoration" for other subjects (cf. Pramling Samuelsson et al., 2008; Österlind, 2018). One recurring example of content as means for other content is the use of music, images, and movement to support scientific content. At one preschool, the scientific content concerns water and the sewer system, where the teacher reviews the different phases of water. This leads to a projection of a video of a coral reef on the wall. The

children get to paint to music. The preschool teacher documents this by writing, "We capture the movement of the fish in water, and we listen to music". The children get to dance like water molecules in different phases, and to dance and sing along to an H_2O song from a children's radio programme. The function of music, images and movement emerges as a means in this teaching process, which can be interpreted as function in the form of inspiration. It also facilitates the learning of science. Namely, the focus is not on music, images, movement, and science as equivalent content areas, but rather that music, images and movement are incorporated into the lesson for the sake of science. Consequently, music, images and movement are interpreted as a means of teaching.

Naturally, there may be many reasons why music becomes a means in the background and why more preschools do not specifically include music. One reason has been discussed in a study by Ehrlin and Wallerstedt (2014). They show that education and the continuous education of teachers has certainly enhanced their confidence in the use of music in their practices, but preschool teachers occasionally lack more developed language *about* music. This may also be a point in this study: musical elements are included, but there is a lack of language, musical terminology, to explain what is being taught.

Using a theory- and concept-based analytical path, we discern relatively transdisciplinary or relatively interdisciplinary traces in the content, which are presented via two in-depth examples. The first exemple involves transdisciplinary content, *Blue-bot and playing instruments*, and the second concerns interdisciplinary content, *Bus Seeds*. The analysis focuses on tracking content comprising both goals and means. The content, music–mathematics–technology, or what we call *rhythmatechs* may be relatively interwoven or relatively divided.

5.5 Transdisciplinary content – Blue-bot and the instruments

Music is a far more commonly as a means than as a goal in the empirical material. Mathematics, science, and sustainable development comprise the majority of the content in which music can be interpreted as a means. *Blue-bot and the instruments* is an example of a relatively linear project with a clear goal: to "awaken the children's curiosity about programming and build upon their interest in music and movement". Programming is in the foreground, but it is interwoven with music and

mathematics. The first teaching session was conducted indoors with three children and the camera was mounted on a tripod.

The session begins with the children lifting instruments out of a box. A relationship between the social and the material is revealed, and blue maracas are placed together. The way in which the mathematical activity of sorting and classifying is interwoven with musical instruments becomes evident. There are also two tambourines, a hand drum, and a xylophone. One child begins to play the xylophone. The teacher suggest that they can sort the instruments before playing.

> Teacher: *We are not going to start playing yet; first we are going to sort and see what we have.*

The process of sorting and classifying the instruments based on colour continues. In other words, the focus is on mathematics rather than music. The teacher places a sheet of paper with boxes on the floor, takes out a Blue-bot:

> Teacher: *Blue-bot does not know where to go. We must explain that when Blue-bot goes to a colour, we will play that instrument.*

It becomes clear in this context how playing the instruments requires Blue-bot; otherwise the children will not know which instrument to play. It also becomes clear that Blue-bot needs the instruments: there is no point to the programming if not to find out which instruments the children will play. Another interpretation is that the mathematical activity of locating (getting Blue-bot to move) is in the foreground. In a material relationship, the instruments and the Blue-bot can captivate the children and shape the teaching. Objects can, in co-action with the teacher and children, be interpreted as directing the attention and advancing the teaching session.

> Teacher: *When it gets to the red box, we can play. Now let's see if it gets there. /…/ What do we do when it gets to the red box?* The children begin to play.
> Teacher: *Now let's see if the robot can move again. We will press two steps forward. Do you think we can play now?*
> Child 1: *No.*

Teacher: *Let's see where it goes.* The Blue-bot advances two steps, which is not to a red box.

Teacher: *If it gets to a red one, we have to turn it, right?*

Child 1: *Yes, then it goes and we get to play.*

Teacher: …*Then I'll press turn and then two steps forward.* The robot reaches a red box.

The teaching session evolves to include green and blue instruments in addition to red ones. The teaching session concludes after a little while and other occasions are similar to the first one. The teaching sessions can be viewed as a project taking a transdisciplinary approach, in which music, programming and mathematics are interwoven. The teaching is based on the co-plans from the interests the children have shown. In the teaching process, the relationships between the children, teacher, Blue-bot and instruments can be interpreted as leading the sessions forward.

5.6 Interdisciplinary content – Bus Seeds

Bus seeds is the name for a group of children who travel by bus when they are in preschool. It is a mobile preschool activity. Bus Seeds exemplifies interdisciplinary teaching with transdisciplinary elements and moments, in which music can be interpreted as both a goal and a means, the interwoven link to content as movement, language and technology. This relatively linear project was carried out in various groupings outdoors, indoors, and on a bus. During the project, new lyrics are written to the familiar melody of the song "Who's Da Man", colloquially known as the "Zlatan song", and a music video is recorded. The background of this creative activity is that the children "enjoy singing", but they think many songs are "boring". Thus, the teaching is based on the children's interest. An interdisciplinary approach is already detectable in the co-planning, in which individual subjects such as music, language and technology are mentioned. Some of the children "rhyme and play with language". At the same time, some of the children "talk to one another about what is real on film" and the educators would like to "make their own song with the children".

As we begin the documentation, three children are sitting in the bus; they are going to write the new lyrics. They have a sheet of paper in front of them on which the preschool teacher has written words that the children want to include in the alternative Zlatan song. One child says that Zlatan quit:

Teacher: *Yes, but Zlatan is only the melody of the song. But our song will have different words.*

Music in this context can be interpreted as a fixed point of reference in that the goal is to compose new lyrics and it becomes clear that lyrics and melody are separate. Transdisciplinary moments arise during the creative process, as the lyrics (language) and melody (music) are also mutually dependent. The teacher directs the children's attention to the lyrics they will create.

Teacher: *What do we usually do when we're out on the bus? Say anything that we usually do.*
Child 3*: Dig in the forest…*
Child 2: …*We take care of our animals.*
Child 3: …*and we pick up all the rubbish…*

The teaching session continues, and after additional reflections on what they do in the forest, the teacher sings the chorus and the first verse with the new lyrics. The children sit quietly and listen; they appear to be proud and satisfied. Then the teacher directs the children's attention to a linguistic activity – rhyming:

Teacher: *You also said looking for treasure. Geocaching, and going to the beach [Swedish:* strand*]. What rhymes with beach [*strand*]?*
Child 1*: Hand. Tooth [*tand*].*
Teacher: *We go to the beach [*strand*]…*
Child 2: …*and look for rubbish on the beach.*

Even if they are clearly focused on the content of the lyrics, the focus on rhyming remains.

Child 1: *I don't think that rhymes.*
Teacher: *Yes, beach [*strand*] and sand, doesn't that rhyme?*
Child 2: *We go to the beach [*strand*] and look for sand. Bottles [*pant*] in the sand.*
Child 1: *We go to the beach [*strand*] and look for bottles [*pant*] in the sand.*

> Child 3: *We go to Oset [*name of a place*] and look for bottles [*pant*] on the beach [*strand*].*

The teacher writes down a fresh copy of the new lyrics and sings while the children listen attentively. To this point, the creative focus has been on the production aspect of music, on how to write lyrics to go with a melody, which is woven with the linguistic craft of rhyming.

In another teaching session, the alternative lyrics have already been written and three children choose to come up with movements to go with the chorus of the song. In the teaching session, the song lyrics are reinforced with illustrative movements that the children made up (cf. Holmberg 2014, p. 145). In this session, the music can be understood as a means for the goal of coming up with movements to go with the music. Simultaneously, the music is in the foreground, as the movement sequence has less meaning without music but the music still has meaning without the movements. Then technology enters the teaching session, and the transdisciplinary method is replaced with a more interdisciplinary approach. A green screen is hung up in the woods, facilitating a relationship between the social and the material. A music video is recorded in which the children move in relation to the bus. Later the children reflect on how, with technology, the green screen offers an alternative world:

> With a green screen, it's like there's another world – but not.

The movements are also mentioned, including going inside the bus and standing on the roof of the bus. Some degree of source criticism emerges as the children reflect on how it is not real:

> You can't stand on the roof of the bus, you know, so it isn't real.
> They're actually walking inside the engine of the bus, it's back there...you can't do that.

The focus continues to be on a relationship to technology as the children explored how the *Green Screen by Do Ink* app works. In the co-evaluation, one preschool teacher reflects on the children's source-critical approach:

> It became clear from what the children said that they know that movies can trick you with a green screen. But they did NOT really know how everything is put together and becomes a film. Then the educators brought out the iPad to edit the film and showed them how to easily put different images together.

The documentation concludes with the *Bus Seeds* music video. The song is accompanied by guitar and a clear adult singing voice supporting the children:

Chorus	No one goes to the woods like we do	wave with one hand
	Bus seeds, I say bus seeds	wave with two hands
	We're looking for creatures in nature	picking seeds
	Bus seeds, I say bus seeds,	wave
	I love you, I love you	make hearts in the air
	The preschool bus is what we do.	Drive with a pretend steering wheel

Verse	We're going to Vättern to walk on the pretty beach [*strand*].
	Because we're friends and we walk hand in hand
	Can you believe some people
	Throw litter on the street
	We will make right what they are doing wrong
	Turning in bottles is as simple as a song
Verse	We explore and play and we sing every day.
	With us, everyone should feel happy
	We never give up because we're going to the top of "jära"
	Of course we're good, we're the best
	Come join us and be our guest

The lyrics can be interpreted based on the existential and emotional dimension of music via a focus on socialisation and inclusion: "we're friends and we walk hand in hand" and "with us, everyone should feel happy". There is also a shared name, *Bus Seeds*. A clear "us and them" (cf. Holmberg & Löf, 2017) emerges: "We will make right what they are doing wrong". The lyrics have a somewhat

educational tone: "Can you believe some people throw litter on the street". They also contain elements of environmentalism and sustainable development: "Turning in bottles is as simple as a song".

The teaching sessions have several starting points, namely the interests of the children and preschool teacher as well as the curriculum and can be seen as an interdisciplinary project. Throughout the project's transdisciplinary steps and moments, the fixed point of reference is the making of the music video (doing), where the content – music, language, movement, technology, and sustainable development – is interwoven. Among other things, the relationship between children–preschool teacher–music–technology captivates the children and shapes the teaching. The overall process can be interpreted as guided by goals, but there are opportunities for non-linear input.

6. Discussion

In this article, we aimed to contribute knowledge about what can characterise the content of a post-structurally and didaktically informed teaching arrangement in Swedish preschools based on findings from a collaborative research study. The findings reveal that, in part, content can be characterised as project- and theme-oriented, with content as a goal in the foreground or as means in the background. Content can also be both transdisciplinary and interdisciplinary. Transdisciplinary steps or moments can emerge in interdisciplinary content.

6.1 Project- and theme-oriented working methods as potential preservation of the values of different content areas

In the post-structurally and didaktically informed teaching arrangement, the "how", "what", and "why" questions emerge in relation to (a) project- and theme-oriented working methods (how); (b) inter- and transdisciplinary content (what); and (c) to the function of content when choosing content as a goal and/or means (why).

What-How? Content in project/theme-oriented working methods
What? Inter- and transdisciplinary content
What-Why? Content as goal and/or means

Figure 4. Overarching results in relation to some didaktik questions.

All teachers select content around which teaching can revolve. These choices influence the content the children encounter, and these encounters also likely reproduce different outlooks on content. In the material, content choices are explicitly and regularly related to children's interests and to the goals in the curriculum. Earlier in this article, we presented examples from the curriculum in which certain content areas are assigned the function of both goals and means ("method" and "modes of expression") while others are not assigned this double function. The content areas can be unintentionally interpreted as having been assigned different values. If the children encounter some content areas more often as means, more in the background, and other content more often as goals, more in the foreground, this can be interpreted as the preschool reproducing a status hierarchy, where different content areas appear to have different values. This can be connected to equivalence and intrinsic value in relation to different content and subject areas, namely that content has inherent value and potential added value. In this sense, teaching choices at preschools may aim for all content and subject areas to be conducted equally, as both goals and means, within the framework of democratic values.

6.2 Focus on concepts and model testing

We tried out a didaktik model that combines the didaktik questions "what", "how" and "why" with the didaktik triangle in relation to the project- and theme-oriented content, inter- and/or transdisciplinary content, and content as goals and/or means (see Figure 5).

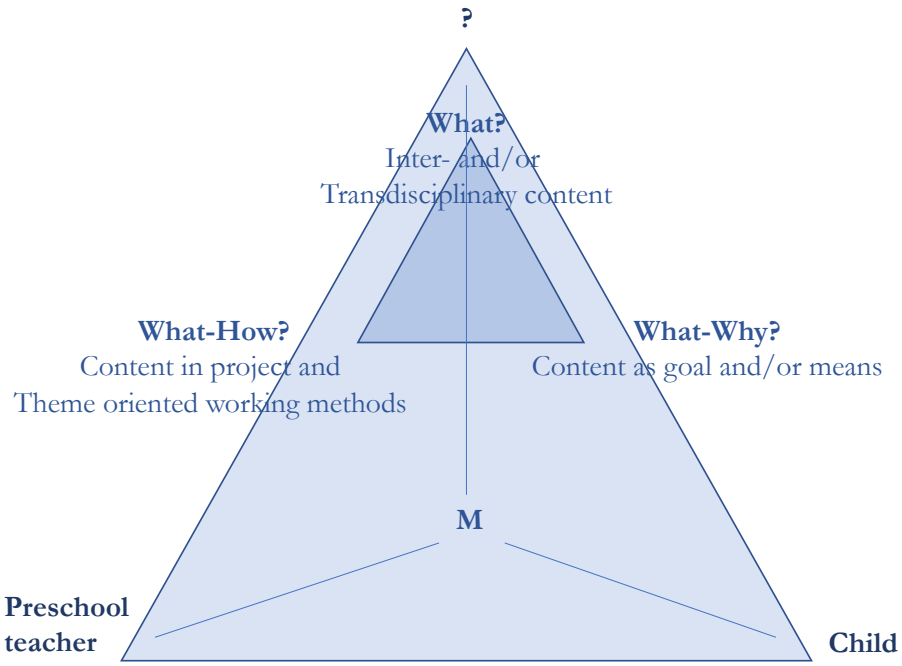

Figure 5. A didaktik triangle model in a post-structurally informed teaching arrangement, with a focus on didaktik questions in relation to the content corner of the triangle. M stands for the material as actor in didaktik relationships and relates to content as well as to teachers and children.

The didaktik model can be seen as an open figure of thought that can provide support for reflection and choice of content, working method, and justification of content in teaching. Multivocal teaching may lead to content emerging as both interdisciplinary and transdisciplinary in project- and theme-oriented working methods. All the mentioned areas can then be chosen multivocally and emerge as both goals and means.

Among other things, the idea behind transdisciplinary content in teaching involves weaving various disciplines together and creating alternative content foci, "moving between, across, through and beyond established scientific disciplines" (Palmer, 2011, p. 47), unlike interdisciplinary content, which may converge but cannot be interwoven. For example, music, mathematics, and technology can be included as scientific disciplines with broad content areas. The concept of *rhythmatechs* has been tried out by using music–mathematics–technology as an alternative to interdisciplinary

content with greater separation between subjects. Music emerges in the examples as both a goal and means, but it also emerges as means alone in teaching sessions where mathematics and/or programming can be interpreted as in the foreground. In rhythmatechs the subjects have a mutually dependent relationship, rather than music serving as decoration (Österlind, 2018), for example.

Rhythmatechs was tried out as a concept with a link to the didaktik questions, in which material actors are also included. The content can be related to the didaktik "why" question, which is oriented towards content function (cf. Uljens 1997), concerning the analysis of content in relation to whether it emerges as goals and/or means. In relation to rhythmatechs, the analysis focuses on tracking content that may comprise both goals and means.

6.3 Research contribution

There have been other didaktically oriented studies with various content-related foci (e.g., Holmberg, 2014; Ehrlin & Wallerstedt, 2014). Multiple studies highlight interdisciplinary approaches and demonstrate that music is used primarily as a means (An et al., 2014; Harris, 2007; An et al. 2016; An & Tillman, 2015; Yoho, 2011; Holmes & Hallam, 2017). The present study focuses on teaching in Swedish preschools, and the general results of the chosen content areas are consistent with previous studies. For example, music emerges more as a means in the background than as content with intra-musical goals in the foreground.

Miller and Lindt (2018) discuss how movement as a means can lead to greater interest, engagement and learning. This becomes evident in the present study, for example in how the material in didaktik relationships can be perceived as the element that captivates the children and shapes the teaching sessions.

From a didaktik perspective with a focus on the matter of content, in this article we have also presented the "why" question and connected it to content as goals and/or means and to trans- and interdisciplinary content within the framework of project- and theme-oriented working methods. In our collaborative research project, we have not presented a complete picture of what characterises content; rather, we discussed of what *may* characterise content in a didaktically and post-structurally informed teaching arrangement.

7. Conclusion

By presenting the results of the collaborative research in this article, we have made a contribution of knowledge that highlights content in a post-structurally and didaktically informed teaching arrangement characterised by some content areas landing in the foreground more often than others. Some content areas often serve as goals in the foreground, while others serve as means in the background. We can also relate this tendency to the curriculum's wording about creating in the curriculum, which can be pointed out as both content and method (SKOLFS 2018:50).

Further, the results suggests that transdisciplinary teaching may instead culminate in interdisciplinary content, with transdisciplinary steps and moments. We conclude that weaving content together into alternative content constructions (such as rhythmatechs) is challenging, as is directing the children's attention during the teaching session towards in-depth content while propelling the creative process forward. A non-linjear teachingprocess can be challenging. The results allow for the identification of a didaktik model and for the content combination that the concept of rhythmatechs offers to be tried out as a multivocal alternative to more subject-focused teaching.

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[i] The study was conducted within the framework of the R&D programme "Multivocal teaching in preschool". The article is based on a concluding report for the research portion of the programme (Vallberg Roth, Aasa, Ekberg, Holmberg, Sjöström & Stensson, 2021, https://www.ifous.se/app/uploads/2021/11/202108-ifous-2021-4-m.pdf). The programme was carried out in partnership with eight responsible school authorities and Malmö University.