

# Constructing Choreography—A Transdisciplinary Challenge: Children’s Constructing the Choreography of the “Dance of the Dinosaurs”

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The aim of this study is to contribute to the understanding of the transdisciplinary exploration of children in constructing the choreography of the “Dance of the Dinosaurs”, with mathematics being one of the disciplines used. Central questions explored were: 1. What form did the children’s transdisciplinary exploration take? 2. What could be learned about the mathematical understanding of the children? and 3. What problems emerged during the process and how did the children respond to these? The study is an example of dialogical research, providing a bridge between post-modern and modern theories and approaches. Deconstructive dialogue, imagination, and rhizomatic thinking are central concepts in the theoretical framework. The empirical material consists of six-hour video-taped material. The study found that the children explored and identified new problems, which they then critically reflected and called in question. Time, space, shape, size, numbers, and patterns emerged in their mathematical work. The children cooperated with each other during the problem-solving process and looked for further challenges.

*Keywords:* transdisciplinary exploration, mathematical work, cooperation

## Introduction

Recent educational steering documents have highlighted the mathematical ability of children and their way of learning mathematics and using mathematics in different contexts (Swedish National Agency for Education, 1998). Today, there is much evidence suggesting that children do not explore the world by subject, but rather create meaning through different “languages”—such as writing, reading, dancing, and movement—involving all senses (Dahlberg & Moss, 2005; Lenz-Taguchi, 2010). The focus of this study is the transdisciplinary cooperation between children, in which mathematics constitutes one of these “languages”. Kress (1997) referred to the transdisciplinary exploration of children as “multi-modality”, which means that children apply a number of different means of expression to communicate, and Deleuze and Guattari (1987) called it “rhizomatic thinking”, i.e., learning and thinking where different disciplinary and verbal phenomena cooperate in a complex and dynamic way.

This study aims to contribute to the understanding of the transdisciplinary exploration of children in constructing the choreography of their own “Dance of the Dinosaurs”, where mathematics was one of the disciplines used. The question posed was: What form did the transdisciplinary exploration of children take in

the “Dance of the Dinosaurs”? Other questions were: 1. What could be grasped about the mathematical understanding of children through studying their method of application? and 2. What problems emerged during the process and how did the children respond to these?

### **Theoretical Framework**

#### **Dialogical Research—A Field of Tension Between Different Paradigms of Learning**

The theoretical position of the study, which can be referred to as “dialogical research” (Alvesson & Deets, 2000), as applied to pedagogical investigation, was that the suppositions and theories of modernity, indicating a difference between humans and the environment, subject and object, internal and external, and theoretical and practical, are being avoided. “Dialogical research” also enables researchers to incorporate different theories, including older ones. Hence, a possibility is to comment on parts of the cultural historical theories of Vygotskij (1987; 1995), and concurrently turn to the post-modern and post-structural perspectives presented in Derrida (1998; 2005), Levinas (2005), and Deleuze and Guattari (1987). Common to these perspectives is that they question the dichotomies created between the individual and society, the internal and external, and the aesthetic and the rational. Vygotskij (1987) chose to talk about dialectical relationships, while the post-modern theories talk about complexity and multiplicity.

As in the post-modern perspective, Vygotskij (1987) showed how the created knowledge can never be a reflection of factual circumstances. The conscious is dynamic and changeable and the process is dialectic in constant movement between the internal and the external. This study turns to Vygotskij’s theory of “making unfamiliar”, the role of the imagination in creating knowledge, and the theory of activity. At the same time, the investigation is based on the post-modern and post-structural creation of theory according to Derrida’s theory of deconstructive conversation (Derrida, 1998; 2005) and Deleuze’s concept of knowledge—“rhizomatic thinking” (Deleuze & Guattari, 1987). In these perspectives, knowledge is not seen as something universal, unchanged, and absolute. Consequently, teaching cannot be directed towards general ideals as this would make the child into an object, as opposed to a subject in its own process of creating the subject and meaning. Rather, the aim is for teachers to listen to children and try to identify their questions, theories, and hypotheses about the surrounding world. These questions and theories then become the basis of teachers’ considerations on their own attitudes and on how to meet and challenge the children in the exploratory process. How the process will end and what course it will take, are open.

#### **Making Unfamiliar, Deconstruction, and Ethics**

Malaguzzi (1981) created the metaphor “A child has a hundred languages”, suggesting that children are “fortunate”, worth listening to, taking seriously, and showing respect to. The acts of children and their questions and problems they seek to solve become the focal point of teachers’ considerations. Using the concept of “zone of proximal development” (here called “the development zone”), Vygotskij (1995) has shown that children possess a rich potential for development. Play and exploration are described as activities that are an integral part of the life of a child. A child’s actions are directed towards the goal of the activity and through these goal-oriented actions, the child surpasses the current level of understanding and works within the development zone.

Lindahl (2002) showed what happens when a teacher guides a child from the perspective of his/her own goals but not those of the child: These conversations are called “reproductive” and are characterized by the

child reproducing knowledge, instead of mainly producing something new of his/her own. The space allowed for children's own initiatives and "side issues" is restricted; children in this learning situation are stopped in their own thinking and imitate each other in solving problems. To imitate each other's solutions to problems is regarded, in Reggio Emilia discourse, as one part of the exploration of children. In the context of exploration, it is about testing the ideas of others to see if these can offer a different way of looking at a phenomenon (Rinaldi, Giuchi, & Krechevsky, 2001). To Vygotskij (1987; 1995), imitation can also be a way for children to develop an understanding of their own and create meaning. For example, children use the words of other people before they comprehend the full significance of the words. Simultaneously, a dialectic process of interpretation starts at the crossroads between the words of other people and the own thinking, significance, and meaning.

In reproductive conversation, imitation as matter of course emerges in a different way. To imitate each other becomes a solution that children choose as an answer to the situation, created by the teacher, for example, when they are constantly being interrupted in their own thinking and communication with their companions. Thinking in a reproductive conversation loses its personal depth and the conversation ends up on the surface. When a teacher fails to keep the goals of the children in focus, his/her guidance appears not to create prerequisites for the children to operate in the development zone. The interpretation being made of the development zone suggests that children have competence, thoughts, and ideas far beyond what can easily be measured. Always, there is something "more" in the children, in the context, and in the presence, that cannot see and certainly do not know anything about (Lindahl, 2002). This is an interpretation of the development zone which can be compared to Malaguzzi's (1981) metaphor of a child's "hundred languages", expressing a strong humility towards the child and his/her inherent richness.

In shedding light on the role of art and the imagination in creating knowledge and meaning, Vygotskij (1924/1971) turned to the Russian formalists and their conception of "making unfamiliar". The rules of everyday language are broken in poetry, which gives rise to "making unfamiliar", as the poetry works in a deautomatized way, according to the formalists. Thus, the evolution of literary history represents a constant breach of ingrained conventions. When a new notion becomes convention, it loses its "unfamiliar making" effect. This effect appears in the description by Vygotskij of how a child interprets his/her experiences and creates something new, a meaning of its own through transforming exaggeration in a creative, narrative act. The imagination, which Vygotskij termed the "combinatory ability" of the mind, plays a pivotal part in this act, and is characterized by transformations, condensation, shrinkage, and exaggeration. If the role of the imagination in the creation of knowledge is denied in teaching, understanding is put at risk of becoming barely reproductive and not being as creatively productive, as Vygotskij considered desirable (Vygotskij, 1987; Lindahl, 2002). This productive, creative, and variable way of regarding creation of knowledge and meaning, described by Vygotskij (1987), has points of contact with the theory of Derrida (1998) concerning deconstruction and deconstructive conversations. Deconstruction is often associated with text; however, Derrida made it clear that deconstruction is equally about dialogical and living conversations. Deconstruction as communication almost becomes a moment of non-understanding, of not knowing, insecurity, and somewhat losing the self to the Other. Derrida endorsed the ethics of Levinas (2005) and his view of the Other and the Other's otherness to show how respect of the Other is basic in all communication. For example, one cannot force his/her way of thinking and understanding of the world on the Other. Levinas emphasized that respect is about the right to be different. It is through the presence of the Other that the subject is created. These ethics could be regarded as implicitly present in all human relations, according to Levinas (2005). Prerequisites for an

ethical meeting are openness towards the Other's infinite otherness, a welcoming attitude, hospitality, and that meeting the Other as an enigma.

Vygotskij's (1924/1971; 1995) theory of "making unfamiliar" could be considered as having similarities with the deconstruction theory of Derrida (1998). Vygotskij showed how the activity of the imagination is a prerequisite for knowledge not to become reproductive but productive and creative, i.e., to lead to new creations. Derrida (1998) spoke in a similar way about how a shift in meaning, a "difference", occurs in the reconsideration of given "assumptions", and how it opens the way to something completely new or different. "Differences" emerge in deconstructive conversations, also characterized by openness towards the otherness of the Other. In this perspective, the view of the Other becomes central, as it will be decisive for whether the conversation will lead to "differences" or merely allow recreation of already given "assumptions". The intention is not to agree in the sense of all thinking in the same way, but to enable differences to emerge, which could create something new beyond ingrained conceptions of how things can be understood.

### **Rhizomatic Thinking—Escape Routes and Sidetracks**

Philosophers Gilles Deleuze and Felix Guattari coined the metaphor "rhizome" or "rhizomatic thinking" to stand for an image of thought and show how thinking emerges among people in tangled ramifications (Deleuze & Guattari, 1987). "Rhizome" is a term derived from botany and refers to the stems of certain plants, which can produce new shoots and root systems. These are often plants that are hard to root out, thanks to the rhizomatic growth; that spread unpredictably in all directions. Instead of regarding the creation of knowledge as a linear path, Deleuze and Guattari (1987) argued that the process can start at several points and move rhizomatically. One follows new threads of roots to localize other nodes or clusters, pointing in other directions. In that way, and through conceptual inventiveness rather than logic, an "escape route" can be created, an opening for the flight of thought from what else limits creativity.

In studying children's philosophical exploration of ethical dilemmas (Lindahl, 2010; 2011; 2013), it can be noticed how children use the language creatively in describing grown-ups' disinterest in playing with smaller children, whom they described as "small as an earlobe". The conversations between children and teachers contained a playful element. For instance, making fun of things was important using known words as well as creating new ones. "Sidetracking" could be perceived as taking winding "escape routes". It provided openness towards the unknown, which characterizes rhizomatic thought processes. In a Vygotskian perspective, the "routes of escape" can be perceived as the imagination of children, including breaking boundaries, "making unfamiliar", and testing new perspectives.

### **Mathematics, Dance, and Transdisciplinary Exploration**

Children and mathematics have previously been studied from a constructive perspective, in relation to problem-solving. These studies focused largely on understanding of concepts, as well as on establishing what environments create the best conditions for mathematical learning, such as ordering and grouping based on size, form, and geometrical patterns (Clements & Sarana, 2007; Dienes, 1960; Reis, 2012). Further, the focus in these studies was on the competence of children, competence development, and learning of mathematics. A conclusion they all arrived at is that teachers should learn to discover how children use mathematics in their play and other activities of their own choice, and take these insights as a starting point to challenge the further use of mathematics. Reis (2012) suggested that the theory of variation (Marton & Tsui, 2004) could be used together with the pedagogy of development (Pramling-Samuelsson & Asplund-Carlsson, 2003) in making

development models for how the work with mathematical learning of children can be pursued.

Based on transdisciplinary thinking, Palmer (2010) showed how children learn mathematics through the body, the room, objects, and impulses from medial discourses in a transdisciplinary learning process. The language of dance, expressions, and materializing becomes productive in connection with the concepts and material of mathematics. Here, the interest lies in the mere process. The research question evolves from “What does this mean?” to “What happens after this?”. Learning occurs both between individuals and between people and the context of the discourse of the environment. Time and place become agents, like concepts and ideas (Barad, 2007; 2008). Also, it is impossible to draw any clear lines between different kinds of bodies, human or non-human, the material, and the discourse. However, one danger with this approach may be that the role and responsibility are diminished in space, material, social media, etc.. If the enquiry and interest of children will remain in focus, all pedagogical choices must be based on an ethical position about the Other and the otherness of the Other. In this study, transdisciplinary exploration is based on the notion that everything is connected to everything. The understanding of a certain act or phenomenon cannot be reduced to one aspect and exclude others within a complex context. However, in the context of the preschool or school, a teacher must be given a special significance as being utmost responsible for the Other and the otherness of the Other to be allowed space and be treated within the totality of the complex situation. Based on the preschool or school he/she is working in, it is the teacher who creates the spatial, material, and dialogical prerequisites for transdisciplinary exploration; it is the teacher who interprets what is important for these specific children here and now in this situation.

Teachers’ ability to interpret the situation has been described, based on the concept of “situational sensitivity” (Lindahl, 2010; 2011; 2013). This includes teachers’ trust in the own ability to interpret the situation and critically reflect upon both the own acts and those of the children. There is an acceptance that there is no “right way”, that you simply have to trust the situation and the outcome, and to try to feel secure despite uncertainty. Situational sensitivity is not a mystical feeling; it just appears in certain people with a special ability for interpretation. By contrast, developed situational sensitivity is based on reflected experiences, which in turn demand knowledge and education, *Bildung*. This type of situational sensitivity creates images of how responsible meetings can be made possible and “otherness” can be welcomed, and is based on a philosophy about the child (the Other), values, the world, and *Bildung* in its discursive and emancipated sense. Situational sensitivity makes many options possible, including the option of more easily following children in their unpredictable exploring.

To sum up, the theoretical framework of this study is based on Vygotskij’s theory of making unfamiliar, a process in which the imagination, the creative ability, and a productive view of knowledge are highlighted. The theoretical framework is further based on Derrida (1998; 2005) and Levinas (2005) concerning the understanding of deconstructive conversations, how children create something new in these, and how they respect the otherness of Others, as discussed by Levinas. All pedagogy has an ethical starting point, based on how the subjects regard the Other. The view that knowledge and learning are rhizomatic, resembling the growths of a tangled root, as proposed by Deleuze and Guattari (1987), is also part of the framework. According to this, transdisciplinary exploration can be regarded as a way children learn, where nobody knows where the exploration is heading or where it originates from. This study tries to find points of contact with both Vygotskij’s theory (1987; 1995) and post-modern and structural theories. The theoretical position of the study could be referred to as the field of tension between modern and post-modern structural approaches.

### **Method**

Before the dance project was put in stage initiated, the children dramatized how they believed the dinosaurs moved. They made drawings, wrote down observations, and built three-dimensional dinosaurs. In conversations with the children in one of the smaller groups, the question arose regarding how dinosaurs moved and, if they could dance, what music they would have liked. This made the teacher ask the children: If dinosaurs could dance, what do you think it would look like? Could you do a dinosaur dance? Together, the children chose music for the dinosaur dance from the Office of Multi-media. The initial group consisted of five children, all of them were girls: Alva, Isabelle, Agnes, Annabelle, and Elvira. The question which was later to occupy the children was: “Can we draw the movements of the dance?”. The problem, jointly formulated by the children, was whether they would be able to draw the movements of the dance. The first step in problem-solving was to create movements suitable for the chosen music, and the second, to shape the movements of the dance on paper.

The children dancing the “Dance of the Dinosaurs” all attended a preschool class. Their interest in the exploration of dinosaurs led to a dance project involving a few groups of three to four children per group. The exploration of the children was discussed with the teacher. The children participate in different exploratory projects at the school. The project here studied was titled “the dance project”.

The empirical work consists of digital film recordings, altogether six hours of film, and diary notes. Totally, 26 children aged from six to seven came to participate in the project including dance and choreography. The group of children who introduced the project and who participated in the study consists of five girls aged six to seven. They are Alva, Isabelle, Agnes, Annabelle, and Elvira. Ethical issues were taken into consideration according to the guidelines of the Swedish Research Council. This means that all the participating children’s parents, including the children themselves, have given their permission to the study.

The method of processing the object of inquiry and analysing the data from a theoretical framework point of view resembles what Patton (1990) called “orientational qualitative inquiry”. The knowledge drawn from this method of interpretation is put in perspective. In this regard, the method of analysis differs from the deliberate marked unconditionality usually associated with hermeneutical attempts. A number of excerpts have been chosen from the transcribed films to illustrate the exploratory process. After every sub-section, the events and their significance from the point of view of the theoretical framework are commented. Different possible ways of interpretation are pointed out with the purpose of “inviting” the reader to make different interpretations. Finally, summary of findings is presented in the “Conclusion” part of this research.

### **Children’s Exploration—An Infinite Adventure**

The work starts when the children are given different tools to help them, such as a roll of paper, a CD player, and music of their own choice. They place the roll of paper, or the “map” as they call it, on the floor. Gradually, as they determine what movement goes with the music, they draw symbols, describing the order the movements come in and writing their respective number. The children test out different movements, and they draw symbols on the communal piece of paper they call “map” (see Figure 1). This is repeated time after time; they dance, show each other, everybody is trying together, and then they sit down to draw. The process is described below.



Figure 1. The communal “map”.

Alva and Isabelle (turn around and say simultaneously): One, two, and three.

(Then, they sit on the floor and continue to draw. Isabelle raises her hands and shows what they will do, and how to do it.)

Annabelle: Slap.

Annabelle and Elvira (stand up and jump as they simultaneously say): One, two, jump, jump, one two, jump, jump. We will do this twice, check it out.

Elvira: How many times?

Alva: One, two, three, eh... two, three, one jump, jump. We will do it twice, here.

One movement is followed by a number and then again by another number indicating the number of times it will be performed. Movement one will be repeated twice, movement two six times, and so on.

Annabelle: How do you make a 9?

(Elvira takes her own pencil and shows her. In the margin, Elvira writes her own 9.)

Elvira: Like this. Let me show you!

Annabelle: Is not that a “P”?

Agnes (turns to Annabelle): If it is going to be a 9, should it be like this?

(Agnes writes a new 9. Annabelle traces Agnes’ 9 with her pencil and then writes a 9 of her own.)

Children imitate and support each other, solving problems that come up. The teacher remains in the background, but is present in the exploration of the children. When she sees Annabelle having a problem in writing the number 9, she could have chosen to step in to “help” and show how it is done, or start explaining to Annabelle. However, she chooses to wait and see what will happen in the group when Annabelle expresses her problem. This could be regarded as an expression of “situational sensitivity”. It shows that she trusts the children in the group, who apparently give Annabelle what she asks for and needs.

### Dealing With a New Problem

But a new problem emerges in the group: The dance ends before the music is over.

Isabelle: But the music lasts longer than our dance?

(A big discussion starts during which everyone talks simultaneously. They cannot match time with the movement.)

Alva: Oh, it lasts a long time, and we danced so well. It was because we danced so fast. We have to do more because the music lasts longer. What can we do?

Annabelle: But if we do like this, twice, instead of once, like this, see, like this. One, two, three, slow. You know, like this ... one, two, three.

(The children think it over. They test a few more advanced moves and some gymnastic moves.)

Alva: Then we have to draw more movements, to make the dance last longer. Up and down, up and down, it is from the side. We need one (movement) between the eighth and the ninth (movement).

Annabelle: Twelve, it will be the last one, so it has to be number 13.

Alva: This, yes, that we should use at the end.

Alva shows with her body and draws a picture to illustrate a split (see Figure 2).

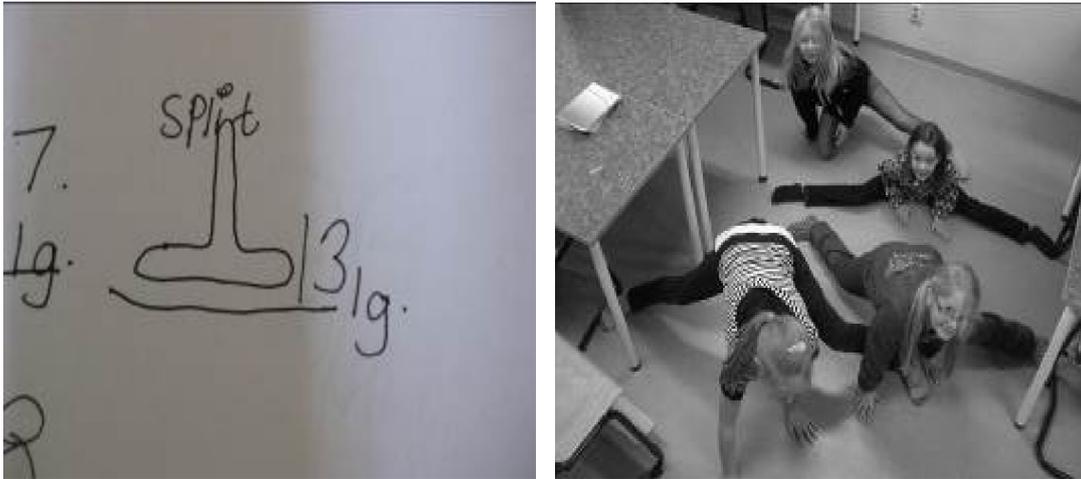


Figure 2. Alva's demonstration and drawing of the split.

The drawing is followed by a digit, for the number of the movement, and yet another digit for the number of times the movement will be executed. The children get up and jump.

That the dance ends sooner than the music is a hard problem to solve, different suggestions are put forward and discussed. Eventually, the group decides to include more movements to match the length of the dance with that of the music. The children show with their whole bodies how the movement will be seen, and this may be regarded as a “perception of space”—position and direction.

Alva: Up and down, up and down. It is from the side. We need one (movement) between the eighth and the ninth. No, it should be the last, so it must be number 13. This one, Annabelle is choosing, it should be number 12, we will have it at the end.

Annabelle: One foot forwards, one foot backwards, one foot to the side, one, two (jumps twice).

To find a solution to the problem, the children test different movements and rhythms simultaneously. They are demonstrating and talking at the same time, but also listening to each other's suggestions. After some discussion, the children decide to create more movements, to be put after movement number 12. Thus, they connect time with movement, which is noted as a form of “perception of time”.

### **From Common Ground to the Personal/Communal**

From having made a drawing jointly, the children each want to create their own private “map”, or schematic drawing, of the dance from movement 1 to movement 13 (see Figure 3).

Annabelle (points to her map): It looks like a Nintendo.

(Elvira draws her map in three parts. She places the parts in order, beginning with number 6 instead of 1 (see Figure 4).)

Annabelle (regarding it): But I wonder, look, 1, 2, 3, 4, and 5 comes in the middle, it becomes another dance (giggles twice).

Elvira (also laughs, and then she realizes her mistake and corrects it): Oops, it became a little wrong.

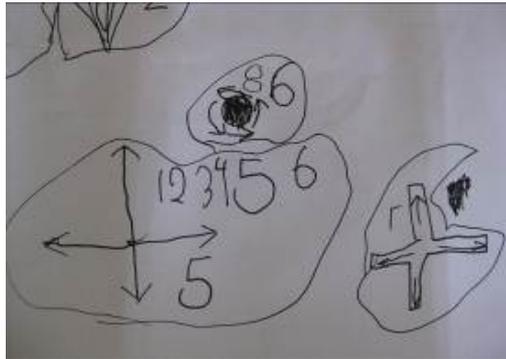


Figure 3. Part of Annabelle’s “map”, or schematic drawing of the dance.

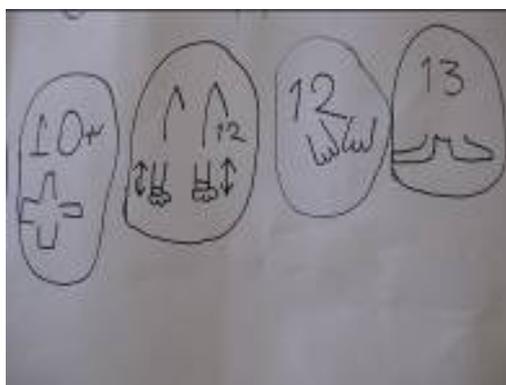
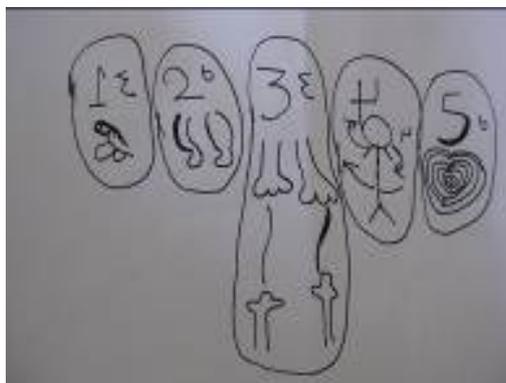
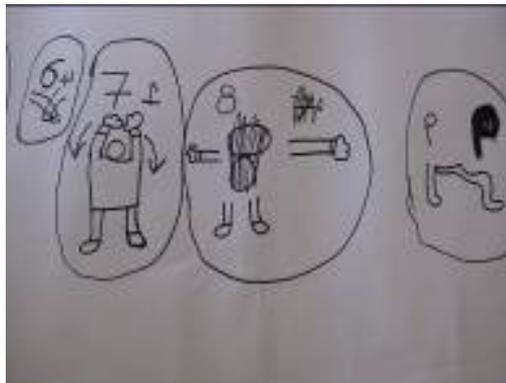


Figure 4. Elvira’s schematic drawing in three parts.

The exploration of the children also includes size and form. They create a pattern when they jump, while at the same time showing awareness of the number of jumps: “How many times? One, two, three, two, three, one, two, jump, jump. One, two, jump, jump. We must do it twice”. The children record their movements, reducing them, while sometimes they create symmetry in the movements. Figure 5 shows a symmetrical movement in the shape of a heart, drawn by Annabelle.

Annabelle: We shall start small and then grow and get bigger and bigger.

(At the same time, Annabelle and Elvira both suggest that movement number five will grow (increase in size) and be executed six times.)

Alva: What shall we have? Can we use what Annabelle and Elvira said?

Elvira: Yes, alright. That will be fine. Like...

Annabelle: Look here, grow bigger and bigger, it lasts for four beats laps.

(The teacher nods, smiles, and looks at Annabelle and the other children.)

The exploration of the children therefore appears to include beat and tempo. The number of each individual movement, and their form and the number that each is performed are put on paper in order. Elvira is the first to decide to draw the movements from left to right. The children use symbols, formal as well as informal, to represent the movements of the dance. Informal symbols are constructed to represent different movements communally in the group.



Figure 5. Symmetrical movement in the shape of a heart.

There exists an allowing climate in the group, with the children listening to each other and giving each other space. One possible explanation could be that the common goal, the end they want to achieve, is very important to them, shaping their behaviour. They turn towards each other and often ask their friends what they think should be done to achieve that goal: “What shall we have? Cannot we do what Annabelle and Elvira said?”. They all seem to enjoy the common exploration. They listen to each other, participate, and each contributes to the common project to create a dinosaur dance. The children appear to “own” the question.

#### **But Why Should It Be a Dinosaur Dance of All Things?**

In later conversations with the children, the children said that the dance project has been fun and that they have learned a lot about dance and making maps. One question arises, however:

Elvira: But why does it have to be a dinosaur dance of all things? Dinosaurs would not have applauded over their heads. The movements are not like dinosaurs make.

Sofie (teacher): Would you like to do a new dance?

Elvira: Yes, but not about dinosaurs, not a song like that. We should have a song where they sing from YouTube. Like Lady Gaga.

Sofie: Would a map help you, then?

Alva: Yes, but we would make it more carefully.

Sofie: Mmmm, more carefully, what do you mean?

Alva: Well, not like a draft, a map lengthwise.

The question remains. Why is it a dinosaur dance? Why not a dance for something other than dinosaurs? In thinking back on their project, the children have almost abandoned all thoughts about dinosaurs. At the forefront is the dance, the music, and the making of a “map”. All five children answered that they would use a “map” again, but that next time they would design the map horizontally, i.e., with the paper in landscape orientation.

The concept of a map was suggested by Elvira early on in the process. The making of the “map” became a tool for the children’s choreography of the dance. It became a tool of communication and problem-solving, formulated by the children, in their effort to draw the movements.

When planning their second dance project, not about dinosaurs, but with the dance itself in focus, the group draws a combined map first, as a “draft”. Then, everybody wants to make his/her own. The children feel that they cooperate well, but have problems in agreeing. When they eventually do agree, they have found a movement that is so good that everyone is really satisfied.

Annabelle: It was hard to find dance steps that everybody wants to have. In the end, when we managed something good, everybody liked it.

Elvira: We learned to make maps of the dance, so we did not have to remember everything in our heads.

Alva: It was hard to find a good song, this was not so good. ... Elvira taught us to do a split, though I still cannot do it.

Elvira: I have practised since I was three.

Annabelle: We learned how to move quickly, though we already knew it.

Elvira: We learned how to dance to the beat of the music.

Sofie: Mmmm (nods and looks at the children).

When the children talk about what they have learned, they mainly talk about what they have used in the learning process. They also talk about the body, as they have explored the possibilities and boundaries of the body.

### **A “Contagious” Interest**

The interest in the dance is “contagious” both within and outside the class of children. It is this interest that the researcher now continues to work on, looking for new questions, and so on. An interesting question is whether the children use the experiences from the dinosaur dance in the process of designing a new dance. The investigation shows that the children use the “map” as a natural tool in creating new dances. Those children who were involved in the first project have been able to contribute their learning and experience to the communal learning process. The other children in the class turn to them as experts.

Different groups differ in the amount of time they need for getting started. One group has run into great difficulties and has really had a “struggle” in dividing the work-up among their members. Spending a lot of time early on in the process helped them to get started in the long run. One member of the group said, when the process was finally flowing, “Now dance for me, so I can draw”. In this group, the roles became very obvious:

One member asked questions, wrote down, organized, and structured the group dance on paper, while another took responsibility for the music and the third created new dance steps.

One discovery was the emphasis the groups put on working closely together. For some children, it seemed very important to visit other groups from time to time to see the work of others. Maybe was it to get inspiration, impulses, and new ideas. When the dance steps ended, a teacher got the children to ask other groups questions, and they usually turned to one of the “experts” from the original dance project.

### **Conclusion**

Describing complicated processes and doing them justice is an almost impossible task. What happened when the children encountered problems, discovered new materials, and met with other people is so much more complex than can be recorded linguistically and observed from certain theoretical perspectives. This project, which still continues in new configurations and with new variants, should be regarded as an attempt to show something of the complexity in the transdisciplinary exploration of children. Even if the children themselves constitute the “engine” in the process, there is a teacher present (in this study, Sofie) who offers the children access to an allowing surrounding and exploratory tools, such as tape-recorders, paper, and drawing materials. However, the teacher needs to take an entirely different position from a teacher in a reproductive conversation (Lindahl, 2002). In a learning environment as described in the present study, the teacher identifies the goals of the children and supports them in reaching these goals. Thus, from a Vygotskian perspective (Vygotskij, 1987), the teacher acts within a zone of development. Also, characteristically, the teacher shows situational sensitivity, for example, as she chooses to act when the children run into problems with the length of the music and the number of movements they have drawn. She is ever present in the “doing” of the children, which is detectable in her body language, for example, when she says “Mmm”, smiles, and so on.

In the present investigation, the children have expressed the wish to create more projects, such as the dinosaur dance project. The dance project is “contagious” to the other groups in the school and from time to time, the children in the first dance project take on the role of mentors to the new dance groups. Here, transdisciplinary exploration emerges between the common and the concrete goal of the children, i.e., to create a dance with a map of the dance. This is no longer an entirely unprejudiced exploration where nobody knows how it will end. However, nobody knows anything about what will happen along the way in the process of exploration and solving problems. Regarded from a Vygotskian perspective (Vygotskij, 1987), the children realize and reach the goals of their activity, namely, to create a dinosaur dance where movement, timing, and the beat are held together and rendered understandable by their choreography. The children act in the proximal zone of development and create learning. To some extent, the exploration of dance, made by the children, can be regarded as the tangled root system of “rhizomes” growing into different directions and shaped by what has arisen between them. This is a completely different process to step-by-step, linear learning.

What could be learned about the mathematical comprehension of children through their method of application? The language, expression, and putting on of dance moves rely on mathematical concepts and symbols. The children learn something about mathematics through the body, reflection, and the combining ability of the imagination. Every movement takes its time, must be adapted to the beat, and represents a special image. Every new movement is a new experience, something new to explore with the body and in dialogue with each other. The children engage in deconstruction and create a difference, something new.

Beats and tempi are explored, and new movements and rhythms are created and tested. The order, form, and number of the movements become visible on paper. One child was uncertain of how to write the number 9, but learned from another child, who showed her and explained to her, whereupon she tried over and over again until she got it right. Symbols, both formal and informal, emerged in the map making. Informal symbols emerged, constituting an “unfamiliar making” process through the changes and exaggerations of the children. Description of position, direction, and sequence was a constant part of the process.

When encountering a problem, for example, when the music lasts longer than the movements for their dance, the children are prepared to listen to proposals from others, which is basic for both an ethical and a deconstructive conversation. They now connect time with movement, which could be regarded as a perception of time. The map of the dance, being both the tool and the goal of the children, consists of numbered symbols for the dance steps, and has emerged in combination with time, beat, and melody music. It may be seen to resemble a tangled root system consisting of different thread-like roots to hold on to and further pursue. “But why a dinosaur dance of all things?” is a question the children have posed in conversation with the teacher. One possible answer is that the attention of the children has been revolving around the concrete problems and the goal they have wanted to achieve. However, the children express eagerness to design another dance, which they will do by creating a new, more precise dance map. The children already have the experience of creating a dance map, which experience and learning they can contribute to making a new dance. As with every learning situation, there will be new challenges and new problems that will need to be solved. The dance will continue, but there will be new events, new challenges, and new explorations: an infinite adventure.

## References

- Alvesson, M., & Deets, S. (2000). *Kritisk samhällsvetenskaplig metod* (Critical methodology of social science). Lund, Sweden: Studentlitteratur.
- Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Durham: Duke University Press.
- Barad, K. (2008). Posthumanist performativity: Toward an understanding of how matter comes to matter. In S. Alaimo, & S. Hekman (Eds.), *Material feminisms* (pp. 120-154). Bloomington, I.N.: Indiana University Press.
- Clements, D. H., & Sarana, J. (2007). Early childhood mathematics learning. In F. K. Lester (Ed.), *Second handbook of research on mathematics teaching and learning* (Vol. 1, pp. 461-556). Charlotte, N.C.: Information Age.
- Dahlberg, G., & Moss, P. (2005). *Ethics and politics in early childhood education*. London, U.K.: Routledge/Falmer.
- Deleuze, G., & Guattari, F. (1987). *A thousand plateaus: Capitalism and schizophrenia*. (B. Masumi, Trans.). Minneapolis, M.S.: University of Minnesota Press.
- Derrida, J. (1998). *Of grammatology*. Baltimore, M.D.: John Hopkins University Press.
- Derrida, J. (2005). *Rouges: Two essays on reason*. Stanford, C.A.: Stanford University Press.
- Dienes, Z. P. (1960). *Building up mathematics*. London, U.K.: Huchington Educational.
- Kress, G. (1997). *Before writing: Rethinking the paths to literacy*. London, U.K.: Routledge.
- Lenz-Taguchi, H. (2010). Rethinking pedagogical practices in early childhood education: A multidimensional approach to learning and inclusion. In Y. N. Maidenhead (Ed.), *Contemporary perspectives on early childhood education*. Maidenhead, U.K.: Open University Press.
- Levinas, E. (2005). *Totality and infinity: An essay on exteriority*. Pittsburg, P.A.: Duquesne University Press.
- Lindahl, I. (2002). *Att lära i mötet mellan estetik och rationalitet—Pedagogers vägledning och barns problemlösning genom bild och form* (Learning encountering aesthetics and rationality—Teacher’s guidance and children’s problemsolving through art and form). Malmö, Sweden: Högskolan i Malmö.
- Lindahl, I. (2010, September 6-8). Wondering together—Children’s philosophizing upon ethical issues. Paper presented at *The European Early Childhood Education Association (EECEA) Conference*, Birmingham, UK.

- Lindahl, I. (2011). Sharing values and doing democracy—Children, educators, companies in collaboration for sustainable development—a narrative study. In *CICE Lifelong Learning and Citizenship*. London: Institute for Policy Studies in Education, London Metropolitan University.
- Lindahl, I. (2013). Interacting with the child in preschool—A crossroad in early childhood education. *European Early Childhood Education Research Journal* (accepted for publication).
- Malaguzzi, L. (1981). *Intervju med Loris Malaguzzi av Karin Wallin. I. K. Wallin, mfl. Ett barn har hundra språk. Om den skapande pedagogiken på de kommunala daghemmen i Reggio Emilia Italien* (Interview with Loris Malaguzzi by Karin Wallin in I. K. A child has got hundred languages. About the creative pedagogy in the daycare centers in Reggio Emilia) Stockholm, Sweden: Sveriges Utbildningsradio AB.
- Marton, F., & Tsui, A. B. (2004). *Classroom discourse and the space of learning*. Mahwah, N.J.: Erlbaum.
- Palmer, A. (2010). “Let’s dance”: Theorizing feminist and aesthetic mathematical learning practice. *Contemporary Issues in Early Childhood*, 11(2), 130-143.
- Patton, M. Q. (1990). *Qualitative evaluation and research methods*. London, U.K.: Sage.
- Pramling-Samuelsson, I., & Asplund-Carlsson, S. (2003). *Det lekande lärande barnet i en utvecklingspedagogisk teori* (The playing and learning child in a pedagogical development theory). Stockholm, Sweden: Liber.
- Reis, M. (2012). *Att ordna från ordning till ordning: Yngre förskolebarns matematiserande* (From ordering to ordering: Preschool children’s mathematisation). Göteborg, Sweden: Acta Universitatis Gothoburgensis.
- Rinaldi, C., Giuchi, C., & Krechevsky, M. (Eds.). (2001). *Project zero: Making learning visible: Children as individual and group learners*. Reggio Emilia, Italy: Tipolografia la Reggiana.
- Swedish National Agency for Education. (1998). *Läroplan för förskolan* (Curriculum for preschool). Stockholm, Sweden: Skolverket & CE Fritzes Förlag.
- Vygotskij, L. S. (1924/1971). *The psychology of art*. Cambridge, M.A.: MIT.
- Vygotskij, L. S. (1987). Thought and word. In R. Rieber, & A. S. Carton (Eds.), *The collection of works of L. S. Vygotskij* (Vol. 1 Problems of general psychology, including the Volume 1. Thinking and speech). New York, N.Y.: Plenum Press.
- Vygotskij, L. S. (1995). *Fantasi och kreativitet i barndomen* (Imagination and creativity in childhood). Göteborg, Sweden: Daidalos.