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The Visualisation of Polyadic Sustained Shared Thinking Interactions: A Methodological Approach

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Key words: graphic visualisation; teacher-child interaction; polyadic group setting; sustained shared thinking; early childhood education; videography; linguistic conversation analysis; grounded theory method

Abstract: Sustained shared thinking (SST) is considered an important element of high-quality teacher child interaction (SIRAJ-BLATCHFORD, SYLVA, MUTTOCK, GILDEN & BELL, 2002). However, SST rarely occurs in early childhood institutions, and when it is studied, it is mainly observed in dyadic interactions. Since communication in kindergarten also takes place in group settings, polyadic SST-dialogues were explored in this study using videography, information about children's family language (monolingual/multilingual) and tests for children on emergent literacy from the international research project "SpriKiDS" (VOGT et al., 2019). Micro-processes were analysed by means of linguistic conversation analysis (BRINKER & SAGER, 2010) and grounded theory method (STRAUSS & CORBIN, 1996 [1990]) to identify strategies that promote SST in groups of children. Within the analysis process, visualisations were developed to discover elements of polyadic SST-interactions and to present findings. In this article, possibilities and limitations of visualisations for analysis and presentation purposes are described by means of two play sequences in different group sizes. The use of visualisations seems to support the exploration of teachers' interaction strategies and helps to discover patterns by putting an analytical lens on micro-processes around children's SST-contributions. An added value is seen in the graphic display of complex relationships, which can contribute to the understanding in presentations.

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1. Introduction

How can interactions between several dialogue partners be clearly represented in a shared thinking process? How can connections between different elements in interactions be elaborated in the analysis process and communicated in a comprehensible way for recipients? Interactions between people are complex. They include many verbal and non-verbal elements that influence each other in micro processes. In early childhood education, high relevance is assigned to interactions, since the quality of educator-child interactions has proven to be important for children's developmental progress (PIANTA et al., 2005; WIRTS, WILDGRUBER & WERTFEIN, 2017). Sustained shared thinking (SST) (SIRAJ-BLATCHFORD, SYLVA, MUTTOCK, GILDEN & BELL, 2002) is an important factor for successful interactions in early childhood institutions, but such shared thinking processes rarely occur in daily practice. In the present study, SST interactions between kindergarten teachers and groups of children were analysed to explore the conditions that enable those cognitively stimulating dialogues with children. In the course of this study a graphical visualisation form was developed to support the analysis of micro processes in polyadic SST interactions and communicate findings with recipients at presentations. This graphical visualisation format will be described in the following article. In order to construct a visualisation, information of quantitative and qualitative data is encoded via graphic elements such as colour, dimension, proportion, position, structure and symbols. When a person examines a visualisation, this translation is carried out in reverse order (FRIENDLY & SAS INSTITUTE, 2000). Group size also plays a role when interactions are explored in group settings, and the dynamics of interactions are different in smaller groups than in larger groups. The possibilities and challenges of visualising polyadic SST interactions are elaborated in this article using two anchor examples with a group of three persons and nine persons. [1]

As a starting point and to embed the research study, the theoretical background and selected studies on SST and play and the function of graphic visualisations in qualitative research are explained (Section 2). Then the research design and adopted methods are described (Section 3). In Section 4 the graphical representation of polyadic SST interactions is expounded by means of two play sequences with different group sizes. The possibilities of graphical representation for the analysis of micro processes are described as well as for presentation purposes (Section 4). Finally, the findings are discussed, including limitations (Section 5). [2]

2. Visualisations and Sustained Shared Thinking: Theoretical Background and Research Studies

2.1 Graphic visualisation

In social sciences, visualisations of qualitative data have been established by pioneers such as MILES and HUBERMAN (1994). Graphics perform various functions in the research process. They can serve as tools for analysis, exploration, presentation, and information. Furthermore, visualisations are important for communication about research in the scientific community and with the public (RÄDICKER & KUCKARZ, 2019). The AMERICAN PSYCHOLOGICAL ASSOCIATION (APA) mentioned four standards that define a good visualisation:

> "[...] simplicity, clarity, continuity and (of course) information value. A good figure augments rather than duplicates the text, [...] is easy to understand—its purpose is readily apparent [...] and is consistent with and in the same style as similar figures in the same article" (2020, p.225). [3]

Basically, two functions of scientific visualisations can be distinguished. Analysis figures can be a valuable tool in the analysis process and are designed to support the understanding of a collected data set. They can serve for exploration and help to discover patterns or uncommon contexts. Analysis graphs can facilitate the suggestion of hypotheses, models or the inclusion of important variables in a model (FRIENDLY & SAS INSTITUTE, 2000). In qualitative research visualisations can be used to illustrate connections and correlations in the data, in concepts or research designs and display conditions in the investigated research field (RÄDICKER & KUCKARZ, 2019). KNOBLAUCH, BAER, LAURIER, PETSCHKE and SCHNETTLER (2008) pointed out that visual research methods are growing in popularity and are being applied more often in social sciences. They referred to the potential of visualisations in the analysis process. RÖHL and HERBRIK (2008) conducted a study on visualising maps in role plays. They were able to show that maps helped participants orientate themselves in the imaginary world and creatively involve their characters in interactive play through visualisation. Visualisations can also be used for data collection. MIGNONE, CHASE and ROGER (2019) described the life story board as a graphical and tactile tool for qualitative research to collect data. The narrative of a person and the associated background were visualised and constructed with the life story board. The graphical approach provided rich data in their study. They discussed that the graphical tool might be a benefit in interviews on various research questions and topics. "Having varied data elicitation approaches for qualitative researchers to choose from, enhances the potential to obtain rich data for diverse research purposes, settings and populations" (§67). BALL and GILLIGAN (2010) focused on visualisations in the field of social migration. They questioned whether visualisations support research by displaying processes that were discovered through other methods, or whether a visual methodological approach helped to illuminate aspects in the data that would otherwise be difficult to study or remain undiscovered. They concluded that visualisations in the analysis process can be

a useful tool to gain insights into areas that would be difficult to explore with other methods. [4]

Data-based visualisations are graphics that include data from a project. They are a tool to visualise relationships, i.e. when codes occur simultaneously. Elements of a data set can be visually represented and connected with each other. During the analysis process graphical representations can help to discover relationships between codes. Thus complex relationships can be depicted graphically. Visualisations can help to make links in the data visible and comprehensible for recipients (RÄDICKER & KUCKARZ, 2019). Visualisations have potential for qualitative analysis purposes because they can help unveil underlying structures in the collected data. By making structures visible through graphic display, connections can be discovered in the analysis process. This provides an additional view of the collected data from a different angle. Visualisations can also have an added value to establish comparability. The comparison of visualised structures and patterns of different sequences can support the generation of theories, the formation of types or the processing of other findings. [5]

Presentation figures can be used as a device for description, presentation and dissemination of results. The graphical presentation of results of quantitative data is very common, such as bar charts and pie charts. Sometimes visualisations are originally created for analytic purposes and are then re-designed into presentation figures (FRIENDLY & SAS INSTITUTE, 2000). APA (2020) referred to different types of figures that are used to present data. The visualisations used in this study fall within the category of charts.

> "Charts generally display nonquantitative information with the use of enclosed boxes, squares, or circles connected with straight or curved lines or arrows. They are used to show the flow of participants or subjects [...]; illustrate models—for example, conceptual or theoretical models [...]; and illustrate qualitative [...] and mixed methods [...] research designs or frameworks" (p.233). [6]

Infographics are frequently featured in presentations to visually represent non-visual data (BALL & GILLIGAN, 2010). Various studies showed that visual information is more likely to be noticed and captured faster by recipients than information from continuous text (BOUCHON, 2007; GARCIA & STARK, 1991). Findings from the psychology of perception suggest that infographics have a motivating effect. Since optical difference attracts the attention of recipients, the uniformity of a text is interrupted by graphics, and this helps maintain a reader's interest. Furthermore, visualisations have the advantage that they require less space than the continuous text for a comparable amount of information (BOUCHON, 2007). Meanwhile, visualisations offer a wide range of possibilities to combine texts and images. In the area of presentations, KNOBLAUCH et al. (2008) described the potential of electronic journals, which can not only incorporate images and graphics into the text, but can also link videos, which opens up an additional dimension of visualisation possibilities. [7]

2.2 Sustained shared thinking

High quality education is characterised by high quality interaction (TIETZE et al., 2013). The interactions between educator and child(ren) are an important factor for successful developmental processes. English researchers were able to show that attending a high-quality early childhood institution has a lasting beneficial effect on children's school performance. Long-lasting positive effects were found, still identifiable at the age of 11 years (SAMMONS et al., 2007). SST has proven to be a characteristic of excellent practice in early childhood institutions. This form of interaction was identified as a factor for high process quality in the two research studies "Effective Provision of Preschool Education" (EPPE) (SYLVA, MELHUISH, SAMMONS, SIRAJ-BLATCHFORD & TAGGART, 2004) and "Researching Effective Pedagogy in the Early Years" (REPEY) (SIRAJ-BLATCHFORD et al., 2002). Children showed better cognitive developmental progress when the educator communicated with them through shared thinking processes. The research team of the REPEY study coined the term "sustained shared thinking" (SST) based on the observed shared thinking processes between educational professionals and children in the interactions of best practice institutions. SST is defined as follows:

> "An episode in which two or more individuals 'work together' in an intellectual way to solve a problem, clarify a concept, evaluate activities, extend a narrative etc. Both parties must contribute to the thinking and it must develop and extend" (p.8). [8]

In this form of interaction, children and educational professionals generate and expand a thinking process together. They yield and share their thoughts as equal partners, for example, when they invent plays and stories, seek solutions to problems or plan, carry out and reflect upon activities. This refers to a way of cognitive cooperation that is not entirely new: accompanying children in processes of understanding, solving problems and promoting their cognitive development has already been described in social constructivist theories. In the context of co-constructivist practice, SST is characterised by dialogical exchange in a spirit of partnership between educator and child as well as by the openness to construct new knowledge together. SIRAJ-BLATCHFORD (2009) explained a theoretical connection to VYGOTSKY's "zone of proximal development" (1978 [1935]), the approach of "interthinking" (MERCER, 2000, p.141) and the concept of "scaffolding" (WOOD, BRUNER & ROSS, 1976, p.90). Interaction processes between educator and child with the potential of cognitive development involve "shared thinking", "scaffolding" and "guided participation" (ROGOFF, 1990, p.8). Shared thinking is based on the equal status of the interaction partners. In their study on shared thinking, GÖNCÜ and ROGOFF (1998, p.333) were able to prove that joint thinking processes of adults and children were decisive for positive effects on children's learning. These results were in line with the findings of the EPPE and REPEY studies. [9]

However, research studies agree that shared thinking processes are rarely observable in the practice of early childhood institutions (ALBERS, 2009; HOPF, 2012; KÖNIG, 2006; WIRTS et al., 2017). The REPEY research team analysed

20 minutes of participant observation in the daily routine of kindergartens in 14 best practice institutions of the EPPE study and coded educator-child interactions and social grouping at 30 seconds intervals. The proportion of shared thinking processes in the best practice institutions was about 5% compared to direct instruction (45%) and social interactions such as encouragement or rules of conduct (30%) (SIRAJ-BLATCHFORD et al., 2002). In German-speaking countries, KÖNIG (2006) investigated interaction processes between kindergarten teachers and children and focused on long-lasting interactions (≥3 min.). By far the most dominant social form during interaction units were small groups (64.4%), followed by dyads (25%). In 60 hours videography, 149 long-lasting interactions were identified, of which only one was categorised as SST-process between a kindergarten teacher and child (dyad). All other interaction processes were adult-dominated. The educational staff did not actively involve the children in problem-solving. KÖNIG concluded that interactionistic-constructivist aspects were only sporadically observable in teacher-child interactions. Instructions and reactions to child activities dominated, without using the potential of shared co-constructive learning processes, as the teachers often withdrew from these processes at an early stage. In a mixed methods video study, HOPF (2012) verified a positive effect of SST in early science education in kindergarten. Interactions of kindergarten teachers and multilingual children in planned didactic sequences for early science education were analysed. 33% of the interactions were shared thinking processes between teacher and children, two thirds were direct instructions. HOPF attributed the high proportion of shared thinking processes to the planned didactic preparation of the topic, the cognitive stimulation potential, the inspiring learning environment and the consideration of the children's living environment and interests. These factors seemed to contribute to shared problem-solving processes and cognitive debate. Children with lower cognitive skills participated less frequently in the shared development of ideas. In the qualitative investigation of SST interactions, characteristic elements could be observed such as introductory questions at the beginning of the sequence, followed by open questions and scaffolding in form of targeted questions. Important factors were also seen in the involvement and interest of the children in the topic. HILDEBRANDT, SCHEIDT, HILDEBRANDT, HÉDERVÁRI-HELLER and DREIER (2016) chose a standardised experimental setting to gain insights into SST interactions and their effect on the dialogue behaviour of children. In dyadic settings, the research team analysed the language interactions of 2 to 6-year-old children (N=38) while looking at picture cards with educators. Educators supported the children with a SST script and an instructional script. The investigations revealed an increase of children's speaking parts in the SST sequences. Four to six-year-olds developed more hypotheses and justified their contributions, and these effects were found to be independent of socioeconomic status and cognitive skills. In the REPEY study, SST mostly occurred in free play situations with offers of freely selectable activities in mathematics or literacy (SIRAJ-BLATCHFORD et al., 2003). [10]

2.3 Play and sustained shared thinking

In play, children deal with themselves and their environment. Their learning takes place elementarily and centrally in play: the joy of learning and developmental potential are released quite naturally. Intrinsically motivated, children increase their knowledge and skills through play (WELTZIEN, 2013; WÜNSCHE, GUTKNECHT & WELTZIEN, 2013). However, "good play facilitation and responsive teaching require an intentional adult role—one of enriching and expanding children's ideas, interactions and explorations" (JENSEN et al., 2019, p.20). It is a central task and challenge to professionally accompany children in their play processes. [11]

BRODIE (2014) described a symbiosis between play and SST because both activities can provide mutual support by extending children's interactions, adding playfulness and encouragement to children to explore ideas and concepts and do things naturally. CUSATI MÜLLER, WUSTMANN SEILER, SIMONI and HEDDERICH (2019) focused on free-play and SST and examined children's involvement in teacher-child-interactions under the aspect of gender and age. Videography of teacher-child interactions in Swiss day care centres were analysed involving 12 teachers and 56 children aged six months to five years (M=3.01, SD=1.82). The results indicated that during free play children participated in interactions with teachers in 39.2% of the time, in 60.8% no interaction took place. 13.2% of all teacher-child-interactions were SST processes. Gender and age significantly influenced the participation of children in SST interactions: girls and older children were more involved. In a practise-based study, BOLAND, TJALLEMA and VAN DER ZALM (2018) analysed SST in make-believe play to identify strategies that promote play skills, SST and language competences of three to six-year-old children. In a design based research early childhood educational professionals and researchers first articulated interaction strategies, which they tried out in practice in a field test and subjected them to evaluation and revision. In a multiple case videography study the impact of those key strategies was examined when eight professionals implemented them in three role-play sequences in interactions with two target children. Quantitative and qualitative analysis could identify positive effects of the ten verbal and non-verbal strategies on the promotion of play and language if they were applied in combination. Children were more involved and cooperative in role-plays under the guidance of professionals if the professionals followed children's initiatives and enriched their play. [12]

Shared thinking processes are frequently identified and analysed in dyadic sequences (KÖNIG, 2006; SIRAJ-BLATCHFORD, 2009). Due to the fact that most interactions in kindergarten also take place in group settings (KÖNIG, 2006), this study focuses on polyadic SST-interactions. SIRAJ-BLATCHFORD (2009) referred to the potential of SST in polyadic settings: "What is novel and important about SST is its evidential basis in group settings, and as a useful concept for pedagogy" (p.77). Groups of children in early childhood institutions are heterogeneous. Children with a low level of language competence are less likely to receive cognitive support in dialogues than children with a high level of

language competence, as the support focusses on linguistic expression rather than on thematic and cognitive impulses (DARSOW, PAETSCH & FELBRICH, 2012). For her study, HOPF (2012) chose a sample of multilingual children and was able to show that the language competence of children did not influence their involvement in the SST interactions analysed. So far there are no detailed findings on how kindergarten teachers conduct SST interactions with groups of children (HILDEBRANDT et al., 2016; HOPF, 2012; KÖNIG, 2006). Micro-processes in shared cognitively stimulating dialogues between a teacher and several children have only been rudimentarily researched (HOPF, 2012). Therefore, the focus of the present research project was on the analysis of micro processes in polyadic SST sequences occurring in kindergarten settings. To generate findings on the research focus, an explorative methodological approach was chosen. The adopted methods are explained in the following section. [13]

3. Method

3.1 Research context: Embedment in the research project SpriKiDS

The data used in the present study originated from the international research project SpriKiDS[1] (LÖFFLER et al., 2017; VOGT et al., 2019). The present research study is my dissertation project, in which I do not refer to the research theme of SpriKiDS, but focus on an independent topic. I was part of the SpriKiDS research team and my dissertation project was taken into consideration from the very beginning of the SpriKiDS data collection and intervention. Therefore, important key points of the SpriKiDS project and necessary information for the dissertation study are briefly explained here. SpriKiDS is a quasi-experimental intervention study (pre-test, two post-tests), and uses a mixed methods design. The research team of the SpriKiDS study aimed at gaining research evidence about language fostering in kindergarten focusing on dialect use, standard German and inclusion of second language learners. The research team explored the influence of the language variety spoken by kindergarten teachers on emergent literacy skills of children in kindergarten as well as long term effects on literacy skills in first grade. For data collection, videography, teacher's questionnaires and tests for children on oral language, letter recognition and emergent literacy had been utilised. The sample involved 127 kindergarten teachers and 842 children in Austria, Germany and Switzerland. The kindergarten teachers were recruited in the Alemannic-speaking area around Lake Constance: one third each from Austria, Germany and Switzerland. Intervention group teachers received training in language fostering strategies in everyday interactions, SST and interactive picture book reading. Further information on the adopted mixed methods design and the results of the SpriKiDS study can be found on the SpriKiDS homepage. For this study on polyadic SST interactions, the videos and collected information about children's family language were used as well as the test results on emergent literacy of the *Bielefelder Screening zur Früherkennung von Lese-Rechtschreibschwierigkeiten* (BISC) [Bielefeld

1 *Sprachförderung im Kindergartenalltag in Dialekt und Standardsprache im Kontext von Mehrsprachigkeit (*SpriKiDS) [Language Promotion in Everyday Kindergarten Life in Dialect and Standard Language in the Context of Multilingualism].

Screening for the Early Identification of Reading and Literacy Difficulties] (JANSEN, MANNHAUPT, MARX & SKOWRONEK, 2002). [14]

3.2 Participant observation through videography

A qualitative field study provided insights into the complexity of SST interactions between kindergarten teachers and children and generated comprehension about conditions for SST dialogues in different settings of every day kindergarten life. The aim of field studies is to gain insights into the natural environment by integrating the researcher into the field of investigation, if possible without causing disturbances (BORTZ & DÖRING 2006; LEGEWIE, 1995). Participant observation through videography offered the opportunity for detailed analysis, since the complexity of social interactions can be examined over and over again focusing on different relevant factors. Video sequences of SST dialogues were viewed and explored repeatedly under different aspects: which polyadic structures occurred, which strategies were used to involve children in the SST process, which dialogue partners brought in their own ideas and at which point of the dialogue, etc. For the implementation of video observation, a video script was created to ensure a consistent data collection in all three participating countries. The camera focus was on kindergarten teachers and their interactions with the children. The teachers were equipped with a wireless microphone. All participating professionals were videographed during two half days to obtain data on typical procedures and activities of an entire morning in kindergarten. The kindergarten teachers were instructed to organise the two visiting mornings freely, as they usually do. During videography, field notes were made using a video protocol to document relevant observations. For this study, the longer teacher-child dialogues (≥4 turns) were recorded in the protocol. The data collection in 127 kindergartens provided about four to six hours of film material per institution. [15]

3.3 Selection criteria for polyadic sustained shared thinking sequences

The lengthier kindergarten teacher-child dialogues (those marked in the video protocol as ≥4 turns) were examined for the criteria "polyad" and "SST". SST sequences starting from three dialogue partners were analysed. One dialogue partner was the kindergarten teacher, the other dialogue partners were at least two children (selection criterion "polyad"). The selection criterion "SST" was based on the definition for SST (SIRAJ-BLATCHFORD et al., 2002, p.8). The following elements were included:

- children bring in their own thoughts,
- kindergarten teacher brings in her/his own thoughts,
- joint thinking process,
- development and extension of the topic. [16]

Furthermore, the identified polyadic SST sequences had to be classifiable by the instrument "Sustained Shared Thinking and Emotional Well-being (SSTEW)

Scale for 2-5-year-olds provision" (SIRAJ, KINGSTON & MELHUISH, 2015). This tool for assessing the quality of joint thinking interactions comprises five subscales, of which the following three were used to describe the identified SST sequences:

- building trust, confidence and independence,
- supporting and extending language and communication,
- supporting learning and critical thinking. [17]

87 polyadic SST sequences were identified. The majority of the polyadic SST sequences took place in free play, some in meal settings and a few in everyday situations such as dressing in the cloakroom. The group size varied mainly between three, four and five dialogue partners. Eight SST sequences took place with larger groups of six+ persons. From those 87 sequences ten were chosen for further analysis. The sampling strategy is explained in detail in Section 3.5. The sample included 51 children aged three to six years and ten kindergarten teachers. [18]

3.4 Transcription of sequences

Since verbal and non-verbal interactions (eye contact, facial expressions, gestures, etc.) as well as para-verbal components (volume, intonation, laughter, etc.) are important for SST dialogues with several children, it was relevant to carefully transcribe these elements. The transcription was based on the minimal transcript of *Gesprächsanalytisches Transkriptionssystem 2* (GAT 2) [A System for Transcribing Talk-in-Interaction 2] (SELTING et al., 2009). [19]

3.5 Data analysis

Analysis focused on kindergarten teachers' interactions in polyadic SST sequences. Micro-processes between the dialogue partners were explored to identify conditions and strategies that enable SST in groups of children. Of central importance in dialogues is the action character of language alongside the linguistic expressions. Linguistic conversation analysis (BRINKER & SAGER, 2010) offered a methodical approach to evaluate social interactions in a linguistically systematic way and to describe them in detail. This method is suitable for analysing the conditions and rules of natural conversations with a focus on their structure and process. The structural analysis served to describe the levels of expression, meaning, action and relationship. The dynamics of the dialogue were illuminated by reconstructing interactive procedures and communicative principles. Already existing theory-based categories—like open ended questions and scaffolding—were integrated into the analysis process via linguistic conversation analysis. In order to explore micro-processes in polyadic SST, the principle of openness was guiding the research process. The methodical approach of grounded theory methodology (GTM) (GLASER & STRAUSS, 1967), which guarantees a high degree of openness, was used to analyse polyadic moments of SST sequences in the video data. This enabled the

generation of inductive categories and to adapt, reject or create new categories based on concrete findings from the field. GTM is useful for analysing the actions of individuals, relationships and for reconstructing the activities of individuals and groups (MEY & MRUCK, 2010). Methodologically, the approach of STRAUSS and CORBIN (1996 [1990]) was chosen. SST sequences were explored with open, axial and selective coding procedures. BRYANT (2009) discussed the researcher's prior knowledge and the use of literature in GTM from a point of view marked by pragmatic constructivism and referred to the possibility of the principle of abduction. GTM, as the name suggests, aims at generating new theories on scientific questions from the data. For this purpose, relationships in the data must be revealed. MEY and DIETRICH (2016) described the inclusion of visual data such as pictures or videos in GTM with segmentation steps, codings, category formation, memo writing and elaboration of the contextual content analogous to "textual" GTM in order to obtain data-based conclusions about connections like relations, patterns or types. They referred to the GTM paradigm "all is data" and used the term visual GTM. [20]

The analysis process was based on the degree of theoretical saturation (GLASER & STRAUSS, 1967). Polyadic SST video sequences were transcribed and analysed using linguistic conversation analysis and GTM. Then other SST sequences were transcribed, analysed and combined and supplemented in a hermeneutical circle with the findings so far. This process was repeated until the analysis of further sequences did not lead to new findings. The sequences were selected according to maximum and minimum contrasts in the area of group size (three, four, five, six+ participants), children's language (monolingual, multilingual, language competence) and setting (play, meal, dressing in the cloakroom) (GLASER & STRAUSS, 1967; MEY & MRUCK, 2010). In the sampling process ten SST sequences were analysed. As the majority of the 87 identified SST sequences took place in play settings, this was considered in the sampling process. Six of the selected SST sequences were play situations, four were meal and everyday situations like dressing in the cloakroom. Monolingual and multilingual groups of children were considered in equal parts. Since the polyadic structure changed with the number of dialogue partners, SST sequences in group sizes of three, four, five and six+ dialogue partners were examined. Data from the BISC tests (JANSEN et al., 2002) and the children's family language complemented the data analysis and provided information about their language competences. Visualisations contributed to the exploration of the relationships and connections in the analysis process, and a number of questions can be asked about their usefulness. For example, what is the potential of visualisations to analyse group interactions? How can visualisations support the exploration of strategies that promote SST? Why are visualisations useful for communicating findings with recipients and how can they facilitate the presentation of results? For this article, two play sequences were selected including three monolingual and nine multilingual dialogue partners in Swiss kindergartens to describe the developed visualisation form. The two SST sequences in different group sizes were chosen to show the possibilities and limitations of the visualisation form. In the following section two anchor examples are presented to illustrate how

visualisations can support the analysis process of polyadic SST interactions and the presentation of outcomes. [21]

4. The Potential of Visualisations for Analysing Polyadic Sustained Shared Thinking Interactions and Presenting Findings

Visualisations are useful to show the dynamics of the interactions and the group constellation. In two play sequences with different group sizes, children and kindergarten teachers are joining in cognitive stimulating thinking processes. First two boys are building a water gutter in the garden and are solving a construction problem together with their teacher. The second SST sequence takes place when four children are solving a conflict about the script of a role play together with their teacher. They agree through SST on the distribution of roles. The names of the children are anonymised and replaced by pseudonyms. [22]

4.1 Constructing a water gutter: Pots, trees, ropes and searching for solutions

During free play the kindergarten teacher observes two boys who are handling ropes, buckets, pots and boards in a quiet part at the edge of the garden, where trees and bushes grow. Liam and Marc are monolingual children (Swiss German) and achieved positive BISC scores, which indicated good language skills. The teacher starts the dialogue with the question what the children are doing (adult initiated). After an explanation phase by the two children about their water gutter project, Liam asks the teacher for help. The three dialogue partners stand and change their positions again and again during the whole sequence. Since the camera focus is directed towards the kindergarten teacher, the camera position also changes several times to record the interactions of the teacher and the children. During a short sequence Liam is outside the camera. [23]

4.1.1 Visualising the polyadic constellations and dynamics

The starting point of the SST dialogue is a child-initiated construction play, a dyad between two boys, which is observed by the kindergarten teacher. During the entire dialogue, which lasts over three minutes, the polyadic interactions remain constant between the three interlocutors and then end again in a dyad between Liam and Marc. The polyad develops in the following forms: verbal polyad between teacher, Liam and Marc, verbal dyad between teacher and Liam (Marc is listening), verbal dyad between teacher and Marc (Liam is listening), verbal polyad involving teacher, Liam and Marc, verbal dyad between teacher and Liam (Marc observes from different positions).

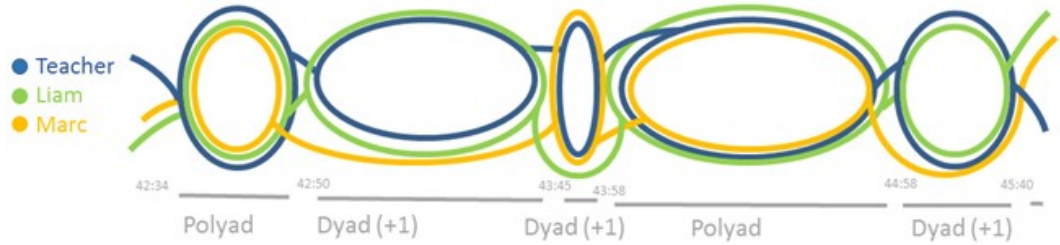

Figure 1: Polyadic structure of SST interactions: Construction play "water gutter project" [24]

Figure 1 illustrates that polyadic conversation sequences alternate with dyadic ones in which one child verbally interacts with the teacher and the second child listens. In the three dyadic sections of the SST sequence, the verbally inactive dialogue partner participates in the SST interaction either observing or with shared attention. These sequences are marked with "dyad (+1)". The description of the various group constellations during the dialogue and the alternation between polyads and dyads in different forms can be precise and useful. Yet the visualisation of the group constellations adds a new dimension. Each colour can be assigned to a conversation partner. The person that starts the interaction verbally is always represented by the circle outside. As the other persons join the interactions their circles become smaller according to the joining order. If a person initiates a new group constellation, a line in his or her colour leads out of the previous circle and merges with a new large circle for a new group constellation. If a person is not verbally involved into the dialogue, a line under the circles is drawn that can then culminate in the next verbal involvement in the form of a circle. Figure 1 shows three dyads in which Marc or Liam are not involved. This is illustrated by the orange and green lines below the circles. However, the attention focus of the children who are not involved seems to be directed towards the dialogue, which can be deduced from the eye contact, shared attention, facial expressions, gestures or other nonverbal activities of Liam and Marc. [25]

The visualisation helps to show the dynamics of the group constellations. This is useful for presentations as well as for the analysing process. A graphic can display and combine several dimensions of the polyadic interactions: who is initiating, who is involved and in which order, who is dropping out and initiates a new group constellation, how many people are involved, and how long the polyad/dyad lasts. A visualisation supports the textual description and expands it by offering the possibility to capture these interactions at a glance. Graphic embodiments are useful to make the process character of interactions visible, which adds value to the analysis. The visualisation of the group constellation also facilitates the communication of findings with other researchers or recipients. [26]

4.1.2 Visualising sustained shared thinking interactions

According to the definition of SST (SIRAJ-BLATCHFORD et al., 2002), all participants must bring their own ideas and thoughts into the process and jointly expand this thinking process. The children contribute their own ideas eight times whereas the teacher adds three new ideas. The kindergarten teacher initiates the polyadic dialogue by going to the children, asking an open question to both, addressing both and seeking eye contact with them.

> Teacher:[2] <<Zips up her jacket and looks at the boys.> What do you do?>
>
> Liam: We would like to make the water run off as (---) <<makes a hand movement, like when the water flows down an imaginary pipe in an arc, looks at his arm movement and then looks at the teacher. Teacher and Marc look and listen to him.> And then the rain comes down like this.>
>
> Marc: <<Looks at the buckets. Marc points with his foot at a bucket.> That is then inside there.> [27]

Both children enter into the dialogue. By using "we", Liam clarifies the joint project plan of the two children. Liam explains his ideas for the water channel project and Marc adds a description of where the water flows to. Marc points out the construction problem at the end of the explanation phase: the rope is too short for the tree. The teacher does not respond to this input (missed SST), but points out to Marc that he has not put on rubber boots. She then makes an effort to end the dialogue verbally and moves away from the children. Liam asks the teacher for help. The teacher responds to the request by asking a constituent question: "What can I do to help?" Through this open ended question she encourages both children to think and communicate. The teacher brings in her own ideas three times. Through scaffolding she points out that the boys could look for another rope or tree. Marc brings in his solution and points to a bush whose branches are not so high up. Here the teacher does not verbally respond to his suggestion, but takes up his idea by changing position and by eye contact.

> Teacher: <<Looks in the direction of Liam, who is outside the camera focus. > (---) I think you have to find another tree.>
>
> Marc: ((Turns around to the bush behind him, then takes two steps towards the teacher and goes back to the bush.)) << He points at the bush.> This one.>
>
> Teacher: <<The teacher looks at Marc and at the bush. Liam takes his rope and the bucket and also looks at the bush that Marc is pointing at.> One that is not so high.> ((Walks along the edge of the pool in an arc to the bush that Marc has shown.)) (---) And otherwise you have to lengthen the rope. (---) One of both.
>
> Marc: <<Still pointing at the bush and looking at the teacher, which has now reached the bush.> This one. This tree. (---)> [28]

The kindergarten teacher addresses Liam while Marc brings in his solution. She continues her conversation with Liam and explains her line of thought to the end.

2 All dialogues had been translated from Swiss German into English. See the Appendix for the legend of transcription.

At the same time she takes up Marc's contribution non-verbally by going to the proposed bush. Liam also agrees with the proposed solution, but modifies it with a specific branch fork on the suggested bush, which is to serve as a suspension for the water channel. Then he tries several times to throw the rope over the forked branch to fix the water gutter there—without success. The kindergarten teacher and Marc watch him. The teacher motivates Liam and finally helps him by discussing the strategy with him: he throws the rope and then she catches the rope and pulls it over the branch. In doing so she throws over the bucket of rainwater and all their already collected rainwater flows out. Liam explains that the bucket will fill up with rainwater again the next day. When the rope finally hangs over the branch fork, Liam points out that he still has to pull it into the correct position so that it is the same length on both sides. Then he suggests to Marc to fetch the buckets and boards to build the water channel. The SST interaction ends in mutual agreement when the rope is successfully attached above the branch. The two children continue their project dyadically and the teacher leaves the small group.

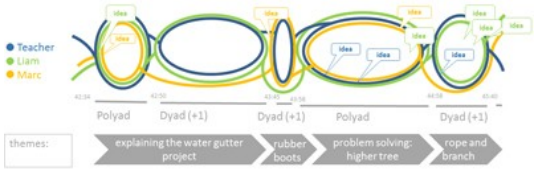

Figure 2: SST interactions: Construction play "water gutter project". Please click here for an enlarged version of Figure 2. [29]

The illustration in Figure 2 gives an overview of who is bringing in new thoughts to the shared thinking process and at what point in the interaction. The dialogue topics are displayed in the arrows below the graphic. This overview helps to understand which interlocutor brings in his ideas to which topic. The speech bubbles can be assigned to the corresponding conversation partners according to their colours. At the same time it is apparent to which topic and in which polyadic or dyadic group constellation the input is being given. For analysis purposes, the graphic representation provides additional value: The visualisation provides an overview of which child or teacher is expanding the thinking process on which topic, in which group constellation and at what point in the sequence. This synopsis reveals structures and dynamics of interactions that are useful for exploring the data in relation to the research focus in this particular sequence. If several sequences are evaluated and visualised in this way, the graphical representations can also be used for comparison and contribute to type formation or theory generation. This form of graphic display can also be beneficial for presentations: the recipient can see and understand at a glance, which dialogue partner contributes his or her ideas in connection with the theme and the group form. This can contribute to better comprehension and shorten long, complicated explanations. In order to gain insights into how teachers engage in SST interactions and which strategies they apply, micro-processes around SST inputs are analysed. [30]

4.1.3 Visualising strategies that promote sustained shared thinking in polyadic settings

The teacher applies different strategies to maintain the shared thinking process in the small group. Which verbal and non-verbal strategies can be observed? In the present sequence the teacher uses questions as a language fostering strategy. She conducts the start of the conversation with an open constituent question, and she also responds to the request for help with an open constituent question:

> Liam: <<Lifts up his arms.> But you have to help us to put it up there.>
>
> Teacher: ((Turns around to the two boys and comes towards them again.)) <<Looking attentively at the two boys.> What can I do to help?> [31]

During the explanation phase and in the further course of the dialogue the teacher communicates with two further constituent questions and two polar questions. She leaves the children enough space to answer during the entire dialogue. Twice the teacher verbalises the actions and thoughts of Liam and twice verbalises her own actions through self-talk. The teacher uses modelling techniques once in the form of a content-related extension, she extends the children's vocabulary twice with nouns ("waterfall into the kettle") and verbs (" lengthening the rope"). [31]

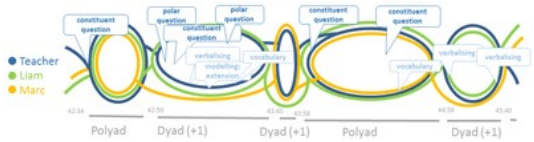

Figure 3: Verbal strategies in SST interactions: Construction play "water gutter project". Please click here for an enlarged version of Figure 3. [32]

The implementation of various verbal strategies during the SST process is illustrated in Figure 3. It becomes obvious that questions are an important element to promote SST. Questions also function as a central strategy for involving several children in the joint thinking process. The teacher initiates both polyads with open ended constituent questions. The application of other verbal strategies such as vocabulary development and verbalisation can also be seen in the graphic overview. In this visualisation, connections between language strategies, group dynamics and process development can be made visible at a glance for researchers in the analysis phase as well as for recipients of a presentation. The speech bubbles in Figure 3 are in blue colour, as the colour in this graphic has a function and carries information. The colour can be assigned to a person—here to the teacher. This visualisation can also be used in the analysis process to facilitate comparisons with visualisations of other analysed SST sequences in order to explore and compare the visualised verbal strategies applied by the teachers. [33]

Since communication takes place through various means of expression, verbal and non-verbal strategies influence the interaction process. The teacher is

responsive to Liam's and Marc's interest and engages in the children's imagination: a water gutter to collect rainwater from a tree is a unique invention. The teacher's sensitive responsiveness to the children's interest is of central importance, which is continuously evident throughout the dialogue. In the discussion about the solution of the construction problem she promotes SST by referring to the children's lives. During the whole sequence the teacher is switching between practical activities and cognitive reflection. For example, she supports Liam with practical activities and verbal hints and evaluations while he throws the rope over the branch fork. She also applies scaffolding to encourage the children to solve problems independently. [34]

Shared attention can be observed fifteen times as an important element of the SST sequence. Moments of shared attention take place in the following section:

> Teacher: <<Looks in the bucket.> You mean the water?>
>
> Liam: <<Makes a hand movement from top to bottom.> Yes. And then everything comes down. > (---) <<Shakes his head. Teacher, Liam and Marc stand around the buckets and look inside.> I don't know how to do it but I know that's right.> [35]

Both teacher and children interact to maintain the polyadic dialogue and create intersubjectivity. Many facial expressions and gestures can be observed throughout the dialogue. The teacher communicates via pointing and other gestures to illustrate explications. Eye contact is another important strategy for maintaining the polyad. Addressees are involved in the dialogue with eye contact —four times toward individual children and twice as a wandering eye contact from one child to the next. Observation serves at the beginning of the SST sequence as a starting point for the dialogue as well as during the interaction of rope throwing. Movements towards the child are observed five times as interactions. These movements help to keep the attention focussed. With a change of position, the teacher integrates Marc's solution into the dialogue. During the whole sequence there is a relaxed atmosphere. This atmosphere is reflected in the laughter and smiles of the teacher and Liam. The polyad is not interrupted by other kindergarten children who are also in the garden. This indicates good classroom management by the teacher. The stable group constellation is also supported by the setting in a quiet part of the garden. To a large extent of the dialogue there are only short pauses for thoughts and decision making, which are shorter than 1 second. This is a sign of the lively exchange and involvement of the three dialogue partners. Longer pauses occur in the rope-throwing phase, as activity and observation are central features. [36]

Depicting all these identified verbal and non-verbal strategies in a single diagram would be confusing. In the analysis process the following aspects are important: which micro-processes encourage children to contribute their own ideas to the SST interactions and which combinations of observed strategies support children's involvement in SST. Therefore the analytic focus is placed on interactions around children's inputs. In the analysis process I focused on the strategies that the teacher applies around the children's SST contributions. The

exploration of these micro-processes under a kind of magnifying glass should help to gain insights into how teachers create SST interactions with a group of children and which strategies or combinations of strategies promote SST. The methodological approach is illustrated in Figure 4. The micro-processes around the children's SST inputs are analysed in depth, which is illustrated with an analytical lens. At the same time, it is important for the analysis to see how the group constellation proceeds during the focused SST interaction, which is why the polyadic context is visible in the magnifying glass. By means of the position of the analytical lens it is also possible to see the context of the overall group dynamics and of other analytical lenses.

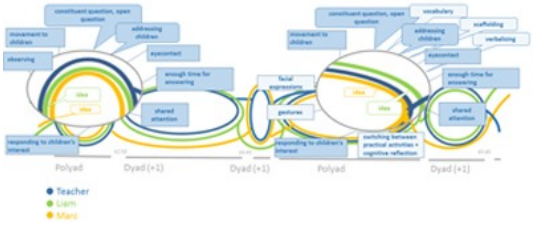

Figure 4: Verbal and nonverbal interactions to promote SST: Construction play "water gutter project". Please click here for an enlarged version of Figure 4. [37]

The graphical embodiment in Figure 4 allows a clear analytic lens on micro-processes and strategies that support SST processes. The first focus of analysis is set on the beginning of the dialogue around the boys' SST contributions. A combination of eight strategies is observable: The teacher observes the construction play of the children, moves to them, responds to their interest and shares their attention. Then she asks a constituent question, addresses both children and leaves the children enough time to answer. All of these interactions take place in a matter of seconds and are in conjunction with each other. The blue speech bubbles represent verbal strategies, the boxes represent non-verbal strategies. [38]

The analytic lens is then placed on the next SST input of the children. A set of 13 strategies seems to promote the ideas of Liam and Marc: seven of the eight previous strategies are observable—all except observation. Additionally, shared thinking is supported by gestures and facial expressions, switching between practical level and cognitive reflection, scaffolding and language fostering strategies like verbalising. The colours in the speech bubbles and boxes show which strategies occur in the first analysed SST interaction of this sequence. They are coloured in darker blue. Speech bubbles and boxes which are newly added in the second analysed SST interaction are highlighted in lighter blue colour. [39]

The complexity of these interactions and strategies can be displayed through visualisation. The recognition of patterns and the formation of types require the systematic search for connections between categories. Research questions in social science often demand that analysis detaches itself from the level of the person and instead refers to the level of action patterns, strategies, etc. (KELLE

& KLUGE, 2010). Each speech bubble and each box in the visualisation has its assigned place. By examining the combination of strategies in the course of the SST sequence using the analytical lenses, a comparison of the analytical lens images enables the viewer to see where a strategy has been eliminated or added. The methodological idea is that the analytical lens images with the visualised strategy combinations function like a kind of matrix that can be placed next to or on top of each other to discover patterns. These patterns can help to identify combinations of strategies that promote SST with groups of children. [40]

A comparison of analytical lens images is possible within a sequence if the various combinations of strategies are compared at different points in time during the sequence, as explained in the water gutter project. However, the visualisations can also be used for a comparison between different sequences. For example, all opening situations of different SST sequences can be compared. Thus, the analytical lens images of different dialogues can give an insight into which combinations of strategies help initiate SST interactions in the beginning and ensure a good start. A comparison is also useful along the axes' main phase of SST dialogues or termination phase of SST dialogues. In the present study, visualisations are an important tool for analysis to discover and identify patterns that help develop SST interactions. Furthermore, the graphical representation is an important feature in presentations and helps explain micro-processes, patterns and findings to the audience. [41]

4.1.4 Visualising participation through communication axes and number of turns

The characteristic of a teacher-child conversation manifests itself in a kind of routine in which the axes of interaction repeatedly lead to the teacher as the conversation leader. This routine also includes the aspect of support, in sense that the teacher tries to support children in their language and cognitive development. This becomes apparent, for example, in the scaffolding and rope throwing sequences, in which the teacher supports Liam with targeted inputs to find a solution and fix the rope in the branch fork.

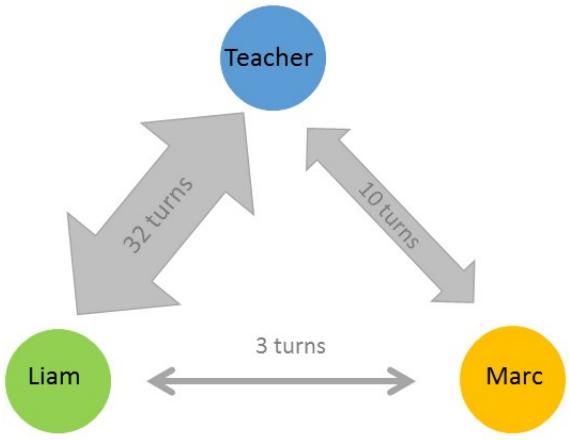

Figure 5: Communication axis and number of turns between dialogue partners: Construction play "water gutter project" [42]

The interaction structure of the dialogue in Figure 5 shows a group constellation that is consistently maintained between the three dialogue partners throughout the entire sequence. The communication axes between the three participating persons are very differently developed, with the axis Liam-teacher dominating. Between Liam and the teacher (32 turns) three times more communication takes place, compared to Marc and the teacher (10 turns). Three very short interactions also take place between Liam and Marc. During the whole sequence it cannot be observed that the teacher initiates communication between the boys. Her focus is on supporting the boys to find a solution for the water gutter project and not on promoting communication between the children. The graphical representation of communication axes and number of turns can enrich the comparison of different sequences. For example, the visualisations of different SST sequences can illustrate how the communication axes change when three, four or five dialog partners interact. It is also interesting to see if one child dominates in each sequence and who it is. Alternatively, one could examine if there are SST sequences in which more peer interactions between children occur. A second anchor example is presented to show how the polyadic structure and communication axes develop when 5 people are involved in the SST process and the group expands to 9 people during this time. [43]

4.2 Bats and doctors: Discussing the script of a role play

In the free play phase Tenzin and Giulia, two multilingual children, call in the pedagogue for help because they cannot agree on a joint role-play theme with Hanna (monolingual) and Sofia (multilingual) in the baby corner. All four children had low BISC scores, which indicated good language skills. The child-initiated dialogue starts centrally in the room and then shifts immediately to the baby corner. Due to the different ideas of the children, the atmosphere is not free of conflict. After a short explanation phase, the teacher invites the children with an open question to a joint problem-solving process. Twice, other children come to the teacher briefly to get help from her. Meanwhile the dialogue is continued in parallel dyads by Giulia, Sofia and Hanna, and the teacher then re-enters seamlessly. [44]

4.2.1 Visualising the polyadic constellations and dynamics

In the SST process, the children contribute 20 ideas and the teacher 18. At the beginning Tenzin complains to the teacher that the other children play "stupid" in the baby corner, where everyone originally wanted to play doctor's surgery together. Sofia immediately clarifies that the girls are bats. The teacher then starts a joint thinking process with the children by asking an open "we" question, thus inviting all the children:

> Teacher: So let's think about this. (---) <<Looks at the children at their eye level.> What could we play?> [45]

When the children don't bring in any ideas, the teacher expands the children's knowledge with information about bats and her visit to the dentist. Tenzin

immediately wants to take over the role of the dentist and Giulia decides to be a baby dentist. Sofia sticks to her favourite subject "bats" and wants to play lovely, sleeping bats. When asked by the teacher, Sofia explains that bats are her favourite animals. To bring all wishes under one roof, the idea of a magic element comes into play. The teacher suggests magic bats. Sofia could also imagine playing magic babies in dialogue with Giulia. To give weight to Tenzin's wishful role of the dentist, the teacher asks whether the bats could also go to the dentist for a check-up. Now all the children are satisfied with the topic and their role and start the role play right away. Figure 6 visualises the polyadic structure and dynamics in the sequence.

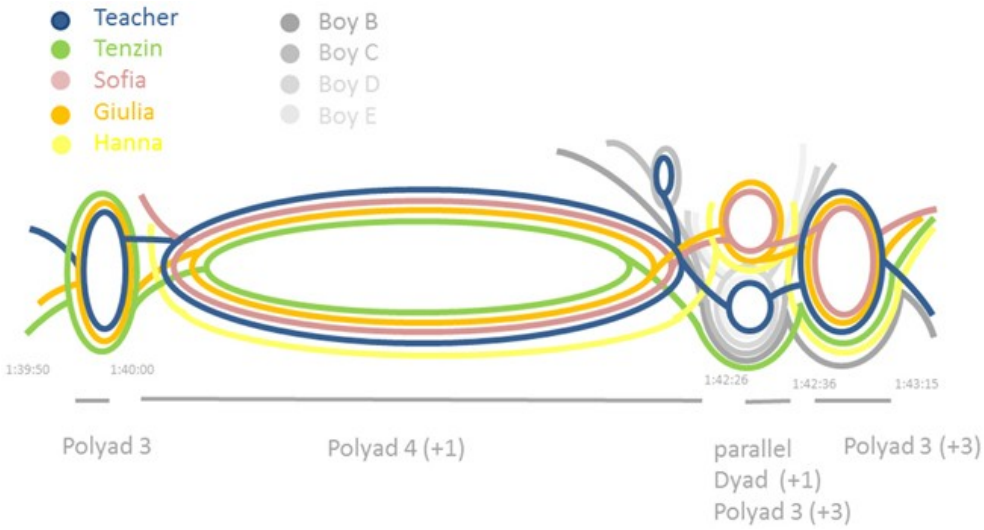

Figure 6: Polyadic structure of SST interactions: Role play "bats and doctors" [46]

Hanna is part of the SST process but does not give verbal input. As a dialogue partner, however, she sets non-verbal interactions. Sofia also expresses Hanna's involvement with the sentence "we are bats". The yellow line in Figure 8 shows Hanna's non-verbal involvement and is drawn under the circles representing verbal interactions. Four children who are not involved in the dialogue observe the interactions without participating themselves. Boys B, C, D and E are shown in different grey tones in Figure 6. They join the role play dialogue in the baby corner at various times during free play because they need something from the teacher. However, they do not interrupt the SST process. Boy B joins in the second part of the dialogue and stays at the entrance of the baby corner until the end. Boy C joins shortly afterwards, observes and then briefly clarifies his question with the teacher. When boys D and E join the teacher to solve a conflict, two short parallel group interactions develop (parallel dyad + 1, polyad 3 + 3). Afterwards boys C, D and E leave the baby corner again. The SST interaction is not interrupted by the interactions of the four boys, but is continued in a parallel dyad by Giulia and Sofia. The teacher then enters seamlessly into the process. However, during the whole dialogue no verbal polyad develops in which all five dialogue partners are involved. [47]

Two simultaneous dyads between the teacher and boy C as well as two children among themselves show that the dialogue takes place in a rather turbulent phase of free play. The teacher takes time for the conflict about the role play topic. At the same time, she gives assistance to a conflict between boy D and boy E, which fortunately can be solved with two sentences. She acts calmly in each case and solves the requests of these children, while Giulia, Hanna and Sofia continue the dialogue about the distribution of roles. The teacher then re-enters the discussion. Despite this challenge, she continues the shared thinking dialogue so that in the end a common solution for the topic and the distribution of roles is found. All dialogue partners are focused on the solution process and think together. The teacher consistently directs the interaction to the various role script proposals of the children and is at the same time open and responsive to contributions from boys C, D and E, who need her help. [48]

The graphic embodiment in Figure 6 helps to present the structure of the polyadic interaction. An increase in group constellation can be observed followed by a decrease later. The group size increases from initially five dialogue partners to six and grows for a short sequence to nine persons. The communication thereby proceeds in parallel polyads and dyads. In the last 39 seconds the group constellation decreases again to six persons, whereby boy B does not actively participate in the process but only takes on an observer role. The visualisation of group dynamics illustrates the increase in group size, the participation of the dialogue partners and the attention focus of the non-verbally involved persons. The graphical embodiment of these aspects is helpful for analysing purposes because it shows the complex interaction structure with its various elements in an overview. At the same time, it is obvious that a larger group size increases the complexity and difficulty of the analysis process and poses challenges for visualisations. [49]

"Natural environment" is a keyword that seems methodologically important. In natural conversations, conversational partners take turns, change and rotate, as partners initiate new group constellations, some pause or drop out. Furthermore, new conversational partners might join in and the size of the group can increase or decrease. Visualisations offer analysis potential for presenting this complexity of natural conversations and group interactions in an overall view. Persons who are acting in parallel and/or are not involved in the main interaction can be represented as well as the parallelism of interactions. A visualisation extends the textual analysis and supports the researcher in exploring and discovering structures and dynamics according to the research topic. Furthermore, visualisations can be used for comparisons. Visualisations of interactions with the same group size or with different group sizes in the sense of minimum and maximum contrasts can provide information on how focused items perform and change. [50]

4.2.2 Visualising participation through communication axes and number of turns

The complexity of SST in a larger group becomes apparent in the graphic depiction of communication axes and number of turns between the dialogue partners, too. The communication axes in Figure 7 are unequally distributed: Sofia and Giulia interact more with the teacher than Tenzin. Hanna is hardly involved in the dialogue around the role play topic and interacts three times less with the teacher than the girls or Tenzin. Short sequences of child-child interactions can be observed. They are illustrated here as less distinct communication axis. Except for two very short dialogues between Tenzin and Sofia or Sofia and Giulia there is hardly any communication between the children. Additionally, the teacher does not initiate communication between the children.

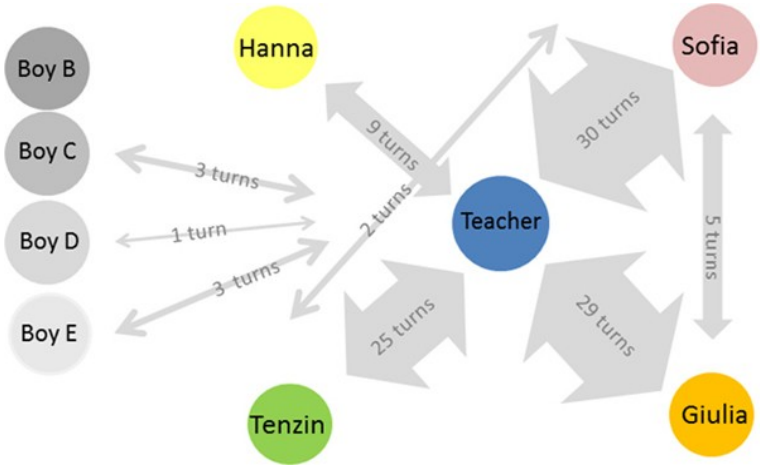

Figure 7: Communication axis and number of turns between dialogue partners: Role play "bats and doctors" [51]

As in the previous example described, the communication axes in this sequence illustrate the typical course of interaction in a teacher-child conversation: the dialogue strands mainly lead back to the teacher. In the role-play dialogue the focus is on the aspect of support and on conflict resolution. During the joint negotiation of the distribution of roles, the different ideas about the play in the baby corner must be reconciled. The visualisation of the communication axes and the number of turns can be used to compare different SST sequences. Again, the participation of the children can be compared through this type of visualisations. Differences and similarities of several sequences can be identified. As described above in the visualisation of the group constellations and strategies, this can also be carried out by comparing the same group sizes (minimum contrasts) and different group sizes (maximum contrasts). [52]

5. Discussion

In research, visualisations can be adopted for various functions. The visualisation of data in the analysis process enables an approach that provides insight and contributes to the revelation of certain aspects of the data. Visualisations that are used for analysis purposes must show the data accurately and allow for the identification of unexpected facets (FRIENDLY & SAS INSTITUTE, 2000). Furthermore, they can serve as a valuable tool for presentation and dissemination of results (RÄDICKER & KUCKARZ, 2019). Within the scope of the present study, a visualisation form was developed to support the exploration of micro-processes in polyadic SST interactions during the analysis process and to communicate findings to recipients at presentations. APA (2020) listed several types of figures that are used in the context of scientific studies. The visualisations in this study illustrate qualitative data and depict the flow of dialogue partners and interactions in the form of circles, lines, arrows, speech bubbles and boxes. [53]

By displaying the polyadic structure in the form of a visualisation, different aspects of the group interaction can be shown together and thus be captured in an overall view for analysis. The following elements are important for gaining deeper and more comprehensive insights: Who initiates the polyad or dyad. Who joins it and in what order. How many persons are involved. Who is not verbally involved. Whether the attention focus of the non-verbally involved dialogue partner is on the dialogue or not. Whether the size of the group increases or decreases and at what point in time. These elements are represented by different colours, circles and lines, so that each person can be assigned to a specific colour, line and circle. The added value of the visualisation of polyadic structures for the present study exists in the fact that all these different elements can be displayed and captured at a glance. This supports the gain of knowledge in the analysis of the data. APA (2020) referred to the informative and communicative function of colour and visual elements in a figure. When choosing colours, contrasts are important to enable recipients to distinguish and understand the information displayed. The explanation of the meaning of colours and visual elements must also be given. As an extension, the colours could be assigned to certain categories or to a specific research interest. Theoretically, for example, multilingual children could be colour-coded in green tones, monolingual children in orange nuances and the teacher in blue shades. The methodological idea behind this is to make the information in the graph more salient in correspondence to the particular research question. Data can be highlighted in visualisations and marked as important information for the research process, too. [54]

The dialogues examined in this research project are natural conversations, as they arise spontaneously and are not planned. "Natural environment" is a methodologically important aspect, because in this kind of conversation interaction partners take turns, switch, pause, dominate, thread in and out, etc. The described form of visualisation might be applicable for the analysis of natural conversations and interactions of any kind. [55]

In the present study the aim was to gain insight into how kindergarten teachers devise polyadic SST interactions and which strategies or combinations of strategies they apply in their interactions with children. Therefore, teacher—child interactions were analysed around children's contribution to the thinking process. Visualisations can serve as a useful tool, as a sort of analytical lens on micro-processes. Moreover, simultaneously occurring codes can be displayed. Graphical embodiment can lead to an awareness of interrelations and connections between codes. Patterns can be discovered as shown in the anchor example water gutter project. The first analytical lens serves for exploration of the teacher's interactions around the boy's SST contributions at the beginning of the dialogue: a set of eight strategies can be identified. Then the magnifying eye is placed on the next SST contributions of the children, in which a combination of thirteen strategies can be observed which include seven of the previous eight strategies. The complexity of the observed combinations of strategies in conjunction with the polyadic interactions can be illustrated in a visualisation. In the analysis process, visualisations can help unveil underlying structures and patterns. The possibility of grouping information and establishing connections between data via visualisations is also described as an advantage by BINGEL (2010) and FRIENDLY & SAS INSTITUTE (2000). Differences and similarities of data can be revealed clearly by means of a graphic. [56]

For the elaboration of patterns, the formation of types or the generation of theories, a systematic exploration of relationships between categories is necessary. The analysis must therefore be detached from the level of the person and focus on the level of strategies or action patterns, etc. (KELLE & KLUGE, 2010). Visualisations can provide a contribution to this by using graphics for comparison. By placing graphics of the polyadic structure of different sequences next to each other, it might for example become visible that polyads with a bigger group size are more likely to depart into side conversations as parallel dyads and polyads develop. The comparison can also show, for instance, that there are few SST dialogues in which a child is always in the role of the observer, since in most dialogues the children change roles frequently. To gain more insight into the strategies that promote SST, the comparison of the analytical lens images can provide an additional value. The visualisations of the lens images with the combinations of the strategies can be used as a kind of matrix. The methodical idea is to place the lens images of different time points of a SST dialogue next to or on top of each other and thus discover patterns. The visualisations of the analytical lens images can also serve for comparisons between different sequences. For example, all sequences can be compared along the axis of the opening situations in order to explore which combinations of strategies initiate SST interactions and provide a good start of the shared thinking process. Thus visualisations of main phases or termination phases can be compared accordingly. The comparison of these visualisations can reveal patterns that help to identify combinations of strategies to promote SST with groups of children. [57]

The graphical display of participation through communication axis provides information about the number of turns each dialogue partner takes. It illustrates the frequency of verbal interactions between dialogue partners and the possible

dominance of participants through the width of the arrows. Both the visualisation of the polyadic SST structures and the graphical representation of the communication axes can be used for comparisons of different sequences. Similarities and differences can be identified by researchers and recipients. It is therefore important that shape, size and colours are used in a consistent manner. These elements support exploration and orientation. [58]

In qualitative analysis, it is sometimes difficult to recognise structures—like the saying: we cannot see the wood for the trees. The described visualisations are a chance to make structures visible. In this sense, visualisations can offer an additional methodological approach to the applied textual forms of analysis and thus enrich the research process. In their qualitative research study on body mapping, McCORQUODALE and DeLUCA (2020) discussed the handling of inductive and deductive categories in the analysis process. They referred to visual data analysis as a balanced interplay between inductive processes in which insights are generated from the visuals, and deductive processes, in which structuring elements from theory are used (SPENCER, 2011; see also McCORQUODALE & DeLUCA, 2020). In the present study, inductive categories and theory-based categories were also displayed together in visualisations and introduced into the analysis process. [59]

Visualisations play an important role in the communication and presentation of results. Findings in the present study can be explained more comprehensibly by means of a graphic representation. Complex relationships in interactions are sometimes difficult to present in text form and require long complicated explanations. Visualisations help to bring findings about developments and relationships to the point so that the recipient can grasp it at a glance. The display of SST contributions and strategies applied along the polyadic structure of a sequence simplify the explanation of the connections and make them easier to understand for recipients. Studies concur that recipients pay more attention to visual information and process this information faster than information from a continuous text (BOUCHON, 2007; GARCIA & STARK, 1991). Visualisations also have a motivating factor: they provide visual difference and interrupt the "monotony" of a text, which can help to maintain attention. In addition, visualisations take up less space than texts for a similar amount of information (BOUCHON, 2007). Visualisations also have disadvantages though—faster information acquisition and processing can lead to the assumption that graphics are easier to understand than texts. The recipient's examination of visualised topics might therefore be more superficial than with texts (BOUCHON, 2007; LIEBIG, 1999). [60]

The described forms of graphical display encounter difficulties to visualise large groups well, as the graphic representation of interactions then becomes very complex. The visualisation of group interactions with more than ten participants might become too confusing for both researchers and recipients. Thus, descriptions, tables or other graphic forms might be more appropriate for analysis and presentation purposes of larger groups. The development of the described visualisations from the data is time-consuming since the graphic representation at

this stage is created by the researcher in "manual work" on the computer. Analysis Software Programs such as MAXQDA or NVivo have graphic tools to link analysed data and codes together and display them in a graphical overview. However, these graphic tools can provide visualisations of other kinds, such as concept maps or correlation models. BINGEL (2010) referred to the principle of appropriateness. A graph should be appropriate to the goal or content and be reduced to relevant information. Complex visualisations are time-consuming and must have an added value for the analysis process or the communication and presentation of results. BALL and GILLIGAN (2010) referred to limitations of visual methodologies because graphical representations might focus the analysis like a kind of frame. They therefore recommended combining different methodological approaches. "That is one reason why a plurality of approaches to research should be encouraged. Visual methodologies can provide insights that are not available through other methods, but they can also complement, corroborate and/or challenge non-visual methodologies" (BALL & GILLIGAN, 2010, §71). [61]

What about SST in polyadic groups in kindergarten? Intermediate results indicate that sensitive responsiveness to the interest and imagination of children (SIRAJ et al., 2015) and shared attention seem to promote joint thinking processes. Children are motivated to contribute their ideas if the teacher refers to the children's lives and switches between practical activities and cognitive reflection. Furthermore, the use of gestures and facial expressions, movements towards the children and addressing children directly seems to facilitate the participation of children in SST. Cognitively stimulating, however, are scaffolding interactions and open constituent questions through which the teacher encourages the children to think and solve problems. BOLAND et al. (2018) identified ten core components that educators can apply to encourage children to SST in make-believe play. In their study the relevance of engaging all children in the dialogues was emphasised, as well as following children's interest and imagination and taking advantage of problems and opportunities that arise. These components are in line with the findings described in the water gutter project. Another important component is to leave enough room for the children to contribute their thoughts. This element was central in the water gutter project, too: the first and second SST interactions of the children could only develop because the teacher created enough space for answering and ideas. Observing is a further central strategy in the described construction play scene and provides a basis for joint thinking. BOLAND et al. referred to observation as a core component as well. Observation is an important starting point for kindergarten teachers to identify children's interests. It supports children in the implementation of their play ideas (WÜNSCHE et al., 2013). [62]

Some limitations are worth noting. As intermediate results are not representative, further analysis of micro-processes can help to provide detailed insight into strategies to facilitate SST in polyadic groups. The teachers were part of the intervention group and participated in professional training including strategies to foster children's language acquisition and SST. Professional training seems to

support competences of teachers to devise shared thinking processes with children (BRODIE, 2014; HILDEBRANDT et al., 2016; KÖNIG, 2006). [63]

In the present article the use of visualisations in the analysis process of polyadic SST interactions and its benefit for the presentation of results were described. Advantages and disadvantages were discussed, with the advantages predominating. As the innovation and development in the field of graphical IT tools is progressing rapidly, the future holds interesting new possibilities for the application of visualisations in analysis processes and in the presentation of scientific projects. [64]

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Appendix: Legend of Transcription

<< Looks…> >	language-accompanying actions and events with range
((Turns around))	extra-linguistic actions and events
(---)	longer estimated pause of 0.8 - 1.0 second

Table 1: Legend of transcription according to GAT2, minimal transcript (SELTING et al., 2009, p.391)

References

Albers, Tim (2009). *Sprache und Interaktion im Kindergarten. Eine quantitativ-qualitative Analyse der sprachlichen und kommunikativen Kompetenzen von drei- bis sechsjährigen Kindern.* Bad Heilbrunn: Klinkhardt.

American Psychological Association (2020). *Publication manual of the American Psychological Association* (7th ed.). Washington, DC: American Psychological Association.

Ball, Susan & Gilligan, Chris (2010). Visualising migration and social division: Insights from social sciences and the visual arts. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *11*(2), Art. 26, https://doi.org/10.17169/fqs-11.2.1486 [Accessed: July 9, 2020].

Bingel, Claudia (2010). *Visualisieren*. Freiburg: Haufe-Lexware.

Boland, Annerieke; Tjallema, Marieke & van der Zalm, Eefje (2018). Interacting with children: Sustained shared thinking in make-believe play. *Paper*, *EARLI SIG V Conference,* Berlin, Germany, August 29-31, 2018, https://www.ewi-psy.fu-berlin.de/en/v/earli-sig5-2018/ressources/Abstractbook_EARLI_SIG5_2018.pdf#page=75 [Accessed: September 9, 2019].

Bortz, Jürgen & Döring, Nicola (2006). *Forschungsmethoden und Evaluation für Human- und Sozialwissenschaftler.* Berlin: Springer.

Bouchon, Catherine (2007). *Infografiken. Einsatz, Gestaltung und Informationsvermittlung*. Boizenburg: vwh.

Brinker, Klaus & Sager, Sven F. (2010). *Linguistische Gesprächsanalyse.* Berlin: Schmidt.

Brodie, Kathie (2014). *Sustained shared thinking in the early years: Linking theory to practice.* New York, NY: Routledge.

Bryant, Antony (2009). Grounded theory and pragmatism: The curious case of Anselm Strauss. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *10*(3), Art. 2, https://doi.org/10.17169/fqs-10.3.1358 [Accessed: July 8, 2020].

Cusati Müller, Medea; Wustmann Seiler, Corina; Simoni, Heidi & Hedderich, Ingeborg (2019). Die Teilhabe von Kindern an Sustained Shared Thinking im Freispiel: Einflüsse von Geschlecht und Alter der Kinder. *Frühe Bildung*, *8*(3), 153-160.

Darsow, Annkathrin; Paetsch, Jennifer & Felbrich, Anja (2012). Konzeption und Umsetzung der fachbezogenen Sprachförderung im BeFo-Projekt. In Stefan Jeuk & Joachim Schäfer (Eds.), *Deutsch als Zweitsprache in Kindertageseinrichtungen und Schulen (*pp.215-234). Stuttgart: Fillibach bei Klett,

Friendly, Michael & SAS Institute (2000). *Visualizing categorical data*. Cary, NC: Sas Institute.

Garcia, Mario R. & Stark, Pegie (1991). *Eyes on the news.* St. Petersburg, FL: The Poynter Institute for Media Studies.

Glaser, Barney G. & Strauss, Anselm L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* New York, NY: Adline de Gruyter.

Göncü, Artin & Rogoff, Barbara (1998). Children's categorization with varying adult support. *American Educational Research Journal*, *35*(2), 333-349.

Hildebrandt, Frauke; Scheidt, Alexander; Hildebrandt, Andrea; Hédervári-Heller, Éva & Dreier, Annette (2016). Sustained shared thinking als Interaktionsformat und das Sprachverhalten von Kindern. *Frühe Bildung*, *5*(2), 82-90.

Hopf, Michaela (2012). *Sustained Shared Thinking im frühen naturwissenschaftlich-technischen Lernen.* Münster: Waxmann.

Jansen, Heiner; Mannhaupt, Gerd; Marx, Harald & Skowronek, Helmut (2002). *BISC: Bielefelder Screening zur Früherkennung von Lese-Rechtschreibschwierigkeiten.* Göttingen: Hogrefe.

Jensen, Hanne; Pyle, Angela; Zosh, Jennifer M.; Ebrahim, Hasina B.; Zaragoza Scherman, Alejandra; Reunamo, Jyrki & Hamre, Bridget K. (2019). Play facilitation: The science behind the art of engaging young children. *White paper*, The LEGO Foundation, Billund, Denmark, https://helda.helsinki.fi/bitstream/handle/10138/305924/play_facilitation_the_science_behind_the_art_of_engaging_young_children.pdf?sequence=1 [Accessed: March 3, 2019].

Kelle, Udo & Kluge, Susanne (2010). *Vom Einzelfall zum Typus. Fallvergleich und Fallkontrastierung in der qualitativen Sozialforschung.* Wiesbaden: VS Verlag für Sozialwissenschaften.

Knoblauch, Hubert; Baer, Alejandro; Laurier, Eric; Petschke, Sabine & Schnettler, Bernt (2008). Visual analysis. New developments in the interpretative analysis of video and photography. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *9*(3), Art. 14, https://doi.org/10.17169/fqs-9.3.1170 [Accessed: July 9, 2020].

König, Anke (2006). Dialogisch-entwickelnde Interaktionsprozesse zwischen ErzieherIn und Kind (-ern). Eine Videostudie aus dem Alltag des Kindergartens. *Doctoral dissertation*, Erziehungswissenschaft und Soziologie, Technische Universität Dortmund, Germany.

Legewie, Heiner (1995). Feldforschung und teilnehmende Beobachtung. In Uwe Flick, Ernst von Kardorff, Heiner Keupp, Lutz von Rosenstiel & Stephan Wolff (Eds.), *Handbuch Qualitative Sozialforschung* (pp.189-192). München: Beltz Psychologie Verlags Union.

Liebig, Martin (1999). *Die Infografik*. Konstanz: UVK.

Löffler, Cordula; Vogt, Franziska; Haid, Andrea; Frick, Eva; Zaugg, Alexandra; Bohnert-Kraus, Mirja; Eckhardt, Oscar; Quiring, Johanna; Von Albedyhll, Laura; Waibel, Alexandra; Willi, Andrea & Zumtobel, Martina (2017). Dialekt und Standard im Kindergarten. *Babylonia*, *2*, 45-47, http://babylonia.ch/fileadmin/user_upload/documents/2017-2/Loeffler_et_al.pdf [Accessed: January 15, 2018].

McCorquodale, Lisa & DeLuca, Sandra (2020). You want me to draw what? Body mapping in qualitative research as Canadian socio-political commentary. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *21*(2), Art. 6, http://doi.org/10.17169/fqs-21.2.3242 [Accessed: June 2, 2020].

Mercer, Neil (2000). *Words and minds. How we use language to think together.* London: Routledge.

Mey, Günter & Dietrich, Marc (2016). Vom Text zum Bild – Überlegungen zu einer visuellen Grounded-Theory-Methodologie. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *17*(2), Art. 2, https://doi.org/10.17169/fqs-17.2.2535 [Accessed: December 21, 2020].

Mey, Günter & Mruck, Katja (2010). Grounded-Theory-Methodologie. In Günter Mey & Katja Mruck (Eds.), *Handbuch qualitative Forschung in der Psychologie.* Wiesbaden: VS Verlag für Sozialwissenschaften, 614-626.

Mignone, Javier; Chase, Robert M. & Roger, Kerstin S. (2019). A graphic and tactile data elicitation tool for qualitative research: The life story board. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *20*(2), Art. 5, http://doi.org/10.17169/fqs-20.2.3136 [Accessed: August 21, 2019].

Miles, Matthew B. & Huberman, Michael A. (1994). *Qualitative data analysis: An expanded sourcebook.* Newbury Park, CA: Sage.

Pianta, Robert; Howes, Carollee; Burchinal, Margaret; Bryant, Donna; Clifford, Richard; Early, Diane & Barbarin, Oscar (2005). Features of pre-kindergarten programs, classrooms, and teachers: Do they predict observed classroom quality and child-teacher interactions?. *Applied Developmental Science*, *9*(3), 144-159.

Rädiker, Stefan & Kuckartz, Udo (2019). *Analyse qualitativer Daten mit MAXQDA.* Wiesbaden: Springer VS.

Röhl, Tobias & Herbrik, Regine (2008). Mapping the imaginary—Maps in fantasy role-playing games. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *9*(3), Art. 25, https://doi.org/10.17169/fqs-9.3.1162 [Accessed: July 9, 2020].

Rogoff, Barbara (1990). *Apprenticeship in thinking: Cognitive development in social context.* Oxford: Oxford University Press.

Sammons, Pat; Sylva, Kathy; Melhuish, Edward; Siraj-Blatchford, Iram; Taggart, Brenda; Grabbe, Yvonne & Barreau, Sofka (2007). *Effective pre-school and primary education 3-11. Project (EPPE 3 – 11): Summary report, influences on children's attainment and progress in key stage 2: Cognitive outcomes in year 5.* London: Institute of Education, University of London/Department for Education and Skills.

Selting, Margret; Auer, Peter; Barth-Weingarten, Dagmar; Bergmann, Jörg R.; Bergmann, Pia; Birkner, Karin; Couper-Kuhlen, Elizabeth; Deppermann, Arnulf; Gilles, Peter; Günthner, Susanne; Hartung, Martin; Kern, Friederike; Mertzlufft, Christine; Meyer, Christian; Morek, Miriam; Oberzaucher, Frank; Peters, Jörg; Quasthoff, Uta; Schütte, Wilfried; Stukenbrock, Anja & Uhmann, Susanne (2009). Gesprächsanalytisches Transkriptionssystem 2 (GAT 2). *Gesprächsforschung: Online-Zeitschrift zur verbalen Interaktion*, *10,* 353-402, http://www.gespraechsforschung-ozs.de/heft2009/px-gat2.pdf [Accessed: April 14, 2017].

Siraj, Iram; Kingston, Denise & Melhuish, Edward C. (Eds.) (2015). *Assessing quality in early childhood education and care: Sustained shared thinking and emotional well-being (SSTEW) scale for 2–5-year-olds provision.* London: Trentham Books.

Siraj-Blatchford, Iram (2009). Conceptualising progression in the pedagogy of play and sustained shared thinking in early childhood education: A Vygotskian perspective. *Education and Child Psychology*, *26*(2), 77-89.

Siraj-Blatchford, Iram; Sylva, Kathy; Muttock, Stella; Gilden, Rose & Bell, Danny (2002). Researching effective pedagogy in the early years (REPEY). *Research Report 356*, Department for Education and Skills, Institute of Education, University of London, UK; Department of Educational Studies, University of Oxford, UK.

Siraj-Blatchford, Iram; Sylva, Kathy; Taggart, Brenda; Sammons, Pat; Melhuish, Edward C. & Elliot, Karen (2003). The effective provision of pre-school education (EPPE) project. *Technical paper 10, intensive case studies of practice across the foundation stage,* Institute of Education, University of London, UK.

Spencer, Stephen (2011). *Visual research methods in the social sciences: Awakening visions.* New York, NY: Routledge.

Strauss, Anselm L., & Corbin, Juliet (1996 [1990]). *Grounded theory: Grundlagen qualitativer Sozialforschung*. Weinheim: Beltz, Psychologie Verlags Union.

Sylva, Kathy; Melhuish, Edward; Sammons, Pat; Siraj-Blatchford, Iram & Taggart, Brenda (2004). The effective provision of pre-school education (EPPE) project. *Final report, a longitudinal study funded by the DfES 1997-2004,* Department for Education and Skills/Sure Start, Institute of Education, University of London, UK.

Tietze, Wolfgang; Becker-Stoll, Fabienne; Bensel, Joachim; Eckhardt, Andrea G.; Haug-Schnabel, Gabriele; Kalicki, Bernhard & Keller, Heidi (Eds.) (2013). *Nationale Untersuchung zur Bildung, Betreuung und Erziehung in der frühen Kindheit (NUBBEK).* Berlin: Verlag das Netz.

Vogt, Franziska; Löffler, Cordula; Haid, Andrea; Zaugg, Alexandra; Frick, Eva; Bohnert-Kraus, Mirja; Eckhardt, Oscar; Quiring, Johanna; von Albedyhll, Laura; Waibel, Alexandra & Zumtobel, Martina (2019). Zentrale Ergebnisse aus dem Forschungsprojekt SpriKiDS – Sprachförderung im Kindergartenalltag in Dialekt und Standardsprache im Kontext von Mehrsprachigkeit. *Zusammenfassung für die trinationale SpriKiDS Tagung [Summary for the trinational SpriKiDS Conference]*, Pädagogische Hochschule St.Gallen, Rorschach, Switzerland, November 23, 2019, https://phsg.contentdm.oclc.org/digital/collection/p15782coll3/id/1097/rec/1 [Accessed: December 10, 2019].

Vygotsky, Lev S. (1978 [1935]). Umstvennoie razvitie detei v protsesse obuchenia [Mental development of children and the process of learning]. In Lev S. Vygotsky, *Mind in society. The development of higher psychological processes* (pp.79-91). Cambridge, MA: Harvard University Press.

Weltzien, Dörte (Ed.) (2013). Das Spiel des Kindes. *Kindergarten heute, wissen kompakt/spezial*, *166.*

Wirts, Claudia; Wildgruber, Andreas & Wertfein, Monika (2017). Die Bedeutung von Fachwissen und Unterstützungs-planung im Bereich Sprache für gelingende Interaktionen in Kindertageseinrichtungen. In Heike Wadepohl, Katja Mackowiak, Klaus Fröhlich-Gildhoff & Dörte Weltzien (Eds.), *Interaktionsgestaltung in Familie und Kindertagesbetreuung (pp.147-170).* Wiesbaden: Springer VS.

Wood, David; Bruner, Jerome S. & Ross, Gail (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, *17*(2), 89-100.

Wünsche, Michael; Gutknecht Dorothee & Weltzien, Dörte (2013). Das Spiel als Bildungsprozess verstehen und begleiten. *Kindergarten heute*, *wissen kompakt/spezial*, *166*, 18-31.

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