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Full Length Article

Rising to the concrete: A cultural-historical study of concept development of infants and toddlers in imaginary situations

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ABSTRACT

This paper presents the results of a cultural-historical study of the genesis and development of concepts by infants and toddlers. Under the conditions of an educational experiment of a Conceptual PlayWorld in a living laboratory of a childcare centre, we investigated the developmental conditions and dramatic imaginary play moments of this cultural age period. We found that a family system was the genesis of the lived experience of a concept from which other concepts are formed/embedded/imagined, and that institutional settings can replicate the historical development of family as an early form of rising to the concrete. We noted how in imaginary play the caring for another kind of family system, supported the conditions for becoming aware of a lived experience of a family. In addition, imaginary play when co-experienced between infants and toddlers and teachers, acted as the initial carrier of word meaning and when educators acted 'as if' the infants understood the word meanings in imaginary play, the early development of concepts over time was supported. These findings add empirically to what is known about the development of word meaning and gives theoretical insight into what it means to historically rise to the concrete within the earliest cultural age period.

1. Introduction

Foundational for all education systems is the formulation and presentation of curriculum content to support the planning and delivery of educational programs. It is well understood in practice that in schooling contexts teachers draw on a set of prescribed content that is designed horizontally across different discipline domains, and vertically in relation to the development of conceptual complexity. The latter is usually presented in relation to the biological age of the child, beginning with the foundation years through to the end of compulsory schooling. However, in recent times many education systems have formulated curriculum goals for the pre-school years and also presented discipline content for teachers to teach (or even instruct) in their play-based programs (Yudina, 2023). Whilst there is global diversity in how prescriptive curricula are, there does appear to be a trend to increase conceptual complexity in early childhood education (see Fleer & van Oers, 2018), sometimes observed through the term schoolification or the academisation of early childhood as part of public discourses (Pyle et al., 2020). However, the research underpinning what might constitute the

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psychological content of a concept for children under three years has generally not been undertaken. Without research into what constitutes curriculum content for this cultural age period, education systems run the risk of simply watering down discipline concepts without knowing if the content psychologically builds vertically or meaningfully for children. But also, deeper insights into what is meant by a concept in the context of infants and toddlers is needed.

In this paper we reference concepts as curriculum concepts (as discipline-based content), word-meaning as a concept (conscious generalization), and relational concepts embedded within a system (core model) where children build their own core conceptual relation when exploring concrete situations in institutional settings. Considering the relations between word meaning, core concepts, and curriculum concepts supported our study of the genesis, forms, and development of concept by infants and toddlers within the institutional practices of educators working in childcare centres. Our research problem sits within the theoretical foundations of the cultural-historical writings of Lev Vygotsky (1987) where the relationship between a concept and word meaning were theorised psychologically. Vygotsky (1987) wrote:

...the concept – represented psychologically as word meaning – develops. The essence of the development of the concept lies in the transition from one structure of generalization to another. Any word meaning, at any age, is a generalization. However, word meaning develops. When the child first learns a new word, the development of its meaning is not completed but has only begun. From the outset, the word is a generalization of the most elementary type. In accordance with the degree of his [sic] development, the child moves from elementary generalization to higher forms of generalization (p. 170).

This theorisation gives insights, but not detail on what might constitute foundational psychological content of concepts for infants and toddler who are in the process of developing word meaning. Additionally, the transition from one structure of generalization to another takes its form in the social relations and theoretical systems that continue to be introduced via everyday life, but also as determined by curriculum documents in educational institutions such as childcare centres. Knowing more about the psychological content and relational systems of core concepts could give a more psychologically informed approach to the design of curriculum content for children under three years of age – an area of educational research that has received the least attention when compared with other cultural age periods across a range of discipline areas (O'Connor et al., 2021).

The goal of this paper is to report on the results of an educational experiment, where we investigated the genesis, forms, and development of word-meaning as an early form of a concept by infants and toddlers within the practices of educators working with a core model of a concept (i.e., ecosystem). We add to the research of Vygotsky into adolescents' development of concepts, by studying this problem in the living laboratory of a Conceptual PlayWorld (Fleer, 2021) with children younger than three years of age. Here we introduced dramatic and personally meaningful conditions within children's everyday childcare centres through a Conceptual PlayWorld. The five characteristics of a Conceptual PlayWorld are: Selecting a dramatic story; Designing an imaginary play situation; Planning entry and exist into the imaginary play situation; Planning a play problem that is resolved when using a concept in service of the play; Educators are play partners with the children. Our results are from across sites where we studied infant and toddler learning and development in play-based settings.

To achieve our research goal, we begin with the theoretical foundations of our approach for studying the development of concepts, followed by the details of our study design and a presentation of the findings with typical examples from our data. We discuss the results in relation to the early period of concept development of infants and toddlers who experienced the same intervention of a Conceptual PlayWorld (Fleer, 2021) inspired by the story of *The March of the Ants* by Dubosarsky and Riddle (2021). We close the paper by arguing that the results of our research add to the empirical base of conceptual development of children under three years of age - thereby contributing to filling an empirical gap left open by Vygotsky because he theorised, rather than undertook research in relation to concept development of children younger than 3-years of age.

2. Theoretical foundations

In seeking to address the problem of the genesis and development of concept formation from infancy through empirical means, we looked closely at Vygotsky's (1987) writings on the meaning of the word (sign) in relation to its functional use, but did so within historically formulated conditions of societal, institutional, and personal interrelations as conceptualised by contemporary researcher Mariane Hedegaard (2008). She suggested this interrelation was missing within Vygotsky's theory of development.

Although conceptualised differently to word-meaning, we also drew upon the concept of *rising to the concrete* by Vygotsky (1987) and Davydov (2008), as this gave greater insights into the essence of what and how conceptual thinking emerges over time in the recurrent institutional practices of the under threes. The idea of *rising to the concrete* brings forward how a concept historically came into existence because of a societal need (e.g., measurement as a standard unit was needed to support trade), at the same time as creating the pedagogical conditions for modelling the essence of the concept within an educational setting (e.g., need for a measurement system when role-playing fitting shoes in a shoe shop as observed in the research of Bert van Oers). We also touch on Hedegaard's (2008) writings on an educational experiment into the teaching practices of primary aged children where the concept of a double move was borne. Finally, we used Vygotsky's (1994) dialectical conception of the ideal or mature form and the real form of development to guide our study of the dynamic relations between person and environment.

With this longstanding and contemporary cultural-historical theorisation of development of a concept, and an acknowledgment of the long and complex process of the development of the child's thinking as a backdrop, we sought to draw on the essence of Vygotsky's writing associated with the development of *word meaning*. We noted that Vygotsky's (1987) writings were presented in relation to the theories and empirical studies of his time, and where his focus was primarily on explaining adolescent development of 'true concepts'. However, there are principles that can be taken from his work that align with the meaningful motivating conditions of naturalistic and

dynamic setting of the living laboratory of childcare centres. Therefore, we present a set of 8 principles derived from our consideration of this theory of conceptual development but do so in relation what is relevant for our educational experiment of children under three years of age. Table 1 summarises the principles associated with word meaning but begins with the idea of theoretical thinking in Principle 1. Beginning with Principle 1 in our research gave a way of conceptualising more holistically the development of word meaning for infants and toddlers because the essence of a curriculum concept (e.g., ecosystem) could be theorised pedagogically as sitting within a system of relations (e.g., habitat, structure of the organism, food source) and thereby as having psychological content (e.g., word as concealed generalization). This conceptualisation is shown in Table 1. Further details of each principle follow.

2.1. Theoretical thinking – rising to the concrete

Principle 1: A recognition of the historical nature of verbal thinking in relation to concept development was core within Vygotsky's (1987) theorisation. He said, "thinking depends on speech, on the means of thinking, and on the child's socio-cultural experience. The development of inner speech is defined from the outside. ...the development of the child's thinking depends on his [sic] mastery of the social means of thinking, that is, on his mastery of speech." (p. 120). In our study the development of a child's speech within the cultural practices that surround the child had to be seen as central for understanding the genesis and forms of conceptual development for such young children (1–3 years).

When theorising the problem of how thinking depends on speech Vygotsky (1987) said verbal thinking had to be seen as a socio-historical form of development. He stressed that what was most important in this theorisation was a "recognition of the historical nature of verbal thinking", and this requires an analysis that follows the "same methodological theses that historical materialism applies to other historical phenomena of human society." (p. 120). Important for our study of infants and toddlers under the conditions of a Conceptual PlayWorld, was understanding and theorising how "...the process of concrete and active thinking arises" as a cultural phenomenon whereby concepts are embedded in social forms of speech that arise historically in relation to human needs (also see Davydov, 2008). The cultural development of human beings was theorised by Davydov (2008) as arising in societies, where concepts explain and make possible new human actions, such as the invention of standard units in measurement. In continuing this example, concepts of measurement arise historically in trade where there was a need for going beyond non-standard approaches, such as dealing with the problem of variability in measurement when using an arm as a unit to measure cloth. Although societal needs bring new concepts, in institutional contexts, such as childcare centres and schools, who are charged with teaching concepts like measurement, the cultural and historical development of the concept is generally not featured. Exceptions are developmental teaching in Russia (see Aidarova, 1982 for a study of mother tongue and literacy development in the first year of school; Vasily V. Davydov for teaching of mathematics in schools), and Denmark (see summary by Mariane Hedegaard, 2020 for the teaching of history, biology, and geography in primary schools). Therefore, in our research we were mindful of how the kernel of a concept, as originally formulated as a societal need, could be brought into the cultural practices and rich play narratives of childcare centres for children under the age of three-year.

Table 1
Principles of infant-toddler development of concepts.

Principle of conceptual development	Summary
Theoretical thinking – rising to the concrete	
1 The historical nature of concept development	The cultural development of human beings arises in societies, where concepts explain and make possible new human actions. Social exchanges in everyday situations give meaning to rules, roles and concrete/social environments. Societal needs create new concepts to help solve everyday practical problems. In this way, a concept will always sit within a theoretical system that was formed historically. However, to understand the historically formed system of concepts, pedagogical practices need to support the development of theoretical thinking by rising to the concrete. That is, determining the meaning of a particular concept that is embedded within a system of relations. In social and material contexts, the essence of a concept can be revealed concretely through developing theoretical relational models – whereby the essence of a concept becomes visible through capturing the system of relations.
The concept represented psychologically as word meaning	
2 A word is a concealed generalization	Word meaning is a unit of thinking and speech. The word does not relate to a single object, but rather to a group of objects.
3 Words act as carriers of the concepts	The social circle surrounding the child is an interactional condition in which words become carriers of the concept over time.
4 Pseudoconcepts	This captures the idea that a child will appear to understand the word meaning (generalization), but has not yet developed a conscious understanding of the word meaning and cannot use the word (as symbolic of the concept) for thinking in their everyday interactions/experiences.
5 Potential concepts	This captures the idea that the adult continues in communications with the child 'as if' the child understood the conceptual meaning of the word meaning.
Dialectical method	
6 The dialectical relations between affect and intellect	We have added to the <i>nomenclature for capturing the development of a concept, by foregrounding how two lines of affect and intellect</i> are culturally entangled under certain conditions. However, every idea or word contains some residue or element of an affective relationship to the reality represented by the word.
7 Motive force	Children's <i>motives</i> and what changes for them as they become (or not) oriented to the word meanings that are introduced to them in the everyday setting of a childcare centre, but also what is impelling them forward in their conceptual development between the cultural age period from 1 through to 3-years of age
8 Word meaning is always part of a complex whole	Identify those units in which the characteristics of the whole are present, even though they may be manifested in altered form.

2.2. The concept represented psychologically as word meaning

Principle 2: *Word meaning* was for [Vygotsky \(1987\)](#) a unit of thinking and speech. Relevant for our study was how, the “word does not relate to a single object, but to an *entire group or class of objects*. Therefore, every word is a concealed *generalization*” (p. 47; original emphasis). [Vygotsky \(1987\)](#) suggested that when children do not possess the appropriate generalization, it becomes difficult for them to communicate their intentions. When children do understand the generalization contained in the word, [Vygotsky \(1987\)](#) suggested that this means the act of thinking with concepts becomes possible. His research showed that thinking with concepts was not possible until the transitional period of the adolescent. In our study we were mindful of the genesis of thinking with concepts and were interested to know how teachers bring into their interactions with children in early childhood settings, the generalization that underpin the words which they embed into the discourses and mature forms of speech ([Vygotsky, 1994](#)) that they make available to infants and toddlers.

In relation to the central problem of the development of *thought to word* as posed by [Vygotsky \(1987\)](#), he suggested that “the child does not create his [sic] speech but learns the developed speech of the adults around him” (p. 145). This is consistent with his concept of the dialectical relation between the child’s present form of development and the mature form of development, where the idea is that which you wish the child to develop must be made available in the child’s environment from the very beginning ([Vygotsky, 1994](#)). He suggested that ‘somehow development happens’ for the child. The examples given by [Vygotsky \(1994\)](#) are in relation to the child’s home language, where there is always a dialectical relationship between the adult’s mature form of language and the child’s real or present development. [Vygotsky \(1987\)](#) suggested that this ‘happens’ because, “The paths through which word meanings are extended or transferred are determined by the people around the child in their verbal interaction with him [sic]” (p. 143). Due to the cultural age of the children in our study, these theoretical ideas were deemed important and point to the need for the study to capture the social relations and mature forms of speech made available to the infants and toddlers.

Principle 3: We noted that Vygotsky identified that *words act as carriers of the concept*. At the heart of [Vygotsky’s \(1987\)](#) theorisation and study of *word meaning*, he was seeking to resolve two key problems when researching the social circle around the child where the interactional conditions of words become carriers of the concept over time. He said that key here was considering both “... the problem of the relationship of *thought to word* and the problem of the relationship of generalization to social interaction” (p. 49). The latter is particularly relevant for our study because infants and toddlers are in institutional settings where educators are charged with acting and planning intentionally for play-based learning of curriculum concepts through social interactions (e.g., [Australian Government Department of Education, 2022](#)) and where word meaning is in the process of developing and acts as carriers of concepts. For example, the curriculum for early education in Australia specifically invites educators to plan intentionally for the learning of discipline concepts in play-based settings. In line with [Hedegaard \(2014\)](#), we suggest that recurrent practices of intentionality within the activity settings, could theoretically bring into existence early forms of generalization in social interaction because of the institutional demand for introducing concepts in play-based settings. But they might not either. This research has not yet been done for the period below three years of age.

[Hedegaard \(2020\)](#) has argued that in institutional settings of schools, teachers seek to orient children to subject matter or discipline knowledge. However, in the context of our study, where discipline knowledge is increasingly being introduced into play-based settings, this gives different conditions and places new demands on children and teachers (see [Hedegaard, 2014](#) for concepts on demands and motives). Therefore, better understanding how words act as carriers of concepts for children under three years has become increasingly important in Australia where the study reported in this paper was situated.

Consequently, to catch how words act as carriers of the concept, our study had to determine how the children entered into developed forms of speech during their interactions. This meant more than examining the new demands of intentionality, but also studying how infants and toddlers were being oriented to concepts during their social interactions with educators. [Vygotsky \(1987\)](#) suggested that in social interactions “the kernel of the future concept ... is germinating... Thus, *verbal interaction with adults* becomes the motive force behind the development of the child’s concepts.” (p. 146; emphasis added). But these pathways are not straight forward, because “the adult cannot transfer his [sic] own mode of thinking to the child” (p. 143). [Vygotsky \(1987\)](#) suggested that, “With the stability and consistency of its meanings, the speech of those who surround the child predetermines the path that the development of the child’s generalization will take” (p. 143). [Vygotsky \(1987\)](#) described the pathways for generalization of word meaning as non-linear and moving back and forth. He had particular phases and stages to describe the pathways. In using a geological metaphor, he said the phases and stages co-existed like strata across epochs, which were always present to the geologist. In our study of infants and toddlers we had the opportunity to study how these metaphorical strata are formed in order to understand if and how *words act as carriers of the concept* for such young children and how and when they are made available to them.

Principle 4: *Vygotsky proposed the theoretical idea of pseudoconcepts*. He said that by the end of the preschool period the child uses words (as carriers of the concept), and in so doing the child appears to understand the word meaning (generalization). In capturing this phenomenon as *pseudoconcepts*, he suggested that preschool children do not yet have a conscious understanding of the concept and cannot yet use the word (as symbolic of the concept) for thinking in their everyday interactions/experiences. In this early period of the preschooler’s conceptual development where the word acts as a carrier of concept, the child does not yet understand the word as a *true concept*. Rather, “The pseudoconcept is the most common form of complex in the preschooler’s real life thinking” (p. 142).

We are inspired by the idea of a pseudoconcept, and note as Vygotsky did, that during the preschool years, a pseudoconcept could help communications between a child and an adult in their everyday interactions in a childcare setting. However, the contradiction between appearing to understand a concept and using the word to act as a functional equivalent to support communication must have its roots in an earlier period of development. That is, during the period from birth to three years. Our study sought to better understand this earlier period of concept development.

Principle 5: In introducing *the idea of potential concepts*, Vygotsky (1987) argued that this term captured what he observed under experimental conditions, where a child isolates objects that are classified by a single feature of functional equivalence (similarity of impressions). He says, the child's actions and words show, "the potential for being concepts, but this potential has not been realized" (p. 158). Rather, he suggested that this practical thinking or thinking in action is centred on defining an object or concept in relation to what it can do or what can be done with the object. There is an element of abstraction from the concrete group of features, which Vygotsky suggested are empirically connected through the child's experiences. He said, "Potential concepts play an extremely important role in the history of the development of the word" (p. 159).

In Vygotsky's writings he marked a shift from a pseudoconcept to potential concepts because the adult continued in communications with the child 'as if' the child understood the conceptual meaning of the word. Adult responses to infants, 'as if' they understand what they are saying or their intentions, is well established in the literature as an important mode of infant-adult interaction – a forerunner for oral language and literacy development. But what might be the key for understanding earlier transitional moments for conceptual development of infants generally, was not fully elaborated in Vygotsky's writing.

Collectively (Principles 2 to 5), Vygotsky's study of the processes by which the word functions as the means for the formation of the concept, initially as a carrier of word meaning without conscious realisation, and later acting as a potential concept through educators acting 'as if' children have conceptual meaning, has synergy with the problem of our study.

2.3. A dialectical conception

Principle 6: Vygotsky (1987) introduced nomenclature for capturing the development of the concept (*syncretic, complexive, true concepts*) that he said developed along two lines that are culturally entangled under certain conditions. When delving into Vygotsky's (1987) text in relation to our study, we did not find the categories of syncretic, complexive, and true concepts as necessarily explanatory for our results. However, there were some interesting characteristics of his theorisation of the under 3-year-olds that we found helpful in our study. For instance, the *connections between affect and intellect* made visible when the analysis of the complex whole is understood as a relational unit. Vygotsky argued that "Every idea contains some remnant of the individual's affective relationship to that aspect of reality which it represents. In this way, analysis into units makes it possible to see the relationship between the individual's needs or inclinations and his [sic] thinking" (p. 50) In our study of infants and toddlers the *connections between affect and intellect* provided a backdrop as we brought forward aspects of Vygotsky's (1994) writing on the social situation of development and the dialectical relations between the mature and real form of a child's development as discussed in *The problem of the environment*.

Principle 7: We were also interested to identify what might be the motive force that propels the development of the concept across cultural age periods. Vygotsky wrote about the *motive force for child development* across many of the volumes of the collected works, but in Volume 1 (Vygotsky, 1987) he explicitly discussed motive force in relation to the development of the concept. He said,

...the motive force that determines the beginning of this process [concept formation of the adolescent] and sets in action the maturational mechanisms of behavior **impelling it forward** along the path of further development is located not inside but outside of the adolescent. The tasks that are posed for maturing adolescent by the social environment – tasks that are associated with his [sic] entry into cultural, professional and social life of the adult world – are an essential factor in the formation of concepts (p, 132; emphasis added).

In our study we were mindful of the children's *motives* and what changes for them as they become (or not) oriented to the concepts that are introduced to them in the everyday setting of a childcare centre, but also what is impelling them forward in their conceptual development between the cultural age period from 1 through to 3-years of age.

Principle 8: Vygotsky (1987) used a dialectical method to study word meaning conceptualised as part of a complex whole, where the task of the researcher was to "identify those units in which the characteristics of the whole are present, even though they may be manifested in altered form" (p 47). He did this by introducing blocks of different shapes and colours with nonsense words underneath each block in order to trace the development of *word meaning* as a unit of thinking and speech. In our study the focus children cannot

Table 2
Data overview.

Sites	Participants	Data
MC (infants and toddlers)	A total of 11 children (1.1–2.0 years with a mean 1.6 years). 6 were boys and 5 were girls.	A total of 1022mins (18.10 h) of digital data was generated over three weeks.
MC (infants and toddlers)	A total of 13 children (0.1–2.2 years with a mean 1.8 years). 7 were boys and 6 were girls.	A total of 780mins (13 h) of digital data was generated. 23 data collection sessions.
BB Room P (infants and toddlers)	A total of 20 children participated in the Conceptual PlayWorld of which 11 (0.8–1.6, mean 1.3). 4 were girls and 7 were boys.	A total of 72mins (1.2 h) of digital data. Five data collection sessions.
BB Room T (1–2-year-olds)	A total of 19 children participated in the Conceptual PlayWorld (0.8–2, mean 1.7). 17 were girls and 12 were boys.	A total of 173mins (2.9 h) of digital data. Ten data collection sessions.
BB Room PreK (2-year-olds)	A total of 19 children participated in the Conceptual PlayWorld (2.5–3.3, mean 2.9). 11 were girls and 8 were boys.	A total of 169mins (2.8 h) of digital data. Six data collection sessions.
BB Room UT (2-year-olds)	A total of 19 children participated in the Conceptual PlayWorld (1–2.6 mean 2.2) were followed. 7 were girls and 12 were boys.	A total of 92mins (1.5 h) of digital data. Six data collection sessions.
W Room K (2-year-olds)	A total of 17 children (2.2–3.5 (mean 2.7). 13 were girls and 4 were boys.	248.58 min (4.1 h) of digital data. Ten data collection sessions.

read, and without a social purpose, as has been described by Margaret Donaldson (Donaldson, 1978), the tasks will not be motivating or socially meaningful. Consequently, in our research we had to consider different experimental conditions for the study of the development of *word meaning* as a unit of thinking and speech. Because we were interested in the genesis and form of conceptual development, we wanted to trace early forms in the process of developing in the naturalistic setting of a childcare centre. This mirrors the methodological principle of studying the process and not the product of development, even though our approach does not align exactly with Vygotsky's method.

3. Study design

Our study sought to better understand the genesis of concept development under the complexity of naturalistic and real-world conditions of teachers and children in infant-toddler rooms (see Table 2 for participants) across sites. The educators and children all participated in an educational experiment (Hedegaard, 2008). An educational experiment is a collaboration between researchers and participants working on a theoretical problem and not just a problem of practice. Central to our educational experiment was the introduction of an intervention of a Conceptual PlayWorld with the theoretical goal to bring concepts into children's play under the motivated conditions of concepts acting in service of the play problem. That is, the practices were planned in relation to children's *motives* and what changes for them as they become [or not] oriented to the concepts. The different cultural age periods (Vygotsky, 1998) bring different social situations of development, which supported us to better understand the genesis, development, and forms of the development of word meaning at different moments in time and in relation to the pedagogical conditions for the development of concepts.

3.1. Conceptual PlayWorlds as an intervention

To support our study all the teachers participated in professional development related to the goals of the research. Each educator planned their Conceptual PlayWorld with the common story book of *The March of the Ants*. The storybook sets up a highly motivating situation and dramatic plot forming connections between helping and knowing how to help. Additionally, all participants were oriented to the concept of an ecosystem (relational concept of the structural form of the organism, habitat, and food source). Because we did not know what might be the form of the concept when beginning the educational experiment, we also engaged the teachers in discussions about the cultural age period of the children and what could be a relational concept that is personally meaningful for such young children. These discussions were an important part of the professional development (reported elsewhere), where educators and researchers sought to identify a core model of the concept of an ecosystem relevant for infants and toddlers. In our educational experiment the researchers also discussed with the educators what might be the authentic problem to introduce an ecosystem to the infants and toddlers.

As part of the implementation of the intervention, the educators supported the children to jump into the storybook narrative and role-play the story plot before dramatic conditions were introduced. The overarching play problem in the drama of the story was that the baby ants were hungry (possibly starving) and needed feeding. This emotionally charged problem brought the lines of *affect and intellect* as culturally entangled moments together, acting as a motivating force for development. The Queen Ant phoned the children, urgently asking for their help because the worker ants were too tired to collect food and the educators planned their practices in ways that continued this story plot 'as if' the children understood the word meaning.

3.2. Data collection

Digital observations: The research assistants made digital observations using a hand-held camera to closely follow the children and teachers, whilst a camera mounted on a tripod captured the practices of the whole room. This approach enabled close study of gestures, whilst also maintaining an overview of practices taking place within each study site. Table 2 gives an overview of the digital data generated for the target groups of infants and toddlers.

Interviews: A series of semi-structured interview with the teachers was undertaken at different times throughout the program related to their curiosities and challenges associated with implementing a Conceptual PlayWorld to their group. Segments of data from the filmed interviews were prepared as audio files and transcribed.

3.3. Analysis

Because infant and toddler communications are primarily expressed through body gestures and sounds, the analysis of data were supported by conceptualising infant and toddler intentions through how they entered into the activity setting of a Conceptual PlayWorld. Drawing on Hedegaard's (2008) conception of motives and demands, we could examine how the teachers' placed demands on the infants and toddlers through the introduction of a play problem, and how in turn these demands were met. However, we were also mindful that infants and toddlers also place demands upon the educators through non-engagement or by simply walking away and attending to their own interests. Therefore, by followed how infants entered into the activity setting, what they paid attention to, and how they met the demands, as well as how they made demands on the ongoing practices of the teachers, we could systematically analyse the data set in relation to the intervention and our research goal. We also knew from Hedegaard (2008) that by creating a particular intervention, in our case an imaginary play situation, that infants and toddlers may or may not become oriented to the educators intentions and goals. In keeping with Hedegaard (2008), we theorised this dialectically as a relation between the demands of

the intervention and the infants' motives. Their motive orientation to early forms of concept formation through the development of word meaning could then be systematically analysed. We followed a three-step process.

The first step in the analysis involved the organisation of all the digital data. Digital folders for each room were prepared, including field notes, transcribed interviews, and photographs. These data were analysed using Hedegaard's (2008) 3 levels of interpretations: common sense organisation; a situated practice level of interpretation; and a theoretical analysis. The raw data were analysed from a common sense perspective through preparing each video into sessions, which were then logged and organised into folders with descriptions. Summary notes were made in relation to each session, and protocols of data were prepared digitally in relation to the over cultural age periods. That is, videos were logged, screen dumps of practices from video observations made, and video clips of practices prepared and linked to the raw data sets.

The second step involved a situated practice level of interpretation, where the digital folders were integrated for common themes emerging from the data set using the concepts of demands and motives in relation to how infants and toddler entered into the activity settings (Hedegaard, 2014). For example, we looked closely at how the children entered into the activity setting of the Conceptual PlayWorld, to see if and how they were oriented to being ants helping the Queen ant to look for food or to feed the babies. We also looked at how the demands of the situation were being met by the children, such as if they responded with feeding actions or made gestures 'as if' looking for food. New folders were prepared and named in relation to the patterns noted. For example: infant-toddler orientations to the play plot, such as pretending to be ant; using tools when finding food; educators acting 'as if' the infants understood the play problem over time; and word meanings being developed, such as when infant-toddlers looked where they had previously seen ants in their habitat; infants imitating ant actions.

The third analytical step involved examining the common themes in relation to what is known about a cultural-historical conception of play (Vygotsky, 1966/1966; Vygotsky, 2005), followed by a theoretical analysis using the concepts of word meaning and the dialectical relations between everyday and scientific concepts as outlined by Vygotsky (1987). However, because the data are digital, this allowed for the 3-step analysis to be undertaken as an iterative process across the data set, with many systematic views of the organised data summarised and revisited in relation to the goals of the research (genesis, form, and development of concepts over cultural age periods) where the eight principles were also brought to bear on the data to support if and how the intervention conditions were able to give deeper insights into early forms of word meaning as core for the development of concepts by infants and toddlers.

4. Findings

Our study identified a set of themes that add to Vygotsky's (1987) theorisation by giving a nuanced and context bound understanding of the genesis, form, and development of concepts for infants and toddlers within naturalistic settings. The findings are presented across four themes. The results are illustrated through typical observations where we followed the perspectives of both the educators and the infants and toddlers from two study sites (MC and BB) as they entered into the activity setting of a Conceptual PlayWorld of the *March of the Ants*.

4.1. The genesis of conceptual development

Our study found a conceptual connection between the lived experience of being in a family to the planned practices of the childcare centre (Conceptual PlayWorld). As Karen explains:



Fig. 1. Family system as the genesis of concept development of infants.

We do a lot of pretend cooking in our home corner area. We eat food, and talk about it, and learn about it in our mealtimes. So the food thing seemed to be a really tangible concept that the babies already understand. We would as the grown-up people get food for babies.

Our results suggest that the first form of a concept appeared to be a *family system*. Being in a family with the lived experience of being a member of a family, gathering/presenting food and being fed, sleeping, and living together in a home, appeared to act as the interrelated parts of a (*family system*). The *family system* is for many children the first form of a concept they experience, and it is one that is personally meaningful to them (see Fig. 1).

4.2. Forms of the concept

Our study found that the family as a lived system could be drawn upon by educators to introduce a new system of an *ant family*. This is a natural extension of a familiar system to one not known. Acknowledging the family system as central for concept development, gives both a foundation and a capacity for introducing an early form of a new conceptual system of an ecosystem. For instance:

Karen and Mya (Educators) are sitting in the ant colony (Fig. 2, bottom row). The children and educators have been out gathering food for the baby ants. Maya says, "We got a lot of food". Karen says, "You have been such busy worker ants" and then she lifts up her hand to her mouth and pretends to eat from the basket, saying, "yum, yum, yum". Mya sits down in the colony holding two baskets with spades, saying "Yes we have". Lyla smiles as she sits with Mya. Lyla calls and gestures to Karen, and Karen says, "Here you are." As she passes to Lyla the basket she is holding saying, "There you are". Mya gestures to Lyla and pretends to feed her. Lyla accepts and pretends to eat the food. Lyla lifts her plastic spade into the basket and pretends to take out food and to place the contents to the side, she repeats this. She hands back the spade. Lyla takes her basket to the side. She plunges her hand into the basket and pretends to take out food and eat it, using similar actions to that of Karen and Mya.

Through the educators being in character as ants from the storybook, a dynamic system of being in an *ant family* could be co-experienced by the infants and toddlers, such as when *Mya gestures to Lyla and pretends to feed her*. Fig. 2 is a composite of imaginary practices that were commonly found within *centre MC*. They collectively looked for food (top row), they took the food back to the colony (ant family home), and they also pretended to be the baby ants eating. They could also be the Queen Ant feeding the baby ants.

Many of the actions of eating food in real life were being mirrored in the imaginary situation, such as when *Lyla lifts her plastic spade into the basket and pretends to take out food and to place the contents to the side*. Additionally, the children went on expeditions in the same way as the ants in the story book, and they gathered and ate the food they found with their tools (shovels) in the same way as the ants did in the story. The adults pretended to feed the children 'as if' they were the hungry ants, and the infants and toddlers responded with gestures of acceptance of the pretend food.

In our study we found that a *family system* was foundational. Significantly, our study identified that the building on of the foundational system needed imaginary play. That is, imaginary play appeared to create the conditions in which the concept of the *ant family* could be *carried in the play practices* and explored through the actions of pretense. As Karen explains:



Looking for food to feed the baby ants (above)

Pretending to be baby ants eating the food (below)

Fig. 2. Imaginary play as a system of concepts in action - early forms of the concept are co-experienced through imaginary play by infants and toddlers and the educators (Copyright PlayLab).

The baby ants interested them. They used their imagination. They pretended to eat the food, share the food. It was really lovely to see how deep the imagination went with our babies.

Our results are suggestive of *imaginary play* supporting a broadening of a family system as identified through the actions and sounds of the infants. The foundation of a family system provided the platform from which an ant family could be brought consciously into the children's play. The story book provided the collective narrative – hungry ants needing to be fed, using similar tools to those shown in the book for their adventures. The story narrative provided the basis for the actions of gathering food with tools, as shown in the top images in Fig. 2. The foundational lived experience of being in a family as the first form of a concept broadened the family system to the system of an ant family, whilst also being deepened through the imaginary play of the interrelated parts of a family system (home, food, babies). The concept was shown to be in the process of being developed, from family system to an ant family system thereby expanding the foundational system of a family.

4.3. Motivated conditions of the drama of the story with the problem of helping the characters

Our study also identified that the educators had a key role in supporting infant and toddler development of a concept. In addition to planning the conceptual shift of a family system to the system of the ant family, the educators amplified the drama of the story by introducing a character into the imaginary play - a Queen Ant who phoned the children and asked for help:

Mya (educator) is marching with the infants to the music and song of March of the Ants. She suddenly stops and pretends to pick up a phone, saying, "Yes your Majesty. Yes, we are on our way. We are marching". Lyla immediately stops and watches as Mya continues her conversation with the Queen Ant. Lyla smiles and gestures towards the phone, and then along with the other children, follows Mya who is marching. They are going on their adventure. Mya keeps the narrative alive in the imaginary play by talking about the pretend objects she finds for the baby ants to eat, or as she notices and comments on what objects Lyla picks up – by suggesting which could be fed to the baby ants.

At other times during the study, Mya's phone call appeared to provide a way for the infants to non-verbally initiate role-playing receiving a call from the Queen Ant, as shown in Fig. 3. Importantly, for our study of concept development, the pretense of the problem of the Queen Ant calling the children fitted within the foundational conceptual system of family, and the extension of this concept to an ant family. This extension allowed for everyday actions of taking a phone call, to further motivate the children into wanting to help by collecting food for the Queen Ant as Karen explains:

The phone call pulled the children together with the marching. And of course, the Queen Ant, that's like the mum, is ringing the children for us to get some food for the babies. If you take it out of the ant world, that idea of the mum, wanting food for a baby, they understand things like that.

4.4. Kernel of the concept in the process of forming

The narrative of the story and the drama of the Queen Ant phoning the children and asking for help, expanded the family system and gave a platform for bringing into the imaginary situation deeper understandings about the phenomenon of the ants, which we suggest touch on the relational concept of an ecosystem. That is, the structure of the organism, the habitat, and food source, as the kernel of a relational conceptual system (see Fig. 4) that teachers consider when planning their programs. As noted by Hedegaard (2020) "The germ-cell models were used by the teachers to guide the students; task solutions whereby the student acquire their own core conceptual relations to explore concrete situated knowledge" (p. 46) (Fig. 5).

To support the children to build these early forms of the conceptual relations (i.e., ecosystem), the educators gave possibilities for the children to experience real ants in their habitat. This gave insights into where to find ants, and also what kinds of food they liked to



Fig. 3. Stimulating motive of the Queen Ant phoning the children to ask for their help (copyright PlayLab).

eat – food that was similar to what the children ate at snack time (e.g., watermelon). For example,

The infants have just heard the story of the March of the Ants. Karen asks if they would like to march like ants outside. Asher jiggles his legs. Karen says, “Let’s go” as she holds Leo’s hand and helps him down from the reading couch. Asher stands looking at Karen, as she says, “Shall we find the ant home outside?” Karen repeats this, and Poppy says, “Yes”. Asher begins moving forward with all the other infants as they all walk towards the door to go outside. Karen says as she claps her hands, “Ready?” and begins singing and moving in a marching action and takes Leo’s hand and they walk towards the door. The other children follow as Karen says, “Shall we find the ants?”. All the children walk directly to the sand and rock area and begin looking for the ants. Asher stands nearby, whilst some of the others squat down and look closely at the area. Karen suggests, “Maybe they are hiding under the tanbark”. Asher squats and points at an ant. Karen asks, “Can you see the ants?”. Karen invites Poppy to look for ants in the place where they previously had seen them. Instantly Poppy runs over and squats and watches the area. Asher turns, and as Karen asks, “Where is the little baby ant?” Asher lifts both arms as though shrugging and saying, “I don’t know”. He then leans forward and looks closely for the ants. Karen moves behind Asher and says, “Asher, there is another tiny ant”. Asher enthusiastically calls out, “aarrrr” and moves closer to where Karen was pointing and begins looking closely at the ants.

Asher has the possibility to seamlessly move from the reading of the story, to marching like ants outside, and then to look for real ants in their habitat in the childcare centre. The connections between the story of the ants with the real ants in their habitat, gave an experiential basis for conceptual development. But also, cycling back and forward between the real situation and the imaginary situation was supported through the props made available to the infants and toddlers. For example,

It is time for afternoon tea, and the teacher invites the children to go back inside to eat like hungry ants. The children follow Karen and Mya back inside and whilst they set up afternoon tea, Asher goes directly to the table where the props and posters of ants on laminated paper can be found.

Karen notices Asher is standing at the table and says, “Can you get the ants to march?”. Asher looks to the table and to the ants as Karen moves an ant and puts it into line with the other ants. Asher takes a pipe cleaner ant lifts it, saying “Arrddarr” and shows it to Karen. Karen acknowledges his gesture and sounds by saying, “ants?”. Then she says, “So the ants are in the garden. Marching”. Asher says, “Aaarr darr” as he moves the ant. Karen responds by saying, “That’s right. The ants are marching”. Karen counts the ants, and then places a pipe cleaner ant close to Asher’s hand and says, “Can you add an ant, to go marching?”. Asher says, Arrr” and then adds the ant to the line. “Thank you Asher. Can you add another ant to go marching?” as she moves another ant close to Asher’s hand.

Karen supports Asher in the imaginary situation at the table with the props, by responding to his early forms of sound words, ‘as if’ he is talking about the ants marching. We saw this when Asher says, “Aaarr darr” as he moves the ant, and Karen responds by saying, “That’s right. The ants are marching”. Karen also extends the situation by counting how many ants are in the row marching, and then invites Asher to add another ant. For the educators, the practice change brought into the activity settings of the childcare centre the introduction of imaginary situations, and the use of new words. Words appeared to matter when supporting the process of building a relational model in which early forms of conceptual development are evident, as Karen suggests:

We use words now, that we didn’t use before. Anatomy, antennae, colony, these are all words you wouldn’t think to teach a baby, but they know what those things are.

Interpretation

How this conceptual system of an ecosystem becomes part of children’s thinking, it very difficult to study in the very early periods of infant and toddler development. We suggest that under both conditions (real family and imaginary play family), this gave possibilities for the early forms of a concept to begin its development, shown first as a relational system of lived experiences looking at ants after reading the storybook, then as the imaginary play of that lived experience where word meaning was in the process of developing.

In Fig. 6, the genesis of the concept of an ecosystem is represented in the bottom row of the triangle, as the lived experience of a

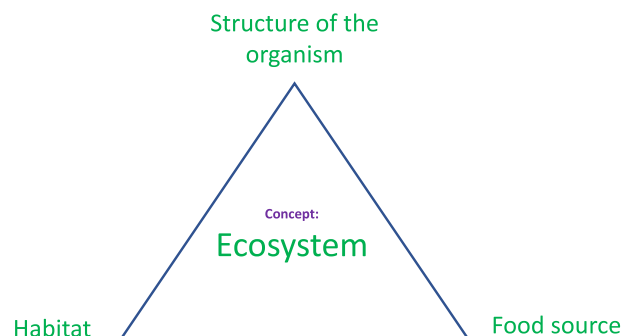


Fig. 4. Kernel of the concept (Copyright PlayLab).



Fig. 5. Looking, finding, and feeding ants in the outside area (Copyright PlayLab).

family system introduced earlier. The form of the concept for this early period is shown first through the system of the family and then the second form of the concepts is within a system of imaginary play. That is, within the imaginary play of being ants conceptualised as the system of an ant family, and as shown in the middle row of the triangle below (Fig. 6). We suggest that imaginary play makes available to the children an early lived form of the concept.

We found similar results in our other study sites for infant and toddler development. However, we were curious about why our findings were not evident in one of our study sites where the infants and toddlers were of the same age range, used the same storybook of *The March of the Ants* for planning and implementing their Conceptual PlayWorld, and where the qualifications of the staff were similar. We found one major difference. In contrast to the other sites, who had access to natural outdoor play environments, where living ants could be found and observed, in P room of Centre BB, the adults, infants and toddlers were in a built environment only. That is, the outdoor area was fenced off from nature, and the ground area was concrete and covered in plastic grass, as is shown in Fig. 7 below. The environment and accessing and studying ants in their natural habitat were deemed by the educators, as a strong predictor of infant engagement in a Conceptual PlayWorld of *March of the Ants*, as Melissa commented during interview:

I'm curious in seeing how much they are actually interested in ants, as we don't really have ants in the centre, since we are like... the way that its built. I am just curious about how much they are going to learn about ants.

As a consequence of the environmental constraints, the educators had to introduce a more abstracted form of the content they were exploring about ants. The educators printed and laminated large pictures of ants for the infants to study (as is shown in Fig. 8).

Two educators and 5 infants are sitting on the floor of their room. The lead educator, Melissa, has a pile of laminated pictures. Melissa holds up one of the laminated pictures and positions it to face the whole group of infants. As she does this, she says, "Shall we look at the lovely ant pictures?". All the infants look to the pictures. As she hands a picture to each infant, she looks directly at each child, and supports each to take the laminated picture. As she passes out each picture to each infant, she names each child as a "Little ant"... Alicja makes a "Wooooo" sound, as though excited to be receiving the picture. Melissa responds by saying, "I have one for you here". Then she asks all the infants, "What are the ants doing?". Melody (Educator), who is seated to the side of the infants, comments on the pictures she can see from the side and quietly asks questions to the infants closest to her.

Melissa points to her poster and asks again, "What are the ants doing?". Infant Alicja flicks the poster towards Educator Melissa. Alicja then picks up the ant puppet that is near her and moves it up and down. The educator asks all the children, "Where are they going?".

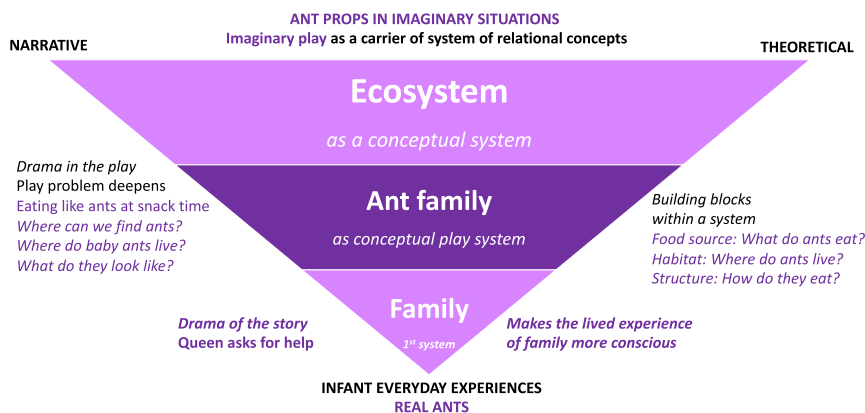


Fig. 6. Imaginary play as the carrier of a system of everyday phenomena and lived experience (Copyright PlayLab).



Fig. 7. Built outdoor environment with plastic grass surfaces.



Fig. 8. Laminated pictures of ants in different habitats.

Alicja lifts up the stick puppet gesturing it to Melissa. She sensitively responds by asking, “Are the ants marching?”. Alicja bobs up and down to this suggestion, moving her puppet up and down, as though she is marching. At the same time Alicja nods her head gesturing ‘yes’ in response to Melissa’s question. Melissa responds warmly, “Yeah. Shall we do some marching? Like ants? Yeah.” She then says, “Shall we ask Ms M to put on the music?” as Melody goes to play the music of March of the Ants.

Interpretation

Whilst there was an association between the action in the song of March of the Ants with the stick figure puppet held by Alicja, and there was a close study by all of the infants of the laminated photographs of ants in different habitats, it was difficult to know if or how the early forms of a relational concept about an ecosystem could be being developed in the abstracted 2-D form. The musical actions and Alicja’s response to marching were sensitively acknowledged and supported by following Alicja’s assumed request for the music and action of marching. However, as rightly argued by Melissa about the lack of access to nature, “*I am just curious about how much they are going to learn about ants*”. Because of “*the way that its (centre) built*”. The question to be asked, is why some centre designs and routines provide so little or no engagement with nature for infants and toddlers, when the direct experience of ants and other natural forms of life, are not only necessary for their general experience in a centre, but act as a foundation from which all learning can be embedded (real ants to abstracted representation of ants) as opportunities to rise to the concrete (Davydov, 2008).

Missing is the living form of the ant, and available is only the abstracted form. The ant family is not experienced as embedded action in an imaginary situation, but rather ants are shown in 2-D from only. There is no system of an ant family being enabled even though there is genuine interest in the ants in the photographs being shown. There is no way to relate the 2-D images to the real ants in their habitat. The 2-D images say very little about how ants move, or how they eat. Actions of the ants that support the building of empirical knowledge about ants, could not be brought into the play actions of the infants and toddlers – only a musical marching action was possible. Therefore, we suggest that the centre design created roadblocks rather than conceptual enablers for an imaginary play situation. In this room, mirroring the actions of the ants as part of an ant family system was not possible in the infants’ play.

5. Discussion

Our results show that much of Vygotsky's theorisation is relevant for our research into infant and toddler concept development. However, there are also contemporary considerations that we have found foundational for understanding the genesis of concept formation when participants' motives are oriented to concepts in the meaningful context of their play. Two overarching findings are discussed: *The family system as the foundation of concept development*; and *Replicating in institutional settings the historical development of the concept through early forms of rising to the concrete*.

5.1. Family system as the foundation of concept development

In our research into the genesis and form of concept development we did not know what the first concept would be, or how the process theorised by Vygotsky begins its pathway in infancy. Through following infants and toddlers under the same conditions of an educational experiment in their respective childcare settings, we identified that before the development of preconcepts of the primary school child, that the genesis of the first lived system of interrelationships was the *family system*. We studied how the teaching of *another system of an ant family* was mediated (backwards) through a personally meaningful system of the family in the institutional setting of the childcare centre. As advised by Hedegaard (2020) for school children:

To formulate a subject's germ-cell, one must look for contradiction in the well-established subject area and then **work backwards towards the origin of the subject area** (Hedegaard, 2020, 47 emphasis added).

Our study found that the first experiential concept of the *family system* was mediated through the introduction of another everyday concept of an *ant family system*. This was identified through working backwards through using the mediated content of the ant family. This appears to be in keeping with the idea by Hedegaard (2020) of formulating a subject's germ-cell, but in our study the content was oriented towards everyday experiential system of a family and the introduced content of a system of the ant family. In line with Vygotsky (1987), we theorised that the experiential system of the family, is not consciously realised, because at the everyday level consciousness is absent. However, "it is a basic characteristic of scientific concept" (Vygotsky, 1987, p. 191). But how? At an experiential level a family system is a lived everyday concept with its own hierarchical system of interrelationships. But an experiential ant family system (as a higher form of the development of the everyday concept) when introduced by educators in both the natural environment of searching for ants and through a storybook, appeared to act as a process of mediation for consciously realising already experienced everyday concept of the family. That is, the *system of an ant family* when introduced to the infants and toddlers for the first time, appeared to support the everyday concept development of a family system with particular interrelationships as observed through the actions of the children in our study. We saw this when the infants marched like ants and went looking for food, which they then returned to the ant colony where they fed the baby ants. Vygotsky (1987) explained this as occurring when the child develops a new relationship with objects, a relationship that "is mediated through other concepts that themselves have an internal hierarchical system of interrelationships" (p. 191). The introduction of the everyday concept of an ant family with an internal hierarchical system of interrelationships gave the possibility for exploring more explicitly the foundational concept of a family system.

Vygotsky (1987) theorised that "*conscious awareness enters through the gate opened up by the scientific concept*" (p. 191). But a system of an ant family, is not yet a scientific concept of an ecosystem. The question we were interested to explore related to how these everyday conceptual pathways, with their backwards and forwards movements are supported in the living context of children in childcare. We drew upon three key ideas found in Vygotsky's writings to help us understand the genesis and early forms and pathways of concept development in infancy.

First, Vygotsky (1987) argued that when a person learns another language, the person begins to think more consciously about their own mother tongue. That is, by learning the rules of grammar, the way words are spoken, and word meanings in another language, the person becomes more oriented to their own lived experiences of their first language, and more consciously aware of what they had previously taken for granted. Therefore, we suggest that for infants and toddlers, the everyday lived experience of a system, such as, being in a family, lays an important conceptual foundation, which is understood differently once another form of the concept of family is introduced. That is, when a more developed everyday conception of an *ant family system* is experienced in play, where evidence of the mirroring of family practices associated with the system of care inherent in the ant family is found, a new relationship with the objects of care and the ant family system (nest, colony, names of the ant body parts, food they like to eat) emerges. When the ants are conceptualised as a family like their own family, a form of infant-toddler generalization of family begins. Therefore, the concept of a family, which has its own internal experiential hierarchical system of interrelationships, can be realised through teaching and the experiential nature of being part of an ant family in imaginary play.

Vygotsky (1994) suggested in the study of the problem of the environment, that "*the developmental process, is already available in the environment from the very beginning*", and in our study this was a lived family system, which we identified as acting "as a model of that which should be achieved at the end of the developmental period" (p. 348; original emphasis). For our study the family system was the first relational pre-concept, but only realised by infants and toddlers through the introduction of another system of the ant family. In our study, a family system is therefore the foundational form of an everyday concept from which other scientific concepts can build a dialectical relationship and where the process of education can create dynamic pathways.

Second, we wondered if and how co-experiencing and acting 'as if' in an ant family contributed to infant and toddlers' development of the concept of a family system. From Vygotsky's (1966) writing on play, we knew that that when a child over 3-years of age is in an imaginary situation, their play narrative draws on the rules and roles of their lived experiences. Vygotsky (1966) cites an example of two sisters who are playing together. They decide to role-play being sisters, and through the experience of acting 'as if a

sister' they make conscious the rules of acting as a sister in their play – holding hands, being familiar with each other's family based experiences. To be a sister in play, they must draw on their lived experiences of being sisters, and in the process of acting "as if" a sister, make conscious the concept of sisterhood. In our study we found that the imaginary situation taken from the storybook of *The March of Ants*, gave both a narrative and a conceptual system of an ant family that could be brought into the infants' play. We also found this for the infants in its earliest form. What was common to all children was the imaginary situation of the ant family being co-experienced with the educators. The circle of social interaction between the children and the educators gave possibilities for 'acting as if' they were the mummy ant/Queen Ant or being the baby ants being cared for, or the worker ant finding food for the babies. With the infants, the educators supported the imaginary play narrative. The infants were swept along with the actions and drama of the Queen Ant calling and asking for help. As might be expected, the moments of sustained imaginary play (Fleer, 2011) were much shorter and more supported through co-experiencing or through the educators talking to the infants 'as if' they were in role as ants. Imaginary play appeared to be an important carrier of a more mature form of the everyday concept that was within the social circle of all the children, and where they were all 'acting as if' everyone was in the same imaginary play narrative of the system of the ant family. This social circle supported all the children to explore the roles and rules of a family system of ants. In play, our study aligns with the idea of "the concept must be seen as part of the entire system of the relationship of generality that define its level of generality, just as a stitch must be seen as part of the fibers that tie it to the common fabric" (Vygotsky, 1987, p. 193). Co-experiencing the ant family system 'as if' ants within an imaginary play system appeared to support an increasing awareness of being in a system of family care and the idea or concept of a family.

Third, much of the writings of Vygotsky (1966) on early forms of imaginary play are associated with how the child changes the meaning of actions and objects in their perceptual field. That is, the stick is imagined as a hobby horse, and the child changes their behavior to become a horse rider. What is physically in the perceptual field changes its meaning in the imaginary situation. This idea was theorised by Vygotsky (1966) in relation to the preschool child. It is suggested that to break with the visual field and imagine what is seen as something else, is beyond what is possible for infants and toddlers (Vygotsky, 1966). However, our study showed that the infants and toddlers regularly changed their relationship with the objects they saw in the imaginary situation of being part of an ant family. We saw this when the children took the spades and spoons to feed themselves pretend food from plastic baskets. We can explain this through drawing on Vygotsky's (1987) concept of imitation. Copying is suggestive of doing the same actions of another, but without understanding. For Vygotsky (1987) the scientific meaning of imitation is shown through a child imitating actions with understanding. This distinction was important in our study. We observed the infants all acting 'as if' characters from the story, where they regularly made the same actions as the educators. However, a level of reciprocity was also evident, as seen in Fig. 2, where the educators pretended to feed the infants and the infants in turn pretended to feed the educators. These examples are suggestive of the children imitating with some understanding, rather than simply copying, and this supports the view that they could disconnect from their perceptual field and play within an imaginary situation. That is, by changing the meaning of their actions in relation to the props, we suggest this showed that they were able to build a new relationship with the objects in their environment, by imagining them in relation to the story, and the drama of feeding the baby ants who were hungry. By doing this, we suggest they were being oriented towards abstraction (image) and beginning a relationship with the concept that was the focus of the teaching program – an ecosystem. Therefore, we believe that imaginary play has an important role in carrying scientific concepts and for creating the conditions for becoming more consciously oriented to everyday concepts that support conceptual development over time. This finding adds to our understandings about the early forms of concept development where word meaning is in the process of developing, and where the generality of a concept is forming.

5.2. Replicating in institutional settings the historical development of the concept through early forms of rising to the concrete

Our study also showed over time how concept development was linked with the idea of rising to the concrete, but in quite different ways to the original theorisation and available contemporary empirical studies. The insight from Vygotsky (1987), Davydov (2008), and contemporary researcher Hedegaard (2020) inspired our approach, even though their research was oriented to school settings.

Vygotsky discussed the idea of the historical development of concepts in different ways across many of the volumes of the collective works. He saw this idea as a fundamental part of his theory of cultural-historical development (Vygotsky, 1987, 1994; Vygotsky, 1998). But how this can happen for such young children and how it might take place in the living laboratory of a childcare centre, was not discussed by Vygotsky. In our study we saw how the historically formed concepts were carried in social relations between the children and the educators.

The idea of the history of the development of the concept gave us insights into how to understand the importance of looking closely at the social relations over time because they appeared to act as carriers of concepts within childcare centres but in ways that brought out the core relations in concrete situated practices. For instance, as noted by Davydov (2008), "Concepts that have developed historically in society exist objectively in the form of human activity and in its results – in purposefully created objects" (p. 92). The childcare centres, by their very nature are historically formed institutions, and in these settings the societal need for caring for children has purposefully created objects of care (e.g., highchairs, cots) and educational resources (e.g., home corners with dolls and high-chairs) to give possibilities for replicating family practices through play. This was shown in Fig. 1 where the purposefully created objects of care in the everyday family life practices were set up for and by infants and toddlers. But objects alone cannot give understandings or support practices of care. It is the historically formed social relations that give meaning to the objects.

The idea of historically formed universal concepts was elaborated further by Davydov (2008). He suggested that, "Every form of social consciousness is a higher product of 'organized thinking.' ...Organised thinking 'provides' individual people with historically formed universals and thus with objective means for understanding the essence of various spheres of reality." (Davydov, 2008, p.108).

Social consciousness of being in a family as symbolically presented through the purposefully created objects, was made available within another institutional settings of a childcare centre, and by its very existence, turns organised thinking of caring and helping into concrete practices. This was shown when both the educators (Fig. 2) and the infants pretended to feed each other ‘as if’ hungry ants. Vygotsky (1994) has suggested that “mastering certain forms of activity and consciousness which have been perfected by humanity during the process of historical development ... provides the foundation for this interaction between the ideal [mature] and the rudimentary [present] form” (p. 352). The historically developed purposefully created objects of care and the sense of care found in families gave conditions for the mature form of caring for the ants by the educators, and the real form of how infants and toddlers care under the conditions of a Conceptual PlayWorld of *The March of the Ants*. We noted that, “These ideal forms influence children from their very early beginnings as part of the process of mastering of the rudimentary form. And during the course of their development children acquire, as their personal property, that which originally represented only a form of their external interaction with the environment” (Vygotsky, 1994, p. 352). As discussed previously, it was the children’s experience of the ant family, that gave rise to the everyday reading of a family system making what infants and toddlers experience every day of being in a family more concrete. The idea of rising to the concrete has some relevance when the pathways are personally meaningful for children, such as through the Queen Ant asking the infants and toddlers to help find food, and through their actions of pretending to feed the hungry ants so that the problem could be resolved. Fig. 9 captures how the pathway to rising to the concrete appeared in our study. First the family system is experienced, second the ant family system is introduced into imaginary play, and finally the mature form of a conceptual system is shown at the third level through how the educators plan. As Davydov (2008) explains,

...theoretical concepts produce the process of development or formation of the system, its holisticity, as something concrete, and it is only with this process that the feature and interconnections of individual objects get revealed (p.94).

Associated with the study of concept development in pedagogical contexts has been how the movement from the universal to the particular can reveal its essence through the process of rising to the concrete. For instance, by studying the universal idea of an ant family, it becomes possible to understand the particular essence of what the ant family is made up of (colony, types of ants, food sources, team approach to gathering food) and in so doing, the smallest unit that makes up the whole (kernel of an ecosystem).

In theorising the *rising to the concrete* in the everyday practices of the under threes, we suggest that the kernel of the concept can be understood as a system of experiences, that progressively become consciously realised over time. As noted earlier, the kernel of the future concept is germinating through this process (Vygotsky, 1987). We also suggest that the rising to the concrete has to be considered as presenting itself differently across the cultural age periods within early childhood. The change from being at home to experiencing being in an institutional setting of a childcare centre (Hedegaard, 2014), brings out the possible early forms of rising to the concrete that are about everyday life of living in a family.

We suggest that Fig. 9 is in keeping with Vygotsky’s (1987) empirical studies and conceptualisation of the transitions that emerge from the pre-concepts (pseudoconcepts to potential concepts) in the primary years to the development of true concepts during adolescence. What changes for the child during the primary years is that s/he experiences ‘instruction’ and becomes oriented to the learning of concepts – as a goal of education systems and schools. As Hedegaard (2020) has shown, the child experiences a double move within the institutional setting of the school through the process of ascending from the abstract to the concrete in school teaching where the double move is between the theoretical concepts and the children’s concepts. In our study we could also see this for the infants and toddlers in its earliest form.

6. Conclusion

We theorised from our results that *the first form of a concept was a family system, and we suggest all other concepts stem from this foundation*. We determined that *the experiential system of the family* appeared to act as foundational for building a relational model from which the pre-concepts could form through a backwards process (Hedegaard, 2020) as another everyday system of an ant family was

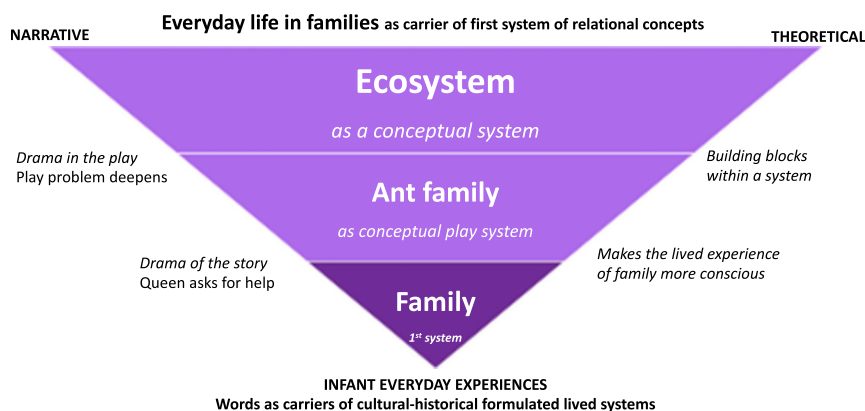


Fig. 9. Early forms of rising to the concrete (Copyright PlayLab).

introduced. Family as a lived experience of infants and toddlers could act as a blueprint from which education systems could plan for supporting the early forms of concept development. We suggest this finding could support new practices in early childhood settings, where teachers are being asked to be more intentional in the teaching of concepts to very young children.

We also determined that *imaginary play acted as a key carrier of the concept for children under three years of age* because children were supported to role play ‘as if’ ants with the drama of the problem, and the educators acted ‘as if’ the infants and toddlers understood the word meanings in imaginary situations. Whilst Vygotsky said that only the adolescent uses concepts in their thinking (as a true concept), and the preschoolers work with pseudoconcepts, communicating ‘as if’ the words carries meaning, we found that *imaginary play acts as a platform for carrying the concepts primarily through the words and experiences set up by the educators*. That is, in the drama of the story and problem to be solved in the imaginary play, allowed the infants and toddlers to co-experience the concepts through acting ‘as if’ they were caring for the ants in pretense. The helping actions in pretense were a form of practical thinking or thinking in action by the infants, but also this could happen because the educators ‘acted as if’ the infants and toddlers understood the word meaning (potential concepts). Important was the recurrent practices within the activity settings (Hedegaard, 2014), which we suggest brings into existence early forms of generalization through social interaction under dramatic conditions of solving a play problem.

Vygotsky (1987) said that every word is a concealed *generalization* (P. 47). But there is always a dialectical relationship between the mature or ideal form and the child’s real or present form of development. Generalization is therefore always in the process of developing and this was how the educators planned and built in the activity setting the recurrent practices of the drama of the story of the ants being hungry whilst also looking in the environment at real ants, feeding them watermelon, or role-playing the Queen Ant feeding the baby ants. As Vygotsky (1987) noted, “The paths through which word meanings are extended or transferred are determined by the people around the child in their verbal interaction with him [sic]” (p 143). Generalization of the concept of a family system as the first concept (word meaning) and as an early form of a core relational model (ecosystem), was carried by the educators and children pretending to be living in an ant family system.

The results add theoretically to what is known about concept development for children under three years of age. Conceptualising concepts for infants and toddlers in relation to a family system, gives directions on what it means for infants and toddlers to conceptually rise to the concrete. The original experienced system of family is explored with some awareness (imitation) through another form of that concept of an ant family. Whilst word meaning of family is developing for the infants and toddlers, word meaning is also holistically embedded within the concrete everyday practices of the educational settings where educators introduced a core model of an ant family in the form of an ecosystem. *Helping the Queen Ant* is aligned with *caring* in the family and the survival of the family unit and species. We suggest that a family system as an historically developed concept arose through societal need for the survival of the species and is experienced in contemporary times as culturally developed caring practices which infants and toddlers co-experience.

When conceptualising rising to the concrete and the development of word meaning for infants and toddlers, we suggest that there has to be a theoretical connection. Our findings show how. By considering how word meaning is developing for infants and toddlers (e.g., colony), at the same time as educators are creating conditions for them to experience concepts as embedded within a conceptual system (e.g., colony as a family system), we noted that the children appeared to develop their own conceptual relations as they explored concrete situations (e.g., feeding/caring for the baby ants) and gained knowledge (e.g., ants like to eat watermelon) in imaginary play situations (Queen ant ask for help to feed the hungry ants).

Finally, the study brings new pedagogical challenges to educators. Traditional expectations of infants to primarily engage in object play exploring toys and materials, was disrupted because infants showed gestures of imaginary play in caring for the ant family that surprised the educators. The ongoing story narrative revisited over time through imaginary play actions gave different conditions for infants and toddlers that we suggest supports the development of imaginary play and the building of a relationship with the concept of a family system as foundational for introducing a core model (habitat, organism structure, food source). Imaginary play appears to act as the carrier of the concept for infants and toddlers. The study brings both contributions and contradictions for the development of new professional practices. But further research is needed to confidently take forward empirical, theoretical and professional outcomes identified in our study of the genesis and early forms of concept formation for infants and toddlers.

CRediT authorship contribution statement

Marilyn Fleer: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing.

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