Chapter 13
A Cultural-Historical Model of Early Childhood Science Education

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Abstract The final chapter of this book brings together the central ideas discussed in previous chapters and presents a model of early childhood science education. This chapter theorises early childhood science education as a dialectical process between everyday and scientific concepts. The central concepts of the social situation of development, the relations between the ideal and the real form, imagination and creativity, and perezhivanie are reviewed in this chapter. Similarly the concepts of shared sustained thinking, rising to the concrete, intersubjectivity, mediation, metaphorical speech, anthropomorphic speech, the gap between the familiar and unfamiliar, simile, and metaphor are also revisited. The nature of institutional practices, the relations between 'telling' and 'explaining', the aesthetics of perception, and how phenomenon are culturally and socially constructed, and what this means for the role of the early childhood teacher are discussed. Further, the nature of children's drawings in science and how this contributes to children's scientific thinking and conceptual development of science concepts are considered. Together, these concepts give a different view of research in early childhood science education to previous reviews. An example of a cultural-historical model of early childhood science education in action completes the book.

Keywords Dialectical process • Social situation of development • Zone of proximal development • Imagination and creativity • Intersubjectivity, mediation, metaphorical speech, anthropomorphic speech • Ideal and the real form • Perezhivanie

13.1 Introduction

In this book we have argued that the *historical legacy of science education research* is rich but grounded predominantly in one theoretical construction of reality. Here we have found problematic the dualism between traditional concepts of what was known as *Children's Science* and contemporary perspectives on conceptual scientific development in the context of *socioscientific* pedagogies. *Children's science* or *alternative conceptions theory* only ever gave one side of the coin. A socioscientific focus on research has re-introduced the role of the teacher in determining learning and development in science in a more dialogical way. However, it was noted in our review of the literature that this research had been directed primarily towards upper

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primary and secondary pupils where *argumentation* on socioscientific ideas features. This latter pedagogical approach is clearly not possible with preschool children. What has been missing for the early childhood field has been a study of the dialectical relations between children's thinking and the social and material conditions which develop *curiosity* and an *affective* reading of contexts and concepts in science (Part I), and a deeper understanding of children's *scientific representation* and how they are culturally constructed and socially mediated by teachers in early childhood classrooms and centres (Part III).

We also noted that the dualism between everyday alternative conceptions of the world and scientific constructions of the world as legitimised by scientists was unhelpful for progressing a model of science learning for very young children. We found more fruitful the idea that everyday conceptions in science were *integral* rather than being conceptualised as getting in the way of learning science concepts. Here we drew upon Vygotsky's theorisation of everyday concepts and scientific concepts in order to put forward a *dialectical view of the relations between everyday and scientific concepts when learning science.* In this sense we have returned to a focus on the child and their scientific thinking, but in relation to the social and material conditions in which that thinking is taking place. It is this *dialectical relations* that has been the focus of our research attention. This dialetctial relation has also been noted in recent research by Roth, Goulart, and Plakitsi (2013) who argue for a *dialectic of participation.* We observed that this dialectical view of science learning is generally at odds with the dominant research attention on early childhood science education research in many countries around the world, which we reviewed in the second part of this book. Our position was featured through the dialectical concepts of imagination and creativity, everyday and scientific concept formation, ideal and real, and the social situation of the environment. A natural tension exists between each of these concepts, and it is this tension that provides the movement in learning and development of children in science.

In this book we also discussed the idea that science knowledge is not static. In the first two parts of the book we put forward the view that scientific concepts change over time and across communities. We argued that how these understandings are formed and researched, also varies and evolves across cultural communities. A universal view does not take account of what children and researchers bring to science education, or how this shapes how knowledge is formed, or indeed what forms of knowledge are valued – empirical, narrative or theoretical (see Chap. 5).

In the third part of the book we discussed how children respond to, encounter and represent their scientific understandings. Specifically, we argued against a process of osmosis of science learning, as has been the pedagogical fashion in early childhood science education across many communities (e.g. developmentally appropriate practice or discovery learning). We drew upon a range of contemporary pedagogical approaches theorised and researched from a cultural-historical perspective. This section of the book, combined with the first section of the book, made visible some important cultural-historical concepts that better informed our understanding of scientific conceptual development of early childhood children than previous theories – constructivism and developmentally appropriate practice.

Together these three parts of the book theorise early childhood science education as a dialectical process between everyday and scientific concepts. To make our case, we specifically worked with a system of concepts: the social situation of development, the relations between the ideal and the real, imagination and creativity, and perezhivanie. We also discussed the concepts of shared sustained thinking, rising to the concrete, intersubjectivity, mediation, metaphorical speech, anthropomorphic speech, the gap between the familiar and unfamiliar, simile, and metaphor. Here we specifically examined the nature of institutional practices, the relations between 'telling' and 'explaining', the aesthetics of perception, and how phenomenon are culturally and socially constructed, and what this means for the role of the early childhood teacher. We also examined the nature of children's drawings in science and how this contributes to children's scientific thinking and conceptual development of science concepts. Together, these concepts give a different view of research in early childhood science education to previous reviews, such as that offered by Eshach (2006), Martin, Jean-Sigur, and Schmidt (2005), Metz (2006) or that which dominates much of content edited by Saracho and Spodek (2008). They are in line with Roth et al. (2013) who also draw upon cultural-historical concepts for discussing science education during early childhood.

In this final chapter in the book we bring together these central ideas and present a model of early childhood science education. We believe our review and theorization offers a development in thinking that is productive for both research methodologies and pedagogies in early childhood science education.

13.2 A Cultural-Historical Informed Pedagogical Model of Early Childhood Science Education

In this chapter we draw on both the concepts reviewed and empirical content discussed in this book to introduce our pedagogical model for creating the conditions for science learning in preschool settings. We know from research that the physical preschool environment affords many possibilities for science learning in play-based settings (see Chap. 2). However, as has been shown throughout this book, it is the relations between the child and the environment through the teacher that provides the best opportunities for maximising the learning of science. As such, we need to conceptualise the development of science concepts in relation to learning. In order to do this, we must first think about the relations between learning and development, and second, we must conceptualise these relations in practice as a pedagogical model suitable for young children in play-based contexts. What is unique about early childhood science education is not just the nature of the preschool child, but also the play-based environment in which the child learns science and develops as a human being. Our pedagogical model (see both Figs. 13.1 and 13.2) is specific for early childhood children and the play-based contexts in which they are taught science.

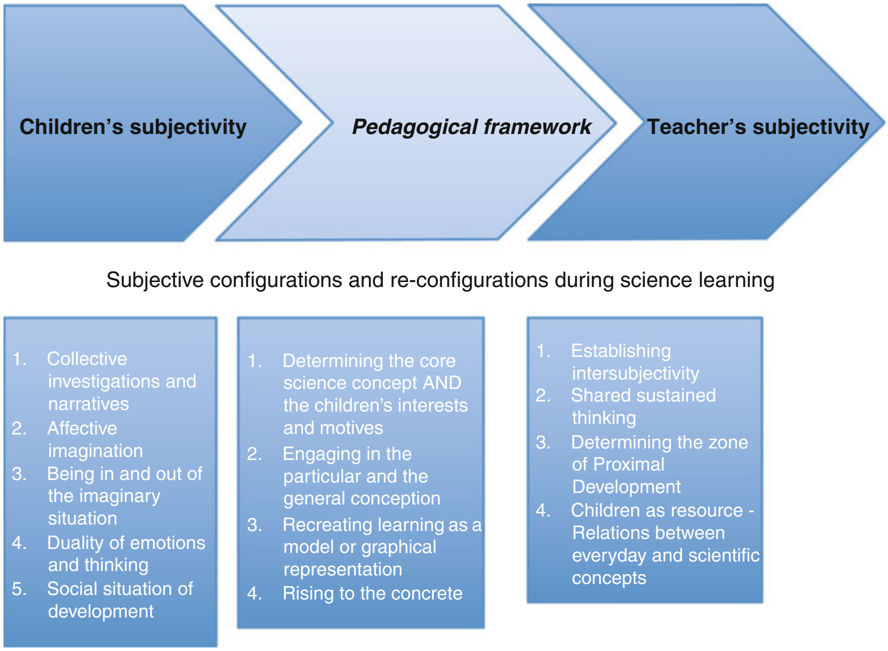

Fig. 13.1 A cultural-historical model of early childhood science education

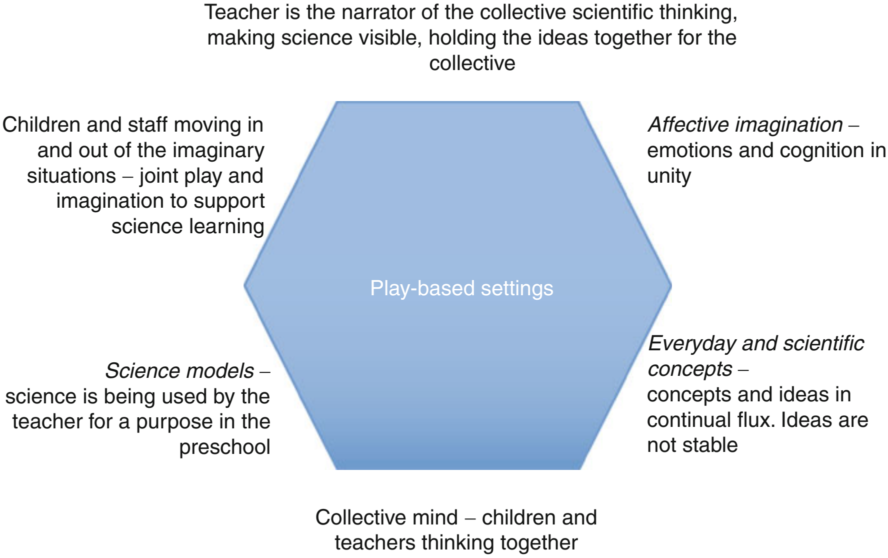

Fig. 13.2 Core elements of what is unique about early childhood science teaching and learning

13.2.1 The Relations Between Learning and Development

Learning is defined from a cultural-historical perspective as a change in the child's "relation to another person and activities in specific settings" (Hedegaard & Fleer, 2013, p. 183) as we see when a child learns scientific concepts. As a result of learning, children begin to act differently, because they have new insights into how their world works. In contrast, a cultural-historical conception of development can be understood as a process where "children's motive orientation and engagement in different activity settings change qualitatively" and as such their leading motive changes (Hedegaard & Fleer, 2013, p. 183). For example, we see this qualitative change in the person when s/he no longer wish to actively play all of the time, but rather has a new orientation to learning, and wishes to engage in the serious study of how her/his world works, or in learning how to read and write. Here the child's orientation has changed from play to learning. Vygotsky (1998) argued that learning has a huge impact upon children's overall development. Learning of concepts is a cultural practice, and as such contributes to the cultural development of the child. Hence, culture helps explain the relation between learning and the development of a child. Whilst biology is important, a cultural-historical view would suggest that it is not the driving force of children's development.

The child who learns concepts, begins to think and act in new ways, according to his or her new understanding of the world around him or her. With new scientific understandings about his or her world, the child can act differently and through this afford new possibilities and learning. A further analogy of this idea, is the child who understands the pointing gesture. Pointing as a cultural and not biological phenomenon, means that children who understand this cultural practice are able to form a different type of relationship to their environment and to others. For instance, they can direct people's attention to something, they can signal the need for something. This is possible because the child has a new understanding, an understanding which acts as a cultural tool, directed to another human being, changing the child's relationship from direct interaction with the environment (i.e. getting the object themselves) to interacting with the environment through another person (pointing to the object for another person to pay attention to or to retrieve for them). The environment does not change, but rather it is a cultural change in the child which affords a new way of interacting *with that same* environment. The child is subjectively configured simultaneously to a social and material world. This process of development can be maximised in preschool centres when a robust pedagogical framework for science learning is used by the teacher.

Through learning scientific concepts children gain a new sense of the situation, and they in turn think about their world in new ways. Over time, and through the learning of many new concepts, we begin to see a qualitative change in the child's development. We can use the metaphor of the tadpole and the frog to explain this qualitative change in development. The tadpole is not a miniature frog, but rather a qualitatively different physically represented organism to the frog. Qualitative change is not an incremental change where a small frog becomes a big frog, but rather it is a qualitative change from a tadpole to a frog. Children's development is a qualitative change. Learning progressively contributes to this qualitative change of the whole child.

13.2.2 A Pedagogical Framework for Scientific Learning

In Fig. 13.1 we bring together the children's perspective of science learning, a conceptualisation of the teacher of science, and a pedagogical framework for creating the conditions for science learning. Each of these elements contributes to the collective subjectivity and the subjective sense (Gonzelez Rey, 2012) that children make of scientific encounters (see Chap. 10). It is acknowledged that these three elements are totally interrelated, and constitute the collective conditions for learning science, despite the illusion of their separation in the model. The content presented in the model should be viewed as a system of concepts that together speak to the social situation of science learning and through this contribute towards the development of children as a whole.

In Fig. 13.1 we conceptualise the children's and the teacher's subjectivity during science learning as a creative and imaginative *production* (Gonzelez Rey, 2009), where a new scientific *sense* is being *configured* and reconfigured (Gonzelez Rey, 2012). In drawing upon the work of Gonzelez Rey (2009), we can theorise this emotional and cognitive flux as a *subjective configuration and reconfiguration*. We know from our research (see Chap. 5) and from the research process itself with young children (see Chap. 7), that children's thinking in science is emotionally charged (see Chap. 3), and continually changes within moments (see Chap. 1). That is, we should not view children's thinking in science as static (see Chap. 1), but rather as in constant motion (see examples in Part III). We capture this dynamic flux in the pedagogical model shown below, through foregrounding children's subjectivity (solid arrow 1) and the teacher's subjectivity (solid arrow 3) throughout all educational encounters that support science learning.

What is key here is embracing children's dynamic thinking, always in flux, always emotionally charged, and always connected to those around them. Curiosity is constructed, enacted, and learned when experienced through a rich but teacher engaged process for science learning. That is, the teacher has an active role in the process (see Part III) and children are not left to discover the science in the situation by themselves, as has dominated early childhood education, where an individualistic construction of learning if featured. We showed the active role of the teacher in Chap. 6 where the teacher contributed to framing the child's learning through investigating why the ant was in the wrong place. The teacher deliberately build theoretical knowledge for the child through the introduction of tools and resources which allowed the children to build a theoretical model of ecosystem – where the dynamic relations between insect, food source, and habitat was actively supported.

Without the teacher structuring experiences to build a theoretical model of the ecosystem of the ant, the child would have continued to look at insects randomly in the environment.

It is important for the teaching of science that the pedagogy celebrates the subjective sense of science that children bring with them to the social and material preschool environment (as a resource). It is the teacher who creates the dynamic conditions, and it is s/he who acknowledges the *thinking flux* and subjectivity of both children and self (own subjectivity – e.g. enjoyment or aversion for science). The emotional and cognitive unity continues to be configured and re-configured during the teaching and learning of science, thus contributing to the qualitative changes and hence overall development of the child. As the child learns something new, s/he interacts in new ways within the learning situation. This affords new conceptual possibilities about how the child's social and material environment is understood, but it also can change how the child feels about him or herself as a learner of science concepts (Chap. 3). We also saw this in the examples given in Chaps. 2 and 3 where the teacher supported the children's scientific thinking through very pleasurable experiences of creating rainbows, exploring light, and understanding the weather patterns for playing outside. The children and the teacher were positively engaged in science learning, and the learning of science was positively contributing to the quality of the children's outdoor play and general experiences.

What we noted in Part I of this book, was that science learning is a highly imaginative and creative act. That children move in and out of imaginary situations in their play, taking with them their growing conceptual understandings in science. Children are both thinking and feeling as they experience science learning (perezhevanie, see Chap. 3), and curiosity is ignited when children have an affective relationship to the content and the process of science learning.

In Chap. 3 we noted how in play based settings that science learning is affectively charged, and imagination was central for realising scientific concept formation. Children collectively develop a consciousness of scientific and technological concepts and emotionality by working together with other children to solve the problem. Children use a *scientific narrative* to collectively work together to solve scientific and technological problems. Children in their role-play of scientific narratives also *collectively* begin to anticipate the results of each others' actions in the play, begin to anticipate their own actions, including image-bearing dramatization, verbal descriptions, prop use and transformation, and importantly, the scientific solutions created through the collaborative support of the teacher. It is the border of the imaginary world and the concrete world that creates a dialectical relation and emotional tension that promotes scientific conceptual development. In scientific investigations, children's feeling state becomes connected with their learning as they anticipate *finding a solution*. Through consciously considering feeling states in science, emotions become intellectualized, generalized, and anticipatory, while cognitive processes acquire an affective dimension, performing a special role in meaning discrimination and meaning formation (e.g., gut feeling this is going to work).

But what is critical here is how teachers help children in knowing what is noteworthy to pay attention to in science learning. This is reflected in the model as:

1. *Establishing intersubjectivity.* Without teachers and children coming to know each other as social players, it is difficult for a teacher to know what will hold a child's attention, what will be meaningful, and what would be an authentic educational encounter. Similarly, without intersubjectivity, the teacher could never position children as a resource, with ideas, curiosity, questions, and interest to role-play aspects of their own social and material world.
2. *Shared sustained thinking.* Without teachers building on or stimulating engaging and deeply theorised dialogues with young children about concepts in the everyday world and concepts in science, children would not see the richness of the science in their world, or would have limited opportunities for thinking scientifically about everyday life. It is the sustained nature of the conversation with a child in play, in everyday life exchanges, and in scientific encounters, that establish and maintain a scientific attitude to life, learning and thinking.
3. *Zone of proximal development.* Teachers who use the concept of the Zone of Proximal Development can identify the actual and the potential development of children. They know that it is in the ZPD that we find the maturing processes of a child's development. The ZPD is about understanding or assessing those maturing processes that become evident when the child is working in cooperation or is guided by others (see Vygotsky, 1998). Teachers determine children's actual and potential development. We conceptualise the ZPD as a form of cooperation between the child and an adult, where the child can with support engage with and conceptualise concepts as determined by their ZPD. It is only those concept which are already within the child's psychological grasp and experience that can be realised during interaction that form the ZPD. Actual development is determined as an independent interaction, and conceptualised as the already formed functions and processes of the child. It is the relations between the actual development of the child and the ideal form of development in cooperation with another, where we see development being progressed. The teacher's role is central here for realising a productive relation between the actual and the ideal.
4. *Children as resource.* In the context of learning, we see that the concept of the ZPD directs our attention to determining the actual conceptual understanding of the child and through the active relations between the child's actual understandings and the ideal concepts, that we see a movement from everyday understandings to scientific understandings. The pedagogical framework creates the conditions whereby the child's everyday understandings act as a resource during the learning of scientific concepts. The child's experiences, motives and interests are key to the pedagogical situation, giving meaning to the educational encounter.

To build theoretical knowledge in science requires a particular kind of cooperation by the teacher with the children, so that children look with scientific eyes, as they build an understanding of their finds in relation to the knowledge system that they are encountering. In Chap. 5 we specifically examined the child's journey into this knowledge system in relation to what conditions had been created by the teacher. This is reflected in the model as:

1. *Core concepts.* Determining what might be the core scientific concepts to be learned
2. *Particular-general dialectic.* Engaging children in thinking about both the particular element (e.g., ant), and the general concept (e.g. species classification 'insect')
3. *Models.* Supporting children to re-create their learning as models and graphical representations, and using metaphors and similes
4. *Rising to the concrete.* Creating the conditions that allowed for children to conceptually *rise to the concrete* by having the opportunity to consider how the abstract knowledge (e.g., species classification) was formed in the first place (observing form, function, food source, and habitat of a particular insect) by scientists.

Taken together, the elements discussed above represent the subjective conditions that determine the social situation of development of the child during the iterative process of learning science concepts in play-based settings. Whilst the science encounters are collectively constructed, how each individual child experiences this same set of scientific encounters will depend upon what he or she bring to the that same situation. Each child will have different prior everyday experiences of their world which they s/he draws upon when making sense of scientific encounters. The scientific experience will be affectively refracted through how the child feels about the learning experience. Scientific curiosity is not just a cognitive activity but is affectively charged process. In this book we have foregrounded the unity of emotions and cognition and argued that affective imagination be a central part of a pedagogical model for teaching science. Yet as Zembylas (2008) suggests "affective factors have been largely neglected in science education research which has been dominated by "conceptual change" view of learning (Alsop and Watts, 2003)" (p. 66), and "relatively little work has explicitly addressed affect, feelings, or the emotions compared to the large literature on attitudes to school science" (p. 67). In our model we not only acknowledged the place of emotions in science, but suggest that this acts like a glue holding all the other elements of our model together as a dialectical unit. Here there exists an indivisibility of environment and the personality of the child, as a form of *perezhivanie*. Here perezhivanie is "all the personal characteristics and all the environmental characteristics … represented in an emotional experience *[perezhivanie]*" (Vygotsky, 1994, p. 341; Original emphasis). This also means that what takes place in the preschool cannot be conceptualised without considering what takes place outside of the preschool, in the family home and in the community. Here we agree with Roth (2012) who has argued for a dialectical approach for science education where what is learned in schools be authentic and valued by the child and therefore useful for life outside of classrooms. To achieve this requires a view of early childhood science learning that brings together both the children's subjectivity and the teacher's subjectivity as a collective and dynamically interacting enterprise, as has been conceptualised by Gonzalez Rey (2012) as a subjective configuration: "The person is always within a network of symbolic processes and emotions, that characterises their social existence. Human activities and relations are configured to each other within a complex subjective system of human existence" (p. 49). It can be argued that learning science in play-based environments affords a very complex network of symbolic processes and emotions that continue to be configured and re-configured. Consequently, it becomes important to capture the essence of what is early childhood learning and teaching of science? What are the core unique features that are distinct from primary or even secondary science learning and teaching? What are the features which are unique to play-based settings and the nature of the young learner? The uniqueness is symbolically represented in Fig. 13.2 where six elements are foregrounded as the core features of the teaching-learning process of early childhood science.

Whilst Fig. 13.1 presented what mattered for learning science, Fig. 13.2 takes from the research and Fig. 13.1 those core elements that are specifically unique to learning science in play-based contexts for preschool aged children. Here affective imagination is foregrounded, but in the context of the teacher acting as the narrator of the collective scientific thinking, making science visible, holding the ideas together for the collective. We saw examples of this throughout the content of this book. Young children need support with noticing the science in everyday situations, as well as help with linking their thinking from one day to the next in preschool settings. Their ideas are not stable, and their thinking is in constant flux. Teachers can support this process through creating models and supporting children to construct representations of their growing ideas in science – as artefacts of their thinking and as cultural tools to support new thinking. Moving in and out of imaginary situations allows children to think iteratively about the concrete object and the abstract representation. Role-play as well as imaginary play supported by the teacher creates many possibilities for also thinking abstractly. We saw examples of this in Part I of the book. In essence, a play-based setting affords the need for a sense of the *collective mind* as children and teachers engage in scientific encounters where scientific ideas are iteratively explored on one day, from day to day, and over the course of weeks, and even the year. However, these unique features of the nature of young scientific learner have not been adequately recognized in science education. Figure 13.2 begins to make the uniqueness of early childhood science learning in play-based settings visible. We illustrate the model in action through a brief example shown below in Table 13.1

Table 13.1 An example of a cultural-historical model of early childhood science education in action

Key concept	Explanation	Example
Teacher as narrator	The teacher holds the scientific narrative together – in one day, over one week, and between children.	Children aged 2 for 5 years demonstrate interest in learning about their bodies as a result of someone being away sick – asking about why Isobella is not at child care. The teacher plans a range of experiences to develop their scientific thinking over a period of 4 weeks. However, to hold together the learning journey, the teacher does the following:
		Each day at group time she re-visits what the children did the previous day; She uses 'thinking books' which are A4 sheets of the children's ideas, thinking and investigations, that are collected and stapled together and read out at grouptime or to families; She also has the children sit in circle to show and tell about their learning, using their thinking books; She does group mind maps, concept maps and other posters of investigations, including storyboards and photographs, iPad animation; children's posters, as records of the ongoing activities. She references these regularly throughout the day.
Collective mind	Children and teacher are thinking together. The teacher is in the imaginary situation with the children as they imagine both play and learning with the scientific concepts.	The children and teacher create a life sized human body from boxes, fabric and plastic that they can crawl inside. The children together with the teacher, enter through the mouth of the their human body, passing through all the major organs. The children and teacher are in the imaginary situation together. The children make an enormous heart from fabric and the children enter into the imaginary circulatory system of the body, projecting out, naming different organ they take oxygen and food too.
Children moving in and out of imaginary situations	The children both imagine the abstract concepts of science and the concrete situation	The children create a Play World of the human body. That is, they enter into the fairytale of Jack and the beanstalk, and when the giant falls to the ground and is unconscious, they undertake a series of investigations/adventures, diagnostics (being doctors), and together with the teacher undertake surgery of the giant. This Play World scenario is supported by visiting a hospital to learn about different procedures that can then be used back in the Play World.

(continued)

Table 13.1 (continued)

Key concept	Explanation	Example
Science models	The teacher helps the children to build a theoretical model of science concepts	The children create their own poster about the human body. They trace around each others' bodies, and then they draw what is inside their bodies, with cut out flaps, for going more deeply into the different organs they have drawn. The children add to their human body poster by making it interactive through projections and sound effects via their iPad animations. Finally, the children with support from the teacher create their own YouTube clip explaining their poster. The links are sent to families for sharing and further discussion. The core concept of a 'system of organs' is the key feature of the theoretical knowledge supported by the teacher in building the model with the children.
Everyday concepts and scientific concepts	Everyday experiences and scientific understandings are concurrently supported by the teacher	The teacher invites the children to make an animation on an iPad using playdough, coloured cardboard, string, etc to replicate their understandings of the human body. The children think deliberately about their everyday understandings, and together with the teacher they check sources (e.g. YouTube, books, expert scientists they phone).
Affective imagination	How you feel about the learning of science concepts and how the science concepts positively contribute to living and working in everyday situations matters	Story world, the interactive poster, the YouTubes, the thinking books, and the narration by the teacher to bring all the experiences from one day to the next contribute to an emotionally charged and positive experience of learning about the human body. Featuring the children's own bodies and imagination supports affective imagination.

13.3 Conclusion

As Robbins (2012) reminds us "Currently, there are a relatively small, but growing number of science education researchers who are framing their work from a socio-cultural or cultural-historical perspective (see Fleer, 2009; Fleer, Ridgway, & Gunstone, 2006; Fleer & Robbins, 2003; Giest & Lompscher, 2003; Leach & Scott, 2003; Lemke, 2001; O'Loughin, 1992; Schoulz, Säljö, & Wyndham, 2001; Traianou, 2006)" (p. 78). In this book we have not only plotted this movement (see Fleer, 2013; Fleer & March, 2006; Goulart & Roth, 2010; Mawson, 2007; Ravanis & Bagakis, 1998; Ravanis, Christidou, & Hatzinikita, 2013; Traianou, 2006), but expanded upon this body of research to give a fuller and richer picture of what constitutes a cultural-historical study of early childhood science education.

In the context of research in early childhood science education, Robbins (2009) also states that "for many in early childhood education there is a movement towards sociocultural views on learning while science education appears largely fixed on individual views of learning" (p. 78). As was shown in this book, that whilst there is more research being done by researchers from early childhood education drawing upon cultural-historical theory, we are still seeing research into children's conceptions in science published, a focus that the general science education community has largely left behind as being unproductive as they move into argumentation and a more socioscientific approach for progressing science education. Consequently, it can be argued that early childhood science education research is full of contradictions. On the one hand it has embraced cultural-historical theory by undertaking rich and progressive research, and on the other hand it continues to undertake traditional research following what the rest of science education now view as dated – alternative conceptions theory or Children's Science. But what has changed is the number of researchers actively engaged in early childhood science education research. Ten years ago very little research was being done in this area. Now there are more studies, more researchers, and more focus on what is unique about young children's learning in science. Rather than pedagogical models that were developed on research with adolescents or models suitable for primary aged children being adopted and adapted for use with young children, the early childhood community has research to better understand the nature of the very young learner. What the early childhood community does not have is access to suitable pedagogical models developed from early childhood education research. This book seeks to contribute to the early childhood community by offering a compilation and critique of early childhood research and by putting forward a pedagogical model of learning science that foregrounds affective imagination as central for play-based settings (Fig. 13.2). Through the contents of this book, we seek to make accessible the wealth of research and pedagogical discussion on the unique attributes to learning science in play-based settings.

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